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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

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
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EXECUTIVE SUMMARY

OPENING OF MEETING

1. The Sixth Regular Session of the Scientific Committee (SC6) took place in Nuku'alofa, Tonga from 10–19 August 2010. N. Miyabe chaired the meeting.

2. Matters considered by the SC6 and its thematic groups — Fish Biology (BI), Ecosystem and Bycatch Mitigation (EB), Fishing Technology (FT), Management Issues (MI), Methods (ME), Data and 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 bigeye tuna and skipjack tuna in the WCPO;
c) a summary of the most recent information and assessments for tuna and billfish stocks in the North Pacific;
d) bycatch mitigation issues associated with seabirds, sea turtles, sharks, and recommendations from Kobe II workshops;
e) requests from WCPFC6;
f) issues associated with the data available to the Commission and initiatives to address data gaps,
g) the status of the West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP), the Japan Trust Fund (JTF) and the Pacific Tuna Tagging Project (PTTP);
h) relations with other organizations; and
i) administrative matters associated with the functioning and structure of the SC meetings, streamlining the operations of the SC, and reviewing the Commission's Strategic Research Plan.

REVIEW OF FISHERIES

3. The provisional total Convention Area tuna catch for 2009 was estimated at 2,467,903 mt, the highest annual catch recorded and 70,000 mt higher than the previous record in 2008 (2,398,664 mt). During 2009, the purse-seine fishery accounted for an estimated 1,894,500 mt (77% of the total catch, and another record for this fishery), with pole-and-line taking an estimated 165,814 mt (7%), the longline fishery an estimated 223,792 mt (9%), and the remainder (7%) taken by troll gear and a variety of artisanal gear types, mostly in eastern Indonesia and the Philippines. The Convention Area tuna catch (2,467,903 mt) for 2009 represented 81% of the total Pacific Ocean catch of 3,042,092 mt, and 58% of the global tuna catch (the provisional estimate for 2009 is 4,222,289 mt).

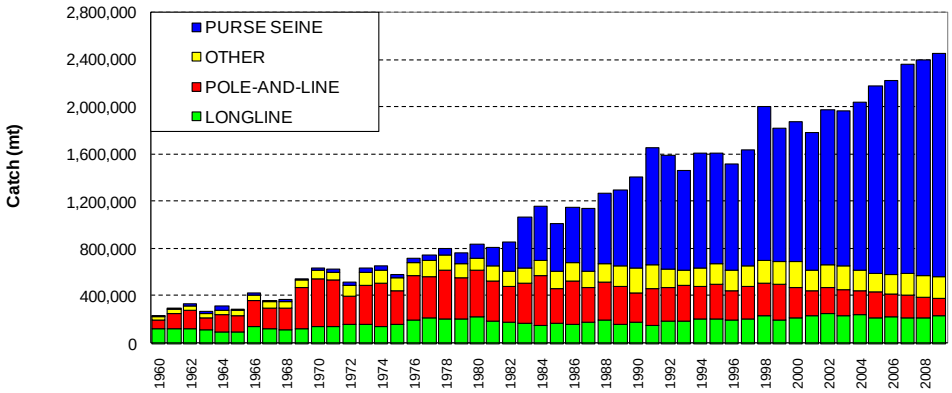

Figure 1: Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area by longline, pole-and-line, purse-seine and other gear types.

4. The 2009 Convention Area catch of skipjack (1,789,979 mt – 73% of the total catch) was clearly the highest recorded and nearly 120,000 mt more than the previous record catch of 2007 (1,672,996 mt). The Convention Area yellowfin catch for 2009 (433,788 mt – 18%) was 115,000 mt (21%), which was lower than the record catch taken in 2008 (547,985 mt). The Convention Area bigeye catch for 2009 (118,657 mt – 5%) was the lowest since 2003, mainly due to a drop in 2009 provisional estimates for the longline fishery. The 2009 Convention Area albacore catch (125,479 mt - 5%) was the second highest on record, with very good catches from the longline fishery.

5. SC6 agreed to include key billfish species in its overview of WCPO fisheries, beginning with SC7.

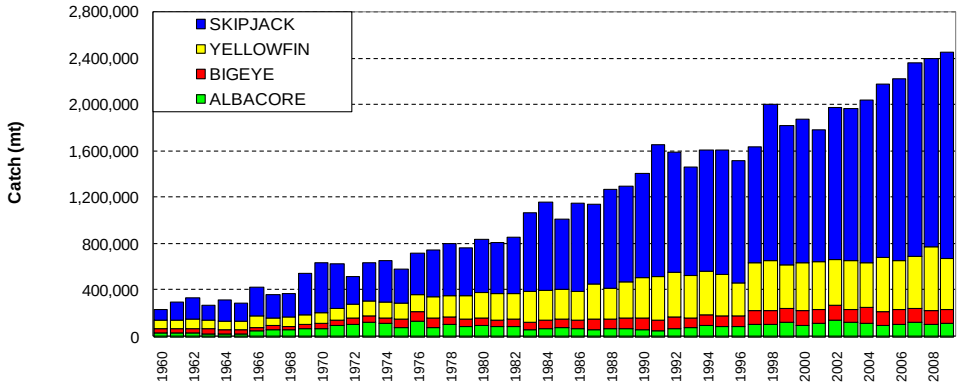

Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area.

FISH BIOLOGY THEME

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

6. To assist SC in determining the priority of Phase 2[1], SC6 requested that the report to the 2011 meeting include outcomes from three runs of the 2010 bigeye stock assessment model; specifically i) the

[1] A four-year Pacific-wide study with a proposed total budget of USD 777,000.

use of the growth curve estimated from the pilot study; ii) the use of the maturity ogive estimated from the pilot study; and iii) a combination of (i) and (ii).

7. SC6 encouraged all flag states to achieve the 5% observer coverage of such vessels as required by the observer CMM to facilitate the collection of biological samples.

8. SC6 also recommended that:

- Maturity schedules for stock assessments should be estimated using histological methods. Gonad index (GI) values can be used for evaluating spawning distributions but should not be used for estimating maturity schedules.
- Presentation of Project 35 (the bigeye age and reproductivity pilot study) be deferred to SC7. Included in the report to SC7 will be three sensitivity analyses (revised growth curve, new maturity ogive and both combined) using the 2010 bigeye assessment.

Project 39 – Regional study of the stock structure and life history characteristics of South Pacific Albacore

9. SC6 encouraged the science services provider to take any new biological parameters into account when next updating the South Pacific albacore assessment.

FISHING TECHNOLOGY THEME

10. SC6 recommended the continuation of research or the review and analyses of research in the following areas:

a) The use of "acoustic technology" for discriminating species on floating objects;
b) Bycatch and small tuna on floating objects reduction research in collaboration with industry and Pacific Island nations; and
c) Studies on the behavior and distribution of target and non-target species around FADs, and on the various specifications and use of FADs and fishing gears in influencing purse seine catches taken in association with FADs.

11. SC6 further recommended studies to: i) quantify changes in fishing efficiency; ii) identify and refine gear, vessel and operational attributes necessary for global standardization; iii) document and analyze fishing efficiency and historical changes in gear, vessel and operational characteristics of fisheries; and iv) quantify changes in fishing efficiency of purse-seine fisheries operating in the WCPO.

12. SC6 recommended, in principle, support for the proposal by the International Seafood Sustainability Foundation (ISSF) and recommended that ISSF undertake a consultation process with "coastal state" Commission members to enable their full participation.

METHODS THEME

13. SC6 recommended that the methods-related projects currently included in the scientific research programme continue to be supported.

STOCK ASSESSMENT THEME

WCPO bigeye tuna

14. Strong support was expressed for continuing the analyses of operational level catch-effort data. It was also accepted that for future analyses of these data that records for distant-water and offshore operations be separated.

15. It was suggested that when input data (including catch size compositions) are collated for the next assessment, Region 3 should be spatially stratified in respect of the areas north of 10°N, where albacore are targeted. Also, reanalysis of purse-seine catch size composition data is required in order to be consistent with the substantial adjustment to catch weights for grab sampling bias. This re-analysis is proposed for the next bigeye assessment.

Stock status and trends

16. SC6 selected run 3d, which had a steepness estimated at 0.98 (hereafter referred to as the base model) to represent the stock status of bigeye tuna, and considered run 4b to illustrate status assuming a lower value to steepness (0.75) (Table BET1).

17. SC6 agreed that the value of steepness is difficult to estimate in assessment models and the estimated value of 0.98 should be considered uncertain. Most estimated values of steepness in sensitivity runs were >0.95; however, the actual value of steepness for the WCPO bigeye stock currently remains unknown. As a comparison to the base model, SC6 chose to also represent stock status with a value of 0.75 which was the mid-point of five steepness values (representing the range 0.55–0.95 of plausible steepness values) considered in sensitivity runs in the 2010 assessment.

18. For the base model, $F_{current}/F_{MSY}$ is estimated at 1.41, indicating that overfishing is occurring for the WCPO bigeye tuna stock and that in order to reduce fishing mortality to $F_{MSY,}$ a 29% reduction in fishing mortality is required from the 2005–2008 level (Fig. BET5). Considering historical levels of fishing mortality, a 31% reduction in fishing mortality from 2004 levels is required (consistent with the aim of CMM2008-01), and a 20% reduction from average 2001–2004 levels.

19. Current stock status in the base model indicates that the current total and spawning biomass are higher than the associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.39$ and $\frac{SB_{current}}{SB_{MSY}} = 1.34$). This indicates that that the WCPO bigeye stock is not in an overfished state (Table BET1, Fig. BET5 top) if the spawning biomass reference period is 2005–2008. However, if the spawning biomass period is considered to be 2009, then the spawning biomass is further reduced (SB_{latest}/SB_{MSY}=1.17).

20. Stock status results with regard to MSY reference points (RPs) are far worse when a lower (0.75) value of steepness is assumed, run 4b requires a 49% reduction in fishing mortality is required from the 2005–2008 level to reduce fishing mortality to F_{MSY}. The stock is in a slightly overfished state (SB_{latest}/SB_{MSY} = 0.97) when the lower value of steepness (0.75) is assumed.

21. The bigeye assessment in 2010 is comparable to the 2008 and 2009 assessment (Table BET2) although there are differences in catch and effort data, size frequency and a few different structural assumptions. The primary differences are revised catch estimates for all fleets from Indonesia and the Philippines; exclusion of some size data from the Philippines and increased purse-seine catches based on experimental spill samples.

22. In comparing the 2009 and 2010 assessment using the same MSY time window (2001–2004), the 2010 base model is more optimistic, with an $F_{current}/F_{MSY}$ estimate of 1.25 compared with 1.53 in run 14 of the 2009 assessment (Table BET3).

23. An analysis of current levels of fishing mortality and historical patterns in the mix of fishing gear types indicates that MSY has been reduced to less than one-half its levels prior to 1970 through the harvesting of juveniles (Fig. BET6).

Table BET1: Estimates of management quantities for selected stock assessment models from the 2010 base model (run 3d) and alternative run 4b, considering lower steepness (0.75). For the purpose of this assessment, "current" is the average over the period 2005–2008 and "latest" is 2009.

	run3d (base)	run4b (h=0.75)
$C_{current}$	147,506	147,774
C_{latest}	126,769	127,040
MSY	73,840	65,840
$C_{current}/MSY$	2.00	2.24
C_{latest}/MSY	1.72	1.93
F_{mult}	0.71	0.51
$F_{current}/F_{MSY}$	1.41	1.97
SB_0	651,500	722,400
SB_{MSY}/SB_0	0.24	0.31
$SB_{current}/SB_0$	0.32	0.30
SB_{latest}/SB_0	0.28	0.26
$SB_{current}/SB_{MSY}$	1.34	0.97
SB_{latest}/SB_{MSY}	1.17	0.85
$SB_{curr}/SB_{curr_{F=0}}$	0.17	0.18
$SB_{latest}/SB_{latest_{F=0}}$	0.15	0.16
Steepness (h)	0.98	0.75

Table BET2: Comparison of WCPO bigeye tuna reference points from the 2010 base model (steepness estimated as 0.98), shown in parentheses is the alternative 2010 run (steepness assumed as 0.75), ranges of six sensitivity analyses in the 2009 assessment and base model and sensitivity analyses in the 2008 assessment.

Management Quantity	2010 assessment Run3d (Run4b)	2009 Assessment	2008 Assessment
Most recent catch	126,769 mt (2009)	134,315 mt (2008)	143,059 mt (2007)
MSY and MSY (recent R)	73,840 mt (65,640 mt) 132,403 mt (131,495 mt)	Range: 52,120 ~ 67,800 mt Range:110,000 – 146,114 mt	Base case: 64,600 mt Range: 56,800~65,520 mt
$F_{current}/F_{MSY}$	1.41 (1.97)	Range: 1.51 ~ 2.55	Base case: 1.44 Range: 1.33 ~ 2.09
$B_{current}/B_{MSY}$	1.39 (1.09)	Range: 1.11 ~ 1.55	Base case: 1.37 Range: 1.02 ~ 1.37
$SB_{current}/SB_{MSY}$	1.34 (0.97)	Range: 0.85 ~ 1.42	Base case: 1.19 Range: 0.76 ~ 1.20
$Y_{Fcurrent}/MSY$	0.94 (0.56)	Range: 0.12 ~ 0.92	Base case: 0.94 Range: 0.50 ~ 0.97
$B_{current}/B_{current,\ F=0}$	0.23 (0.24)	Range: 0.18 ~ 0.29	Base case: 0.26 Range: 0.20 ~ 0.28
$SB_{current}/SB_{current,\ F=0}$	0.17 (0.18)	Range 0.11 – 0.19	Not available

Table BET3: Comparison of fishing mortality-related quantities for assessments conducted in 2009 and 2010 bigeye stock assessments based on various *MSY*-calculation time periods.

	Fmult ($F/F_{current}$)			$F_{current}/F_{MSY}$		
Run	2001-04	2004	2005-08	2001-04	2004	2005-08
2009 run14	0.65	0.50		1.53	1.99	
2010 base model run3d	0.80	0.69	0.71	1.25	1.45	1.41
2010 run4b (steepness=0.75)	0.57	0.49	0.51	1.76	2.05	1.97

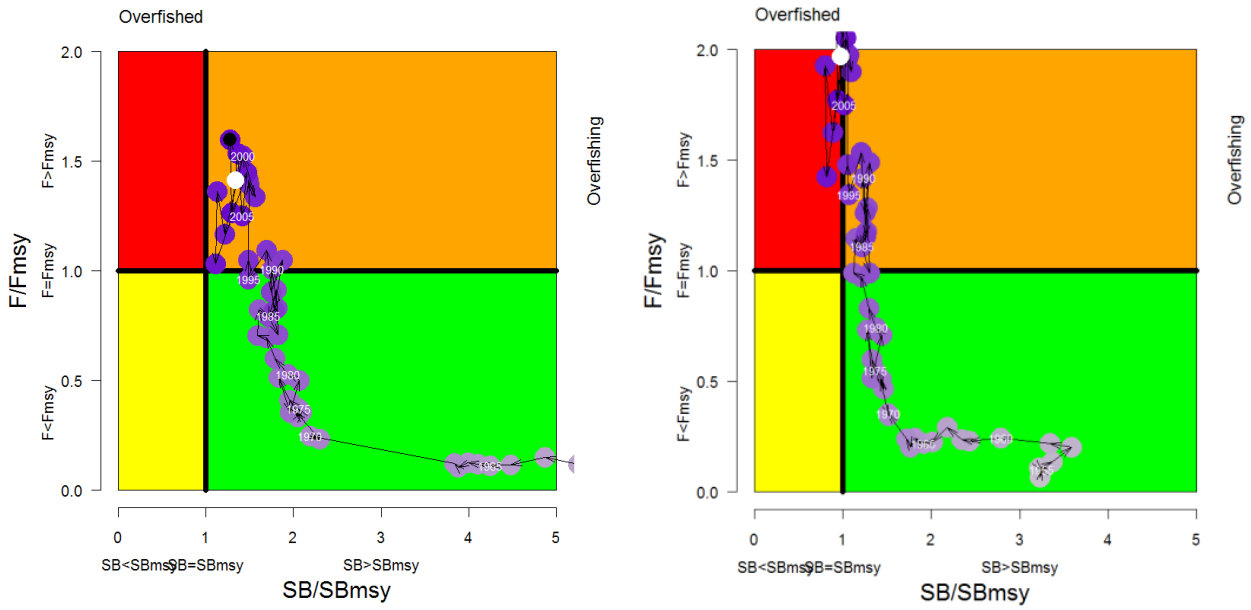

Figure BET5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base model (run 3d, left) and alternative run 4b (right), considering lower steepness (0.75).

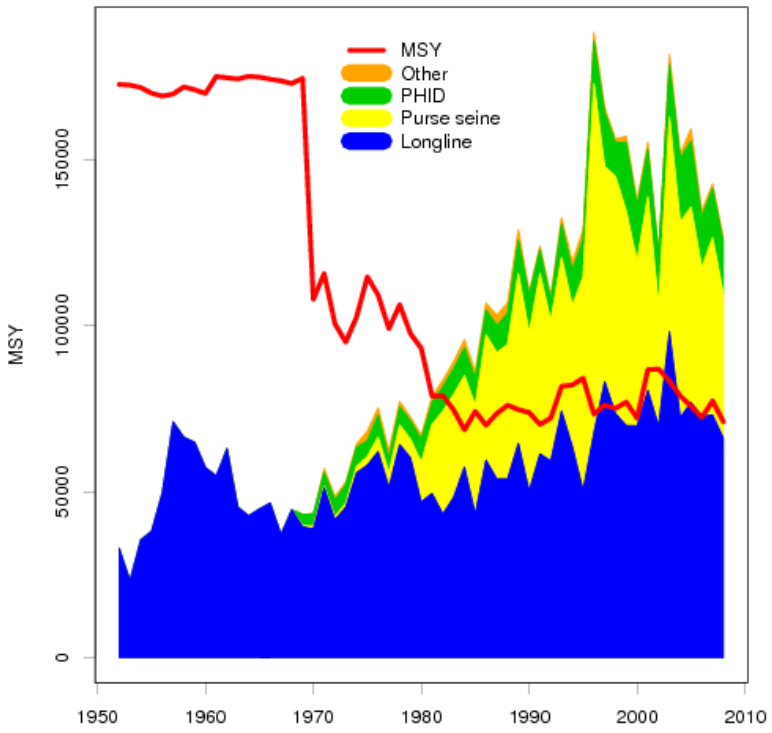

Figure BET6: History of annual estimates of MSY compared with catches of four major fisheries sectors. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small bigeye.

Management advice and implications

24. SC6 recommended a minimum 29% reduction in fishing mortality from the average levels for 2005–2008 with the goal of returning the fishing mortality rate to F_{MSY}. Recommended reductions in fishing mortality change between stock assessments and between the time windows in which MSY levels are calculated. The current recommendation is equivalent to a minimum 31% reduction in fishing mortality from 2004 levels, and a minimum 20% reduction from average 2001–2004 levels. Current stock status indicates that the current total and spawning biomass are higher than the associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.39$ and $\frac{SB_{current}}{SB_{MSY}} = 1.34$).

25. The base model estimate of the $F_{current}/F_{MSY}$ ratio in the 2010 assessment was 1.25 and lower than the estimate (1.53) in run 14 of the 2009 assessment when estimated over the same MSY window (2001–2004), thus stock status is more optimistic in the 2010 assessment.

26. Interpretation of stock status with regard to MSY RPs and associated fishing mortality reductions are highly dependent on the steepness in the stock recruitment relationship. Steepness is difficult to estimate and, therefore, generally uncertain. SC6 noted that the current stock status may be overly optimistic as estimated steepness (0.98) is essentially one (1), whereby recruitment is completely independent of spawning biomass. If steepness is substantially less than 1, then the interpretation of stock status is more pessimistic and greater reductions in fishing mortality will be required to obtain F_{MSY}, suggesting that the stock may be in an overfished state.

27. Overfishing and the increase in catch of juvenile bigeye have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. SC6 concluded that MSY levels would increase if the mortality of juvenile bigeye was reduced.

28. Considering the late submission of bigeye data, SC6 highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes, and encouraged all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.

29. SC6 reiterated the advice from SC5 on the efficacy of CMM-2008-01 in reducing fishing mortality:

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 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.

Further evaluation of CMM2008-01

30. WCPFC6 requested that work be undertaken at SC6 and TCC6 to support bringing forward a new package of measures for consideration at WCPFC7. Some of the changes made to the assessment this year, such as the improved data on Philippine and Indonesian catches, may improve the quality of scientific advice.

31. In considering this request, SC6 recommended that the science services provider undertake the following analyses for WCPFC7:

- A set of generic projections based on the following specifications
    - Based on bigeye run 3d from the 2010 assessment
    - Using recent average recruitment in deterministic projections
    - Considering stepped changes in catch and effort from 2012 (30% increase to 50% decreases) for:
        - longline catch
        - purse-seine associated effort
        - domestic fisheries in Indonesia and the Philippines[2]
    - Repeated for the base-case model for yellowfin and skipjack tuna
- Additionally, three specific projections will be undertaken
    - Continuation of the provisions of CMM 2008-01 into the future, incorporating any new information regarding the implementation in 2009 and 2010.
    - As above, but with all the exemptions and special provisions removed.
    - Continuation of provisions of CMM 2008-01 into the future with the additional high-seas purse-seine closure as announced by the PNA (Attachment H) with an assumption of no redistribution of effort.
    - Assumed patterns of catch and effort for 2010 and 2011 will be based the provisions of CMM 2008-01. It will also incorporate fishery behavior observed during 2009 and 2010 under CMM 2008-01.
    - Changes in catch and effort for the generic projections will be from 2012 onwards and will be relative to 2011 levels (as allowed under CMM 2008-01 assuming full compliance), but will also be reported relative to "2001–2004 levels" from previous agreements (e.g. see Attachment F of CMM 2008-01 for longline values).

WCPO yellowfin tuna

32. No new information on the stock status of this species was presented to SC6; therefore, management recommendations from SC5 are maintained.

Requests from CMM-2008-01

33. The Secretariat reported that no information was submitted in accordance with paragraph 39 of CMM-2008-01 for fishing effort or proposals of effort data from other commercial tuna fisheries provided by CCMs.

WCPO skipjack tuna

Stock status and trends

[2] "Domestic fisheries" in this context is the term used to cover all fisheries based in Indonesia and the Philippines within the Convention Statistical Area that catch tuna. The scientific work of the WCPFC requires data from all fisheries (that is, through the range of the stocks), including archipelagic waters, to ensure that stock assessments are able to incorporate the total fishery removals from the stocks. However, the Commission's conservation and management measures (CMMs), including CMM 2008-01, do not extend to the domestic fisheries in archipelagic waters or territorial seas of the Convention Statistical Area, which are considered the sovereign territory of countries".

34. SC6 selected run 41 as the base model to represent the stock status and Committee's advice on skipjack tuna. A value of 0.75 was chosen as the mid-point of the range of steepness values considered in the 2010 assessment. Similar to bigeye tuna, the actual value of steepness for WCPO skipjack currently remains unknown.

35. Fishing mortality rates tended to be higher during the last decade than for the preceding period and fishing mortality and biomass indicators relative to MSY started to move to 1.0, although they remained substantially below the F_{MSY} level ($F_{current}/\widetilde{F}_{MSY}$ = 0.34)(Table SKJ1). The stock is not in an overfished state because biomass is above the B_{MSY} ($B_{current}/\widetilde{B}_{MSY}$ = 2.42). Table SKJ2 compares RPs between the 2010 and 2008 assessments and the key conclusions based on MSY quantities between assessments are similar.

Table SKJ1: Estimates of management quantities for the 2010 base model. For the purpose of this assessment, "current" is the average over the period 2005–2008 and "latest" is 2009.

	2010 base case
$C_{current}$	1,406,358
C_{latest}	1,575,287 (spill sampling)
MSY	1,375,600
$C_{current}/MSY$	1.02
C_{latest}/MSY	1.15
F_{mult}	2.94
$F_{current}/F_{MSY}$	0.34
SB_0	4,433,000
SB_{MSY}/SB_0	0.27
$SB_{current}/SB_0$	0.72
SB_{latest}/SB_0	0.61
$SB_{current}/SB_{MSY}$	2.67
SB_{latest}/SB_{MSY}	2.27
$SB_{curr}/SB_{curr_{F=0}}$	0.60
$SB_{latest}/SB_{latest_{F=0}}$	0.55
Steepness (h)	0.75

Table SKJ2: Estimates of reference points from the 2010 and 2008 skipjack tuna stock assessments. The spatial domain of the 2008 assessment was limited to the equatorial region of the WCPO.

Management Quantity	2010 Assessment	2008 Assessment
Most recent catch	1,575,287 mt (catch based on spill sampling)[a]	1,546,436 mt (2007[b]) 1,726,702 mt (2007[c]) 1,410,389 (WCPO catch based on spill sampling)
MSY	1,375,600 mt	1,280,000 mt
$Y_{Fcurrent}/MSY$	0.80	0.70
$B_{current}/B_{current,\ F=0}$	0.63	0.66
$F_{current}/F_{MSY}$	0.34	0.26
$B_{current}/B_{MSY}$	2.24	2.99
$SB_{current}/SB_{MSY}$	2.67	3.82

[a] Total catch in 2009 of 1,789,979 mt based on grab sampling.
[b] Equatorial region, based on grab sampling.
[c] WCPFC region mt, based on grab sampling.

Management advice and implications

36. Catches in 2009 increased to a historical high of ~1.8 million mt. This is significantly above the estimated MSY of ~1.35 million mt. The assessment continues to show that the stock is currently only moderately exploited and fishing mortality levels are sustainable. Catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of the fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored.

37. Fishing is having a significant impact on stock size especially in the western equatorial region and can be expected to affect catch rates. Additional purse-seine effort will yield only modest gains in skipjack catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

38. There is concern, yet to be substantiated, that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand) fisheries.

39. Noting the uncertainty in purse-seine species composition, SC6 urged the Commission to continue improving estimates of purse-seine composition data. SC6 requested CCMs port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with the effort to collect cannery data.

South Pacific albacore

Stock status and trends

40. SC6 noted that it may be necessary to obtain progress on some of the biological studies that were discussed in the Biology theme before useful results can be obtained from a new assessment, but noted that there have been substantial differences between different assessments over time and between model

configurations, and it is important to reduce the uncertainty in the assessment to support work on more comprehensive management arrangements than those included in CMM2005-02.

41. SC6 noted that the albacore assessment should be kept up to date, because of the increasing effort on this stock. CCMs also encouraged that any future work on South Pacific albacore tuna should include effects of oceanographic change and address possible local depletion.

Management advice and implications

42. No new information on the stock status of this species was presented to SC6; therefore, management recommendations from SC5 are maintained.

South Pacific swordfish

Stock status and trends

43. WCPFC8 is anticipated to review CMM 2009-03 in 2011. Several CCMs noted that a new assessment for South Pacific swordfish should be planned for next year, and that additional discussions should consider any information available on this assessment, including how it may be possible to extend the spatial scope of previous assessments to include the south-central Pacific.

Management advice and implications

44. The advice from SC5 should be maintained, pending a new assessment or other new information.

Southwest Pacific striped marlin

Stock status and trends

45. SC6 noted that following Australia's request to SC5 to add southwest Pacific striped marlin to its work plan as a high priority, Australia, New Zealand and SPC collaborated in the development of two funding proposals in 2010. However, despite the high priority ranking for such an assessment, both from WCPFC's SC and the Australian Fisheries Management Authority, proposals did not receive funding in 2010. SC6 noted that Australia has sought domestic funding for a revised southwest Pacific striped marlin stock assessment several times since the last assessment but without success. It was noted that given the last stock assessment was carried out in 2006, an updated assessment is urgently needed. It was proposed that SPC be tasked with carrying out a revised stock assessment for presentation at SC7.

Management advice and implications

46. SC6 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

Stock status and trends

47. A 2010 published study refined the ISC2007 assessment by conducting two assessment scenarios to account for different hypotheses about the steepness (0.7 and 1.0) of the stock-recruitment dynamics. The probable status of North Pacific striped marlin indicated that F/F_{MSY} (2001–2003) was 3.67 under scenario 1, and was 1.90 under scenario 2. Corresponding estimates of striped marlin biomass were below

S_{MSY} and ranged from 29% of S_{MSY} under scenario 1 to 44% of S_{MSY} under scenario 2. In relation to *MSY*-based RPs, striped marlin was experiencing overfishing and the stock was considered depleted under each steepness scenario. ISC reported that a two-stock scenario (WCPO and EPO) stock assessment for striped marlin will be completed in 2011.

Management advice and implications

48. SC6 recommended that WCPFC7 further develop a measure for the conservation of North Pacific striped marlin given the high fishing mortality of this species.

49. SC6 noted that considerable effort towards a CMM was made by an informal working group at WCPFC6. However, after four rounds of revisions, the proposed CMM was unsuccessful. As a consequence, this species was identified at that meeting as a priority for CCMs' consideration this year towards the development of a CMM. A new stock assessment is scheduled for 2011 under a different stock scenario. SC6 recommended as a precautionary measure that the Commission consider adopting an interim measure for 2011, which would be revised pending a new striped marlin assessment.

50. If the WCPFC decides to control the fishing mortality rate of North Pacific striped marlin as advised by ISC, it could do so through limits either on fishing effort or on catch, or through other controls. If it decides to limit catches, it would be helpful to know the levels of catch that correspond to a range of reference fishing mortality rates. Therefore, pending a new striped marlin assessment to be conducted by ISC, SC6 recommended that the WCPFC7 request ISC to provide estimated catch levels corresponding to average fishing mortality during 2001–2003 and fishing mortality RPs, including F_{MSY} and F at various spawning potential ratios.

51. SC6 requested a clear direction on how the WCPFC's science services provider will work with ISC scientists on the assessment planned for 2011. The stock assessment report on this species must be discussed in full at SC7 like any other new stock assessments.

Northern stocks

52. An ISC representative, per SC's request, agreed to provide SC7 with an overview of ISC recent assessments for each stock and management advice.

North Pacific albacore

Stock status and trends

53. The most recent ISC stock assessment for North Pacific albacore was completed in 2006 and a full stock assessment will be conducted by ISC in 2011 and reviewed at ISC11. No formal update of stock status has been conducted since the 2006 assessment. However, at its 12–13 July 2010 meeting, the albacore working group (ALBWG) undertook a qualitative update using available fisheries data from 2006 to 2009 and an index of spawning stock biomass (Japanese longline CPUE age 6–9+). Based on this update, the ALBWG concluded that:

i. A new stock assessment will be necessary to fully understand the implications of the new data available since the last stock assessment;
ii. The 2006 stock assessment estimated that albacore spawning biomass reached an historical high in 2005 and then projected a decline thereafter. The age 6–9+ index shows that SSB has declined from previous high levels and appears to be relatively stable since the last stock assessment;
iii. The ALBWG did not focus on recruitment in its latest qualitative review and is unable to provide insight into recruitment in recent years beyond observations in previous plenary reports; and

iv. Nominal effort in most fisheries (as measured by the number of vessels) appears to have declined slightly or been stable since 2005. Although catches exhibit more interannual variability than effort, with the largest variation occurring in the Japan pole-and-line fisheries, most fisheries catches have declined or remained relatively stable over the same period. This could mean that F2009 is less than the F2002–2004 (0.75 yr-1) used in the 2006 stock assessment projections. Alternatively, F2009 may be as high as the value used in the stock assessment projections because the level of recruitment after 2005 is not known.

54. Based on analyses conducted by the ALBWG since ISC9, the following points are highlighted:

i. Both the ISC9 and ISC10 plenaries note that there is increasing uncertainty concerning the status of North Pacific albacore in the absence of a new stock assessment.
ii. The ISC10 plenary notes that there are no strong positive or negative signals in the age 6–9+ SSB index since the last stock assessment.
iii. The next stock assessment is expected to be completed in early 2011 and the results will be presented at ISC11.
iv. The ISC9 plenary reported that the estimated value of F_{SSB}-*ATHL* is $0.75yr^{-1}$ for a 25-year projection period using fishery data through 2008. This value is similar to F2002–2004 = 0.75 yr-1, estimated in the last stock assessment.

Management advice and implications

55. ISC10 had no new information to alter its conservation advice from that provided at ISC9 in July 2009. SC6 recommended that the WCPFC adopt ISC's conservation advice provided on North Pacific albacore.

Pacific bluefin tuna

Stock status and trends

56. In 2010, ISC's Pacific bluefin working group (PBFWG) conducted an update of the 2009 analysis along with a complete set of sensitivity analyses and stock projections using data through 2007. Data used in the 2010 update were analyzed using the same methods and parameters in the stock assessment model as in 2009.

57. The updated "current" fishing mortality rate was calculated as a three-year average (2004–2006) with the terminal year of the model results (2007) excluded due to unreliable estimates. The PBFWG reviewed the results of the update with the objectives of characterizing the recent relative change in fishing mortality rate and spawning biomass. It should be noted that even the most recent estimates of fishing mortality would not yet reflect any actions with regard to the fishery management decision for Pacific bluefin taken by WCPFC6 (CMM 2009-07, Dec. 2009).

58. A summary of the 2010 update is as follows.

i. A number of sensitivity runs were conducted in 2010 to investigate uncertainties in biological assumptions and fishery data. Results indicate that the assumption of adult M is particularly influential to the estimate of absolute spawning biomass and fishing mortality. Although absolute estimates from the stock assessment model were sensitive to different assumptions of M, relative measures were less sensitive.

ii. The estimate of spawning biomass in 2008 (at the end of the 2007 fishing year) declined from 2006 and is estimated to be in the range of the 40–60 percentile of the historically observed spawning biomasses.

iii. Average fishing mortality for 2004–2006 (F2004–2006) had increased from F2002–2004 by 6% for age-0, approximately 30% for ages 1–4, and 6% for ages 5+.

iv. 30-year projections predict that at F2004–2006 median spawning biomass is likely to decline to levels around the 25th percentile of historical spawning biomass with approximately 5% of the projections declining to or below the lowest previously observed spawning biomass. At F2002–2004 median spawning biomass is likely to decline in subsequent years but recover to levels near the median of the historically observed levels. In contrast to F2004–2006, F2002–2004 had no projections (0%) declining to the lowest observed spawning biomass. In both projections long-term average yield is expected to be lower than recent levels.

Management advice and implications

59. ISC's plenary reached consensus on the management advice for Pacific bluefin tuna as follows: given the conclusions of the July 2010 PBFWG workshop, the current (2004–2006) level of F relative to potential biological RPs, and the increasing trend of F, it is important that the level of F is decreased below 2002–2004 levels, particularly on juvenile age classes.

60. SC6 recommended that WCPFC adopt ISC's conservation advice provided on Pacific bluefin tuna.

North Pacific swordfish

Stock status and trends

61. In 2010, the EPO stock assessment was updated to include missing swordfish catch from the IATTC area. Results of the updated EPO stock assessment were consistent with the previous 2009 EPO stock assessment.

62. Based on 2009 stock assessment results, the exploitable biomass of the WCPO swordfish stock was estimated to be about 75,000 mt in 2006 (B2006), roughly 30% above B_{MSY}. The exploitation rate on the WCPO stock in 2006 was estimated to be 14% with a total catch of roughly 9,900 mt or roughly 69% of MSY (MSY=14,400 mt). There was very high probability that B_{2006} was above B_{MSY}, a 93 out of 100 chance, and there was a 0 out of 100 chance that the exploitation rate in 2006 exceeded the rate to produce *MSY*. Based on the 2010 stock assessment update results for the EPO stock only, the exploitable biomass of the EPO swordfish stock was estimated to be about 69,000 mt in 2006, over 200% above B_{MSY}.

63. The exploitation rate on the EPO stock in 2006 was estimated to be 6% with a total catch of roughly 3,900 mt or roughly 78% of MSY (MSY=5,000 mt). There was very high probability that B2006 was above B_{MSY}, a 99 out of 100 chance, and there was a two out of 100 chance that the exploitation rate in 2006 exceeded the rate to produce MSY. The exploitable biomass of the WCPO swordfish stock was 31% above B_{MSY} and the exploitation rate was 46% below F_{MSY} in 2006. Similarly, exploitable biomass of the EPO swordfish stock was over two-fold greater than B_{MSY} and the exploitation rate was 62% below F_{MSY} in 2006. Based on results of the updated North Pacific EPO stock assessment and the 2009 North Pacific WCPO stock assessment, the billfish working group proposed that the ISC plenary maintain the existing conservation advice for this species.

Management advice and implications

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

65. SC6 recommended that the WCPFC note ISC's conservation advice provided on North Pacific swordfish stocks.

Responses to Commission's requests

66. SC6 reviewed the further evaluation of CMM2008-01 as requested by the Commission. The review of CMM-2008-01 and recommendations are contained under Agenda Item 6.1 of the Summary Report.

67. SC6 requested that the science services provider continue to:

- resolve data and methodological issues associated with bigeye and yellowfin fisheries as assessment inputs; and
- advance the analyses of the Pacific Tuna Tagging Project data to incorporate these into the skipjack assessment.

68. SC6 requested stock assessments in 2011 for WCPO bigeye and skipjack tuna, to be reviewed at SC7.

69. If the external peer review of yellowfin tuna assessment can be provided by December 2010, a decision will be made at WCPFC7 on the feasibility of conducting an assessment for SC7.

70. SC6 recommended that the South Pacific albacore base model assessment be updated and include catch and effort data from 2009 and 2010, and be presented to SC7 with improved biological data parameters that may be available.

MANAGEMENT ISSUES THEME

Identifying limit reference points for the WCPFC

71. SC6 made the following recommendations:

- SC6 recommended that Project 57 on RPs, identified at SC5, be completed. Specifically, tasks 1 and 4 to be put out to tender and tasks 2 and 3 to be completed by SPC. The results are to be reported to SC7 and, if appropriate, to the proposed Management Objectives Workshop to be held in 2011.
- After reviewing the results of Project 57, that SC7 make a recommendation to the Commission on candidate RPs (both type and value) for each of the key target species in WCPFC.

72. It was noted that the Management Objectives Workshop should occur after SC7 in order to allow the results of Project 57 to be first reviewed by SC.

Limiting catches of juvenile bigeye: Assessment of the FAD closure

73. Following the discussion on this issue, SC6 made the following recommendations:

- The Commission and TCC should note the analysis of fishing activities during the 2009 FAD closure presented in working paper MI-WP-03 when reviewing the implementation of CMM-2008-01.
- Further analyses should be undertaken as additional data and information comes forward to investigate the effectiveness of FAD closures on reducing juvenile bigeye mortality.
- Observer reports that document purse-seine effort during the 2009 FAD closure should be examined to investigate the setting characteristics of unassociated effort in proximity to drifting objects.
- Observer reports should be used to characterize the details of FAD sets made in contravention to CMM-2008-01.
- The Commission should give additional support to allow the timely analysis of observer data, including the analysis of size-trends in the catch to assist with the understanding of the FAD closure.

Review of Kobe II joint regional fisheries management organizations (RFMO) workshop outcomes

74. The table of recommendations together with SC6's response and comments is presented in Attachment M of the Summary Report.

Workshop on management objectives

75. In supporting this Management Objectives Workshop, SC6 made the following recommendations, and requested that the Commission take these recommendations into consideration when organising the workshop.

i. That WCPFC7 renew their support and the required funding provided at WCPFC6 for holding a Workshop on Management Objectives.
ii. In order to allow SC7 to first review the results of the intersessional work project on RPs, the workshop should be held between SC7 and WCPFC8.
iii. That an independent international expert(s) be invited to the workshop to provide expert guidance on the use of RPs and other issues of relevance to identifying fisheries management objectives. The science services provider (SPC), with the assistance of other regional scientists, contributes to the Management Objectives Workshop in order to provide technical advice on the adoption of RPs to key WCPFC stocks.
iv. SC6 also noted that in order to assist with the success of the workshop that some preparatory scientific work would need to be undertaken. It identified SPC as the agency in the best position to undertake this preparatory work. The Commission is requested to take this into consideration when addressing the level of funding support required for the workshop.

ECOSYSTEM AND BYCATCH MITIGATION THEME

Sharks

76. SC6 recommended to the Commission that:
- The shark research plan be approved.
- WCPFC 7 add porbeagle (south of 20°S)[3] and hammerhead sharks to the list of key shark species.
- The "key shark species" listed in CMM2009-04 be added to relevant sections of the Commission Rules on Scientific Data to be Provided to the Commission, namely: i) Section 1

[3] Until biological data shows this or another geographic limit to be appropriate.

on estimates of annual catches; ii) Paragraphs 1.3 to 1.6 of Annex 1 on operational level data; and iii) where possible recreational catch and effort information.

- CCMs should endeavour to collect catch and effort data for porbeagle sharks (south of 20°S)[4] and hammerhead sharks that reflects the spatial and temporal extent of their longline and purse-seine fisheries. Together with advice from the Kobe II specialist bycatch working group on data reporting requirement in 2011, SC7 will consider adding these two species to paragraphs 1.3 to 1.6 of Annex 1.
- SPC-OFP develop a process for the nomination of a key shark species for consideration at SC7, and identify a subgroup of key shark species for which stock assessments will be conducted.
- Any work undertaken on sharks should be in the context of the entire Commission area, given that no shark species have been defined as northern stocks.
- The Commission requested that ISC coordinate shark data sharing and shark stock assessments with SPC-OFP, and present the results of the shark stock assessments in full at SC7.

Seabirds

77. SC6 made the following recommendations.

i. SC6 noted that extensive research is currently underway aimed at providing a scientific basis for additional changes to CMM 2007-04. SC6 agreed that minor proposed amendments to CMM 2007-04, as recommended by the SC, should not be incorporated into the CMM until such time as there are sufficient changes to warrant revision.

ii. *On the use of weighted branch lines:*
   a. SC6 agreed that line weighting of pelagic longlines is likely to be one of the most effective mitigation measures in reducing or eliminating seabird interactions with baited hooks, and that further research should be undertaken to refine "weighted branch lines" specifications contained in CMM 2007-04.

iii. *On the use of dead baits versus live baits:*
   a. SC6 noted the findings in EB-WP-06, carried out in the southern hemisphere, that indicate the use of live bait in pelagic longline fisheries may increase seabird mortality above that associated with the use of dead bait, based on slower sink rates of live bait.
   b. SC6 agreed that the use of live bait should be discouraged in fisheries operating in areas of high seabird abundance that do not already use live bait.
   c. SC6 recommended that additional research be undertaken to confirm the findings presented in EB-WP-06, and to include different line weighting regimes, in areas north of 23°N and in areas south of 30°S, for consideration by SC. Seabird interaction rates for these experiments should also be reported.

iv. *On the use of blue-dyed bait:*
   a. SC6 noted that recent research suggests that blue-dyed squid bait may be more likely to decrease seabird bycatch in pelagic longline fisheries than other blue-dyed baits such as fish.

[4] Until biological data shows this or another geographic limit to be appropriate.

b. SC6 recommended that additional research be carried out on the efficacy of blue-dyed squid bait over other blue-dyed baits, including during both setting and hauling, for consideration by SC.

v. *On the location of the southern latitudinal boundary:*
   a. SC6 noted that the purpose of the productivity-susceptibility analysis in EB-IP-01 was to determine the probability of seabird-fisheries interactions and the risk of adverse effects of fishing-induced mortality on seabird populations. The results suggest that the southern boundary (30°S) of the seabird mitigation measure (CMM 2007-04) may need to be moved farther north to ensure adequate spatial protection for seabird high-risk areas.
   b. SC6 recommended that SPC-OFP and the Agreement for the Conservation of Albatross and Petrels provide advice on observer data and information on seabird distribution to the Secretariat after which a decision could be made on whether to proceed with a formal new analysis of risk levels of longline fishing to seabirds in the southern hemisphere. Members with observer programmes in this area should collaborate with SPC to assist in improving data holdings for assessing risk levels of longline fishing to seabirds.

vi. *On the use of deep setting line shooter:*
   a. SC6 noted the findings in EB-WP-07, carried out south of 25°S, which suggest that a mainline deployed with a line shooter (as in deep setting) into propeller turbulence at the vessel stern slows the sink rates of baited hooks.
   b. SC6 recommended that testing the deep setting line shooter be carried out north of 23°N to determine its utility in mitigating seabird interactions and other at-risk species (e.g. marine turtles, marine mammals, sharks) in that area.
   c. SC6 noted that there are currently no specifications for the use of deep setting line shooters in CMM 2007-04.
   d. SC6 recommended that TCC consider the development of specifications for "deep setting line shooter", for inclusion in CMM 2007-04.

vii. *On the format of Table 1 in CMM 2007-04:*
   a. SC6 noted that there are clear operational differences in longline fleets and seabird species composition in the areas north of 23°N and south of 30°S.
   b. SC6 recommended that when CMM 2007-04 is next modified, TCC should consider the utility of separating Table 1 into two separate tables, one each for the area north of 23°N and the area south of 30°S.

DATA AND STATISTICS THEME

Data gaps and progress in addressing data gaps

78. SC6 recommended that SC6-ST-WP-01 be forwarded to TCC for its consideration.

Species composition of purse-seine catches

79. SC6 recommended that:
   i) the current work (Project 60) on paired spill/grab experimental sampling should have continued funding and be extended to include fleets, areas and set types where no representative sampling has taken place. Where possible the results of the paired sampling should be verified against cannery, unloading and port sampling data. A standard spill sampling methodology should be documented once the trials are complete;

ii) CCMs collect species and size composition data in cooperation with factories and canneries where catch is landed;
iii) a flow diagram, illustrating how sampling biases can affect species composition data, should be made available to participants. This should document the method used to correct historic logsheet data; and
iv) a follow-up workshop on species composition issues to the workshop held in Sete, France in June 2009 should be held, in collaboration with all relevant RFMOs.

Progress report on reconciliation of WCPFC and ISC data holdings

80. SC6:
i) acknowledged the progress made to date, but reiterated the decisions made by the Commission at WCPFC6 on the process of reconciling the different data held by WCPFC and ISC; and
ii) requested the science services provider to provide specific tables that show provisions of operational level catch and effort data for the North Pacific region from all CCMs.

Regional Observer Programme

81. SC6:
i) noted the Regional Observer Programme (ROP) matters raised in ST-WP-01 and ST-WP-06, and emphasised the importance of the timely provision of observer data to support the verification of catch and effort data and for undertaking the evaluation of fishing activities for stock assessment and bycatch mitigation purposes;
ii) encouraged the Commission to finalize the outstanding matters relating to ROP data management and ROP data provision as a matter of priority; and
iii) noted the lack of adequate funding support provided for data compilation and analysis in the current Commission budget and requested that this be addressed at WCPFC7.

West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP)

82. SC6:
i) noted the WPEAOFMP's Steering Committee report;
ii) noted the excellent progress achieved by WPEAOFMP over the past 12 months; and
iii) indicated its continuing support for this project.

Tagging initiatives (PTTP)

83. SC6:

i) noted the good progress achieved by PTTP over the past 12 months;
ii) endorsed PTTP's 2010–2011 work plan;
iii) noted and endorsed the tagging programmes underway or planned in Hawaii, the EPO, and the coastal and offshore areas of Japan, Korea, Indonesia, Philippines and Papua New Guinea; and
iv) encouraged the science services provider to undertake further analysis to integrate PTTP data into future stock assessments as soon as possible.

COOPERATION WITH OTHER ORGANIZATIONS

84. SC6 noted that the memorandum of understanding with ISC will be reviewed at WCPFC7.

FUTURE WORK PROGRAMME AND BUDGET

Strategic Research Plan of the Scientific Committee

85. SC6 recommended that the revised strategic research plan for 2007–2011 be noted by the Commission, adding that the Strategic Research Plan was modified by SC6 so that there is no requirement for a mandatory external peer review every five years.

Progress of 2010 work programme, 2011 work programme and budget, and 2012–2013 provisional work programme and indicative budget

86. SC6 recommended that:

i. Project 35 (Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology) be allocated USD 31,000 for 2011.
ii. Project 60 (the collection and evaluation of purse-seine species composition data) be funded for 2011 with an allocation of USD 60,000.
iii. An additional USD 30,000 was proposed for SPC to complete the project on South Pacific striped marlin (identified in para. 514).
iv. An additional USD 10,000 was proposed for SPC to complete the project on seabirds (identified in para. 514).
v. An amount of USD 100,000 for scientific services to provide additional support to complete the three full assessments and one updated assessment. The undertaking of one of the full assessments is dependent on the completion of the yellowfin stock assessment peer review before WCPFC7. The SC budget submitted to WCPFC7 may be revised if the peer review is not completed by WCPFC7.
vi. Funding (USD 90,000) allocated for the Management Objectives Workshop, postponed from 2010 and to be held in 2011, be approved by the Commission to be reprogrammed in to the Commission's 2011 Part 1 budget.

Peer review of stock assessments

87. SC6 recommended that:

i) the Commission allocate a budget to carry out the bigeye stock assessment peer review, if required;
ii) the Northern Committee consider allocating funds for peer review of a northern stock assessment. SC6 further noted that North Pacific albacore is a possible candidate for review of the stock assessment scheduled to be completed in 2011.

Table 1. List of Scientific Committee work programme titles and budget for 2010, and indicative budget for 2012–2013, 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 / Project with priority	2011		2012		2013	
	Core	Other	Core	Core	Other	Core
Project 14. (Priority = High) West Pacific East Asia Project	25,000		25,000	25,000		25,000
Project 35. (Priority = High) Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology	31,000		62,000	31,000		62,000
Project 42. (Priority = High) Pacific-wide tagging project	10,000	2,500,000	10,000	10,000	2,500,000	10,000
Project 57. (Priority = High) Identifying Provisional Limit Reference Points for the key target species in the WCPFC	20,000		20,000	20,000		20,000
Project 60. (Priority = High) Collection and evaluation of purse-seine species composition data	60,000			60,000		
Striped marlin (priority = high)	30,000			30,000		
Seabirds (priority = high)	10,000			10,000		
SUB-TOTAL	186,000		117,000	186,000		117,000
UNOBLIGATED BUDGET	60,000		110,000	60,000		110,000
SPC-OFP BUDGET	720,000		792,000	720,000		792,000
SPC-OFP Stock assessments	100,000[a]			100,000[a]		
GRAND TOTAL	1,066,000		1,019,000	1,066,000		1,019,000

[a] Relates to the additional costs of a third full stock assessment, noting that costs of two full stock assessments and one updated assessment is currently included in the SPC-OFP budget figure.

Review of the structure and functions of the Scientific Committee meetings

88. Following a discussion of the new meeting structure adopted at SC6, and after considering options for further improving the efficiency and effectiveness of the future operation of the SC, SC6 recommended that the Commission adopt the following structure for the meeting of SC7:

i) The meeting will meet over nine days (one day less than SC6). It is desirable that the days over which the meeting is to be held minimize the time required for attendees to fly to and from the meeting (i.e. avoid the need to fly on weekends).

ii) Together with the other usual non-theme agenda items (i.e. Agenda Items 1, 2, 10–15 at SC6) the meeting will include the following themes (duration in parentheses):
   a. Data and Statistics theme (3 sessions)
   b. Stock Assessment theme (10 sessions)
   c. Ecosystems and Bycatch theme (4 sessions)
   d. Management Issues theme (2 sessions)

iii) The Biology theme, the Methods theme, and the Fishing Technology theme are to be included in an expanded SC, which is to be held less frequently, as deemed necessary. To allow for the inclusion of these three additional themes, the duration of these SC meetings will be expanded by one or two days, as specified by the preceding SC. Convenors for these three themes will be identified at the SC meeting held the year before the expanded SC

meeting. Scientists who would like to present their work during each theme are requested to contact the relevant convenor who will then decide on whether this work should be presented and discussed.

iv) Issues relating to Biology, Methods and Fishing Technology that are of relevance to the stock assessments to be undertaken that year, and which are to be considered by the Stock Assessment Preparatory Workshop (SAPW), are to be included in this workshop. Because SPC is the convenor of SAPW, those scientists who would like to present their work to SAPW are requested to contact SPC who will then decide on whether this work should be presented and discussed.

v) Issues of significance in relation to stock assessment outcomes and/or the evaluation of CMMs, and which would have been covered by the Methods, Biology and Fishing Technology themes, are to be included in the Stock Assessment theme. These issues should be identified by SAPW and the convenor of the Stock Assessment theme in consultation with the SC Chair and Vice-Chair. To help facilitate the inclusion of such presentations the duration of the Stock Assessment theme has been expanded by one session.

vi) In recent years, special sessions relating to presentations and discussions of large projects of interest to SC (such as the session on the WPEAOFMP held during SC6) have been held on Saturday afternoons. This practice will continue. In the event that a second special session is required (as for the PTTP during SC6) then this is to be held as an evening session on a suitably specified day.

vii) Sunday will continue to be a non-meeting day.

Outstanding issues from the independent review

89. SC6 reviewed the paper GN-IP-03 "Issues to be addressed from the Independent Review of the Commission's Transitional Science Structure and Functions", which outlines outstanding issues to be addressed by SC. SC6's responses to the paper are in Attachment K.

90. In relation to this agenda item, GN-WP-04 "Stock Assessment Preparatory Workshop: Revised Terms of Reference" was considered. This paper is included as Attachment L for the Commission's consideration.

Selection of officers

91. N. Miyabe was nominated by SC6 and recommended to the Commission to continue his service as SC Chair.

Next meeting

92. SC6 welcomed Palau's offer to host SC7, to be held in Koror, Palau, which is provisionally scheduled for 9–17 August 2011.

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

SUMMARY REPORT

AGENDA ITEM 1 — OPENING OF MEETING

1.1 Welcome address

1. S. Matoto, Head of Fisheries, Kingdom of Tonga, welcomed delegates to the meeting of the Sixth Regular Session of the Scientific Committee (SC6), which took place in Nuku'alofa, Tonga from 10–19 August 2010. The list of participants is appended as Attachment A.

2. The Chair of the Scientific Committee, N. Miyabe (Japan), gave the keynote remarks (Attachment B).

3. Acting Prime Minister Viliami Ta'u Tangi (also Minister of Health, Kingdom of Tonga) gave the opening address (Attachment C).

4. On behalf of all participants, A. Mobiha (Papua New Guinea) thanked the Deputy Prime Minister and the Head of Fisheries for their welcome.

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

6. The 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), Pew Charitable Trust, Birdlife International, Greenpeace, the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), and the International Sustainable Seafood Foundation (ISSF) attended as observers.

7. Matters considered by the SC6 and its thematic groups — Fish Biology (BI), Ecosystem and Bycatch Mitigation (EB), Fishing Technology (FT), Management Issues (MI), Methods (ME), Data and Statistics (ST), and Stock Assessment (SA) — included:

i. a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
ii. a review of the status of stocks of bigeye tuna and skipjack tuna in the WCPO;

iii. a summary of the most recent information and assessments for tuna and billfish stocks in the North Pacific;
iv. bycatch mitigation issues associated with seabirds, sea turtles, sharks, and recommendations from Kobe II workshops;
v. requests from WCPFC6;
vi. issues associated with the data available to the Commission and initiatives to address data gaps;
vii. the status of the West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP), the Japan Trust Fund (JTF) and the Pacific Tuna Tagging Project (PTTP);
viii. relations with other organizations; and
ix. administrative matters associated with the functioning and structure of SC meetings, streamlining the operations of the SC, and reviewing the Commission's Strategic Research Plan.

1.2 Adoption of agenda

8. The provisional agenda was adopted (Attachment D).

1.3 Meeting arrangements

9. The Secretariat outlined the meeting schedule and administrative arrangements.

10. The meeting observed a minute's silence in honour of three colleagues (M. Manning, U. Faanunu and B. Thoulag) who passed away over the previous year.

11. In accordance with a decision by the Commission and intercessional discussions with CCMs, the SC Chair announced a revised SC meeting structure, in which all six Specialist Working Group meetings are absorbed into the plenary meeting (theme agendas appended as Attachment E).

12. The SC selected R. Campbell as the theme convenor for the new Management Issues Theme (Agenda Item 7) for the SC6 meeting.

13. The selection of new SC officers, including the new Chair and theme conveners, is addressed under Agenda Item 13.

14. During SC6, two steering committee meetings were held by the following:
i. West Pacific East Asia Project, and
ii. Pacific Tuna Tagging Project.

15. Informal small groups were convened to address matters related to:
i. SC's work programme and budget;
ii. recommendations from joint tuna regional fisheries management organization (RFMO) (Kobe II) workshops;
iii. Strategic Research Plan; and
iv. JTF.

1.4 Reporting arrangements

16. The SC agreed to adopt a Summary Report on the last day of the meeting, with the SC's recommendations to the Commission approved during the course of the meeting (following each thematic discussion) whenever possible. An Executive Summary, which would serve as the basis for the report,

advice and recommendations of the SC to the Commission, would be prepared by the Secretariat following the meeting.

17. A list of abbreviations and acronyms used in this report, and a list of documents for SC6 are included as Attachment F and Attachment G, respectively.

1.5 Intercessional activities of the Scientific Committee

18. WCPFC's Science Manager presented a brief report on the SC's intercessional activities for the last 12 months (WCPFC-SC6-2010/GN-IP-01), highlighting i) renewal of the memorandum of understanding (MOU) with the Commission's science services provider (i.e. SPC's Oceanic Fisheries Programme, SPC-OFP), which provides data management and stock assessment services; ii) publication of the SC5 Summary Report; iii) cooperation with other organizations; iv) the WPEAOFMP; v) the JTF; and vi) other work programme activities.

AGENDA ITEM 2 — REVIEW OF FISHERIES

2.1 Overview of Western and Central Pacific Ocean (WCPO) Fisheries

19. 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 — 2009" (WCPFC-SC6-2010/GN-WP-01). The provisional total Convention Area tuna catch for 2009 was estimated at 2,467,903 mt, the highest annual catch recorded, and 70,000 mt higher than the previous record in 2008 (2,398,664 mt). During 2009, the purse-seine fishery accounted for an estimated 1,894,500 mt (77% of the total catch, and another record for this fishery), with pole-and-line taking an estimated 165,814 mt (7%), the longline fishery an estimated 223,792 mt (9%), and the remainder (7%) taken by troll gear and a variety of artisanal gear types, mostly in eastern Indonesia and the Philippines. The Convention Area tuna catch (2,467,903 mt) for 2009 represented 81% of the total Pacific Ocean catch of 3,042,092 mt, and 58% of the global tuna catch (the provisional estimate for 2009 is 4,222,289 mt).

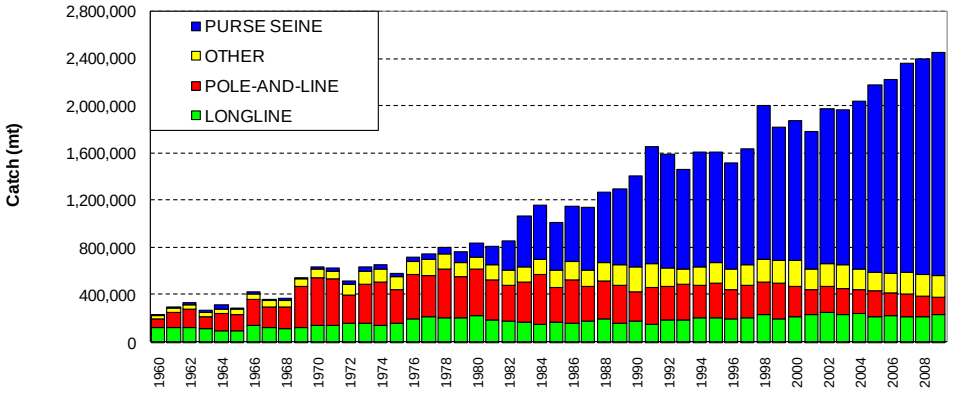

Figure 1: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area, by longline, pole-and-line, purse-seine and other gear types.

20. The 2009 Convention Area catch of skipjack (1,789,979 mt – 73% of the total catch) was clearly the highest recorded and nearly 120,000 mt more than the previous record catch of 2007 (1,672,996 mt). The Convention Area yellowfin catch for 2009 (433,788 mt – 18%) was 115,000 mt (21%), which was lower than the record catch taken in 2008 (547,985 mt). The Convention Area bigeye catch for 2009 (118,657 mt – 5%) was the lowest since 2003, mainly due to a drop in 2009 provisional estimates for the longline

fishery. The 2009 Convention Area albacore catch (125,479 mt – 5%) was the second highest on record, with very good catches from the longline fishery.

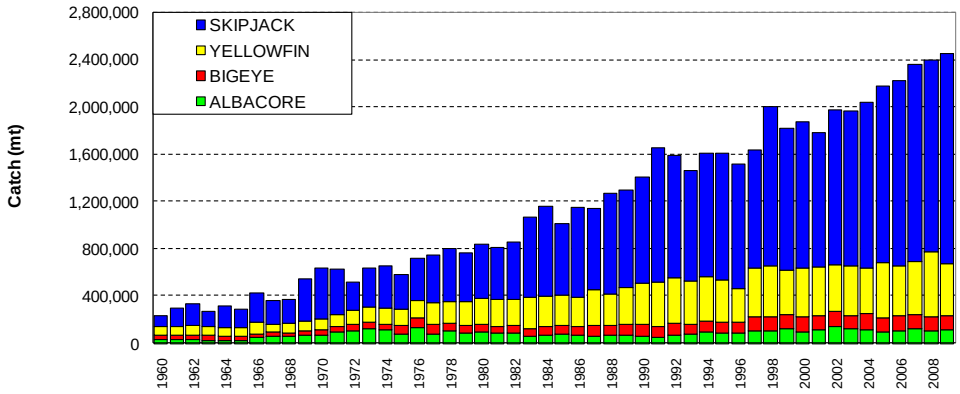

Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area.

21. The provisional 2009 purse-seine catch of 1,894,500 mt was the sixth consecutive record catch for this fishery and 70,000 mt higher than the previous record in 2008. The 2009 purse-seine skipjack catch (1,585,307 mt – 84% of the total catch) was clearly higher than both the 2008 catch (by 190,000 mt) and the record catch in 2007 (by 140,000 mt). The purse-seine skipjack catch has now increased by nearly 700,000 mt (or 79%) since 2001 (890,605 mt), at an average of about 88,000 mt per year. The 2009 purse-seine yellowfin catch (264,787 mt – 14%) was a significant reduction (124,000 mt) on the record catch taken in 2008 (386,293 mt) but still the fourth highest on record. The provisional catch estimate for bigeye tuna for 2009 (43,580 mt) was the second highest on record (only 900 mt [2%] less than the 2008 record catch).

22. The 2009 pole-and-line catch (165,814 mt) was the lowest annual catch for this fishery since the mid-1960s. The Japanese distant-water and offshore fleets (104,232 mt in 2009), and the Indonesian fleets (60,415 mt in 2007), accounted for most of the Convention Area pole-and-line catch. Catches by the Japanese distant-water and offshore fleets in recent years have been the lowest for several decades and this is no doubt related to the continued reduction in vessel numbers (in 2009 reduced to only 96 vessels, the lowest on record). The Solomon Islands fleet ceased operating in 2009, with no apparent plan to resume activities in the short term.

23. The provisional Convention Area longline catch (223,792 mt) for 2009 was slightly below the average annual catch for the period 2000–2009, and around 10% (23,000 mt) lower than the highest on record attained in 2002 (256,582 mt). The Convention Area albacore longline catch (87,080 mt – 39%) for 2009 was only 2,000 mt lower than the highest catch on record (89,883 mt in 2002). The provisional bigeye catch (65,606 mt – 29%) for 2009 was the lowest since 1996, but may be revised upwards when revised estimates are provided. The yellowfin catch for 2009 (69,158 mt – 31%) was similar to the average catch level for this species over the period 2000–2009.

24. The 2009 troll albacore catch (2,027 mt) was the lowest since 1986, and was apparently due to poor catches experienced by the New Zealand domestic fishery. The New Zealand troll fleet (165 vessels catching 1,790 mt in 2009) and the USA's troll fleet (4 vessels catching 237 mt in 2009) typically account for most of the albacore troll catch, with minor contributions coming from the Canadian, Cook Islands and French Polynesian fleets in previous years.

Economic overview of WCPO tuna fisheries

Value: purse-seine catch

25. Skipjack prices in 2009 averaged around 30% lower than 2008 prices; prices in Bangkok averaged USD 1,099 (compared with USD 1,543 in 2008, and USD 1,280 in 2007) and Yaizu prices at USD 1,325 (compared with USD 1,777 in 2008 and USD 1,287 in 2007).

26. The overall decline in skipjack prices in 2009 was driven by the reversal in trends of some of the important factors that previously had driven up fish prices, including trends in global food and oil prices as well as skipjack supplies. The estimated purse-seine skipjack catch in the WCPO was almost 15% higher than in 2008.

27. Price trends for purse-seine caught yellowfin were also down in 2009, with Bangkok prices at around USD 1,387, or 30% lower than in 2008 (22% lower than in 2007); Yaizu prices were USD 2,279, or about 11% lower than 2009, and 18% higher than in 2007.

28. At Yaizu market, purse-seine caught yellowfin prices, in USD terms, averaged USD 2,208/mt in the first half of 2009 and USD 2,345/mt in the latter half. The Yaizu average price during the first half of 2010 averaged USD 2,662/mt, a notable improvement over the previous twelve months.

29. The estimated delivered value of the purse-seine tuna catch in the Convention Area for 2009 was USD 2,300 million, a drop from last year's record level of USD 3,178 million. This represents a decline of USD 878 million or 28% on the estimated delivered value of the catch in 2008. This decrease was driven by a USD 515 million (21%) decrease in delivered value of the skipjack catch, which was estimated to be worth USD 1,897 million in 2009, resulting from a 31% decrease in the composite price that more than offset the rise of 15% in the catch. The value of the purse-seine yellowfin catch declined even more sharply, by almost 41%, to around USD 404 million, as a result of a 24% decrease in the composite price and a 31% decrease in catch.

Value: pole-and-line catch

30. During 2009, the Yaizu price of pole-and-line caught skipjack in waters off Japan averaged JPY 215/kg (USD 2,297/mt), a decrease of 11% from 2008. By contrast, the Yaizu price of pole-and-line caught skipjack in waters south of Japan increased, averaging JPY 253/kg (USD 2,704/mt) during 2009, a rise of only 1%.

31. The estimated delivered value of the skipjack catch in the Convention Area pole-and-line fishery for 2009 is USD 228 million. This represents a 26% decrease in the estimated value of the catch in 2007, resulting from a 7% decrease in prices and a 20% decrease in catch.

Value: longline catch

32. Longline sashimi product prices broadly remained stagnant, with some declining in 2009 as consumption focused on lower-end products owing to adverse economic conditions, both in Japan and USA markets.

33. Yellowfin longline prices (ex-vessel) landed at Yaizu dropped by 3% to JPY 616/kg and average frozen yellowfin prices (ex-vessel) at selected Japanese ports also dropped 3% to JPY 634/kg. Japanese import prices for fresh yellowfin sourced from Oceania declined 9% to JPY 846/kg. Bigeye frozen bigeye

prices (ex-vessel) at selected major Japanese ports rose 4% in 2009 to JPY 895/kg. Average prices for fresh bigeye from Oceania declined 5% to JPY 978/kg (USD 10.45/kg).

34. The price for frozen white meat canning product at Bangkok (10 kg and up) averaged USD 2,653/mt in 2009, up 7% from 2008 and 25% from 2007. Prices throughout the year steadied at between just above USD 2,500/mt and just under USD 2,800/mt. Thai imports of frozen albacore in 2009 rose 20% to 39,546 mt that more reversed the decline of 7% in 2008. Prices improved by 7% to USD 2,621/mt (2.62/kg) from USD 2,448/mt (USD 2.45/kg).

35. The estimated delivered value of the longline tuna catch in the Convention Area for 2009 is USD 1,301 million. This represents an increase of USD 48 million on the estimated value of the catch in 2008. The value of the albacore catch increased by USD 42 million (22%) while the value of the bigeye catch decreased by USD 23 million (4%) and the value of the yellowfin catch increased by USD 29 million (6%). The albacore catch was estimated to be worth USD 232 million in 2009 with the 22% increase being driven by a 6% increase in the composite price and a 15% per cent increase in catch. The bigeye catch was estimated to be worth USD 583 million in 2009 with the 4% decline accounted for by a 10% drop in catch, which more than offset the impact of the 7% increase in the composite price. The estimated delivered value of the yellowfin catch was USD 486 million, accounted for solely by the 6% increase in catch as the composite price marginally decreased (by less than 1%).

Catch and values by gear

Gear	Mt Millions			US$ Billions		
	2008	2009	% Change	2008	2009	% Change
Longline	0.21	0.22	4%	1.25	1.30	4%
Purse seine	1.85	1.93	4%	3.26	2.35	-28%
Pole and line	0.18	0.17	-7%	0.39	0.34	-12%
Troll	0.01	0.01	-13%	0.02	0.02	-31%
Other gears	0.14	0.14	-5%	0.26	0.18	-32%
GRAND TOTAL	2.40	2.47	3%	5.18	4.19	-19%

Catch and values by species

Species	Mt Millions			US$ Billions		
	2008	2009	% Change	2008	2009	% Change
Albacore	0.10	0.13	22%	0.26	0.33	30%
Bigeye	0.13	0.12	-6%	0.70	0.65	-7%
Skipjack	1.62	1.79	10%	2.84	2.19	-23%
Yellowfin	0.55	0.43	-21%	1.39	1.02	-27%
GRAND TOTAL	2.40	2.47	3%	5.18	4.19	-19%

Discussion

36. The question was posed whether it was possible to include billfish species in the WCPO fisheries overview prepared for future SC meetings. It was noted that WCPFC-SC6-2010/GN-WP-01 provides very good background and context for discussions throughout the SC meetings, and that expanding its scope would be useful. It was also noted, however, that caution would be required in determining which additional species should be included to ensure that the main theme of the paper (key target species) is not overshadowed. SPC and FFA indicated that targeted billfish species (e.g. swordfish) could be incorporated in the Tuna Fisheries Overview paper, while other species were better addressed under the Ecosystem and Bycatch Mitigation theme. It was also observed that preparing a full stock assessment for billfish would require much more comprehensive information than is now available.

37. In addition, concern was raised regarding the increase in purse-seine effort and effort on drifting fish aggregating devices (FADs) reported in the paper. It was noted that this is an issue for discussion later in the agenda.

38. Clarification was provided that the term "eco-friendly" is used by some sectors in regard to the pole-and-line fishery, due to the low levels of bycatch and discard by that fishery.

Recommendation

39. SC6 agreed to include key billfish species in its overview of WCPO fisheries, beginning with SC7.

2.2 Overview of eastern Pacific Ocean fisheries

40. K. Schaefer (IATTC Secretariat) presented a summary of the fishery and assessments of major stocks of tuna exploited in the eastern Pacific Ocean (EPO) in the 2009 review of EPO fisheries (WCPFC-SC6-2010/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 300 million hooks and 100 million hooks set annually between 1980 and 2008. Total tuna catches increased starting in 1995, peaking in 2003, and then declining to levels of about 10 years previously.

41. Yellowfin tuna catches have remained fairly stable since the mid-1980s, except for a peak in 2001 through 2003 followed by a substantial decline in 2006 through 2008. The 2008 catch on dolphin-associated schools increased significantly, similar to levels in 2006 and 2007, and there were reduced catches on unassociated schools. The current stock assessment method being used for yellowfin is STOCK SYNTHESIS. Since 2001, recruitment has been relatively low, although not quite as low as it was during 1977 through 1985. The spawning biomass ratio (SBR) for 2008 is above the level corresponding to the maximum sustainable yield (MSY). The spawning stock size is above the MSY level and fishing mortality rates are close to those corresponding to the MSY level. The current status of the stock is considerably more pessimistic if a stock recruitment relationship is assumed.

42. 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.

43. There have been substantial historical changes in the bigeye fishery in the EPO. Beginning in 1994, purse-seine catches increased substantially from the targeting of tunas associated with drifting FADs in the equatorial EPO. During the past 14 years, longline catches have been significantly below catches in the previous 20-year period. The current stock assessment method being used for bigeye is STOCK SYNTHESIS. Recruitment estimates have been above average from 2001 to 2008, except for 2007. Recent estimates indicate that the bigeye stock is overexploited and that overfishing is taking place. Recent SBR levels are below those corresponding to MSY and this result is consistent across various modeling scenarios.

44. A tuna conservation resolution was adopted by the 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 and Chinese Taipei, and other CPCs (IATTC Party, cooperating non-Party, fishing entity or regional

economic integration organization are collectively called "CPCs"), are not to exceed 500 t or their respective catches in 2001, whichever is greater.

2.3 Annual reports (Part 1) from members, cooperating non-members, and participating territories (CCMs)

45. CCMs presented their annual reports (part 1) for 2009.

Australia

46. Australian commercial fisheries for highly migratory species in the Convention Area are managed as part of the eastern tuna and billfish fishery (ETBF) (mainly a longline fishery with a small minor line[5] component) and eastern skipjack fishery (purse-seine fishery). The majority of fishing occurs in the longline sector of the ETBF and as such, is the focus of the annual report.

47. Total catches reported in logbooks for the ETBF decreased from 5,768 mt in 2008 (5,742 mt longline, 26 mt minor line) to 5,403 mt in 2009 (5,271 mt longline, 132 mt minor line). This is a decline from a peak of 8,229 mt in 2002. Longline fishing effort has fallen from a peak of 12.40 million hooks in 2003 to 8.82 million hooks in 2009; however, this is an increase from 2008 fishing effort levels (8.06 million hooks). The decrease in fishing effort from 2003 levels is mainly a result of the strength of the Australian dollar, increased operating costs and the surrender of permits under the structural adjustment component of the recent Australian Government Securing Our Fishing Future package. Fifty-five vessels reported longlining in the Convention Area during 2009. Longline logbook catches of albacore tuna increased from 1,083 mt in 2008 to 1,342 mt in 2009. Longline catches of bigeye tuna decreased from 900 mt in 2008 to 619 mt in 2009. Longline catches of yellowfin tuna also decreased from 1,478 mt in 2008 to 1,201 mt in 2009. Longline catches of swordfish decreased from 1,241 mt in 2008 to 1,111 mt in 2009. Longline catches of striped marlin decreased from 374 mt in 2008 to 325 mt in 2009.

48. There were 11 active minor line vessels during 2009. The number of vessels reporting using minor line has steadily decreased from a peak of 52 vessels in 2001. This is partly due to the surrender of 49% of permits under the structural adjustment component of the recent Australian Government Securing Our Fishing Future package. Annual minor line effort decreased from 310 lines in 2008 to 164 lines in 2009. In the 2008–2009 fishing season, there were no active vessels in the eastern skipjack fishery.

49. 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 2009, observers monitored 564,408 hooks in the longline fishery (6.4% of the total number of hooks deployed in the fishery).

50. AFMA is currently working towards the introduction of quota-based management in the form of individually transferable quotas into the ETBF scheduled for March 2011.

[5] minor line refers to handline, rod and reel, troll.

Belize

51. Belize's longline tuna fishing fleet in the Convention Area has shown a steady decrease in its catch and effort from 2003 to 2009. There has been a reduction of 30 vessels fishing exclusively in 2003 to 6 in 2009, all of which were licensed exclusively for operation in the Convention Area. Belize also has one reefer carrier currently operating in the Convention Area. Due to the reduction in fishing effort, all of Belize's catches have decreased from earlier years. There has been a 94% reduction in overall catches from 3,445.99 mt in 2003 to 213.23 mt in 2009. However, this reduction is a result of four of the vessels being laid up for over six months due to socioeconomic costs. Albacore was the main target species from 2003 to 2006. However, Belize's catches of yellowfin tuna exceeded those of albacore in 2007 and 2009. The average size of Belize's vessels has also risen from 191 gross registered tonnage (GRT) in 2003 to 497 GRT in 2008, and 576 GRT in 2009. The majority of vessels operating during 2003–2006 were between 51 GRT and 200 GRT. In 2009, six vessels were over 500 GRT.

52. Blue marlin is the most common non-tuna bycatch in Belize's longline fishery, followed by black marlin and sailfish. Large reductions in longline effort have also resulted in the reduction in catches of major bycatch species.

53. Belize received no reports of seabird and sea turtle interaction by Belize vessels in 2009. In 2008 measures were introduced to mitigate the impact of fishing for highly migratory fish stocks on seabirds and sea turtles, and Belize advised the WCPFC Secretariat of the measures currently being used by its vessels.

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

55. In the future, Belize intends to re-expand its longline fishing fleet to 10 fishing vessels exclusively in the Convention Area, to fish within the limits set by WCPFC.

Canada

56. Catch, effort and catch per unit of effort (CPUE) data for the Canadian albacore (*Thunnus alalunga*) fishery in the Convention Area for 2009 are summarized in this document. The Canadian tuna fishery is a troll fishery that uses jigs, and targets albacore exclusively. The Canadian fishery was inactive within the Convention Area in 2009, with no effort or catch reported in statistical zones within the Convention Area in either the North or South Pacific Oceans. The total Pacific albacore tuna catch from 2002–2008 by the Canadian albacore troll fishery within the Convention Area has ranged from 83 mt in 2005 to 453 mt in 2003, and effort has ranged from 56 vessel days in 2007 to 408 vessel days in 2002. Both catch and effort by the Canadian fleet in the Convention Area have declined since 2002. Canada participated in two ISC-Albacore Working Group meetings in 2009, and implemented an onboard size-sampling programme by harvesters.

China

57. China has two types of tuna fisheries in the Convention Area: purse-seine and longline, including ice fresh tuna longline (IFLL) and deep frozen tuna longline (DFLL). In 2009, the total tuna catch from the longline fishery was estimated at 41,519 mt, and from the purse-seine fishery 76,649 mt. China has 219 longline vessels and 12 purse-seine vessels.

58. The Chinese deep longline bigeye catch is exported to Japan for sashimi, and the longline albacore catch is sold for cannery products. The purse-seine catch for skipjack is also sold for cannery products. There were two scientific observers for Chinese deep longline vessels in 2009 in the entire Pacific Ocean. One observer trip collected fishery data and biological data during 19 June 2009 to 31 December 2009, covering areas S2°05′～S7°51′ and W159°48′～W168°10′, with 137 sets (346,720 total hooks) and 3,291 sampled fish. Another trip was made from 8 June 2009 to 31 January 2010, covering areas S1°36′～S16°15′ and W125°32′～W141°58′, with the 147 sets (476,920 total hooks) and 4,530 sampled fish. Size data for bigeye, yellowfin and swordfish has been submitted to WCPFC. Data coverage of catch and effort was 100%, with 100% logbook coverage for longline fishery, which will promote quality data collection.

Cook Islands

59. The Cook Islands issued 44 licenses last year to vessels authorized to fish within the Convention Area. In total, 21 licenses were issued authorizing vessels to fish in areas beyond national jurisdiction, within the Convention Area. Sixteen of these vessels also held licenses authorizing fishing activity within the Cook Islands' exclusive economic zone (EEZ), while the remaining five licenses were held by vessels based in foreign ports. In total, 23 licenses were issued to vessels authorizing fishing activity within the Cook Islands' EEZ.

60. Total provisional catch by Cook Islands vessels within the Convention Area for 2009 is 2,143 mt. Provisional total albacore catch estimates within the Convention Area is 1,542 mt, with 1,460 mt attributed to in-zone (i.e. within the EEZ) catch. Within the Cook Islands' EEZ, effort and total catch trends continue to be driven by the albacore fishery in the northern Cook Islands. In recent years, increases in effort have been attributed to (since late-2008) charter and foreign fishing vessels operating in the northern Cook Islands. On average, albacore constitutes 76% of total catches. In 2009, albacore catches taken in the southern fishery made up 5.2% of total in-zone catches, while albacore catches from the northern fishery contributed 73.6%. Although swordfish catches have diminished in recent years, vessels operating from Avatiu and Rarotonga continue to actively target this species during winter months. In total, 10.6 mt were reported from within the Convention Area; however, 9.9 mt of this was taken within the EEZ.

El Salvador

61. El Salvador is a small developing coastal country that borders the Pacific Ocean. The tuna industry has become one of the country's main economic revenues and represents the livelihood of a large number of families who live directly and indirectly from it.

62. El Salvador's tuna purse-seine fleet consists of only four vessels whose main tuna catches are made within the EPO. These vessels are fully controlled by two effective monitoring tools: vessel monitoring system (VMS) (hourly messages are received) and 100% observer coverage by the IATTC programme, with observers remaining onboard even when the vessel operates outside of the IATTC Convention Area. In addition, El Salvador complies with regulations such as fishing capacity limits; prohibition of at-sea transhipments; strong bycatch conservation measures regarding shark fining, dolphin protection, and sea turtles, among other species; as well as implementing fisheries closures in both the WCPFC and IATTC convention areas.

63. El Salvador´s monitoring and control system is highly effective, and our record of compliance in the IATTC and the Agreement on the International Dolphin Conservation Program (AIDCP) is excellent. In

the western Pacific, our fisheries have been conducted pursuant to licensing of coastal states of the region and high-seas fishing.

64. In regard to longline vessels, El Salvador has two operating vessels but these are not authorized to fish in the Convention Area. Finally, it should be emphasized that El Salvador is a small coastal state with an interest in and dependency on the tuna fishery; therefore, El Salvador is very respectful of the management dispositions implemented in order to promote sustainable fisheries. As a CNM, it is El Salvador's complete commitment to not only give full compliance to the measures emanating from the WCPFC, but actively participate within the Commission.

European Community

65. 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.

66. In 2009, four EC-Spain purse-seine vessels, all with a GRT over 1500, fished in the Convention Area. Data from AIDCP observers and, in the case of one vessel, logbooks (100% coverage), indicate a total landed catch of 25,462 mt (3,767 mt of bigeye, 18,686 mt of skipjack, and 3,009 mt of yellowfin). Effort, aggregated catches, discards and bycatch data are also presented.

67. Nine Spanish-flagged longline vessels targeting swordfish fished in the Convention Area in 2009, either year-round or temporarily. The vessels involved in the fishery presented the same average characteristics as in previous years (292 GRT, 862 HP and 41 m in length). The gear used is monofilament surface longline gear (Florida style modified), using an average of around 1,100 hooks per set. The 2009 swordfish landings, as well as estimations of bycatch, aggregated catches and effort distribution, are provided. Estimations of landings available for 2009 indicate a total swordfish catch of 1,721 mt from the Convention Area (674 mt from the Convention Area east of 150º W).

Federated States of Micronesia

68. The current estimate of the total catch by FSM's 31 purse-seine and longline vessels within the Convention Area for the year 2009 is 20,195 mt of skipjack, yellowfin and bigeye. The key target species accounted for 97% (predominantly by purse seine vessels), with the remaining 1% being non-target species. Approximately 95% of the total catch is by purse-seine gear and 5% by longline gear, which are the only two gear types employed by FSM's vessels within the Convention Area. In 2009, FSM employed 31 vessels (6 purse-seine and 25 longline). The total catch from FSM-flagged vessels, including other species, in the Convention Area for 2009 was 29,195 mt.

69. The 2009 catch by FSM's domestic fleet was predominantly (87%) skipjack (116,208 mt), with yellowfin at 12% (2,257 mt) and bigeye <1% (93 mt), and other species of <1%. In general, catch from the domestic fleet within the Convention Area has increased 55% over 2008, and 30% over 2007 catches.

70. Total figures for FSM-EEZ purse-seine, longline, and pole and line catches in 2009 cannot be reported to SC6 as FSM is having difficulties with its data and database for positive reporting; a resolution is being pursued with assistance from SPC.

71. FSM's observer programme operates with a pool of 32 observers. In 2009, there were 119 successful placements, including 20 onboard longline vessels and 99 on purse-seine vessels. The sudden increase of trip numbers by observers for 2009 is mainly due to the FAD closure period, when approximately 87% of all observer trips for 2009 were made. Coverage for observers per fleet and gear type will be reported

in FSM's SC6 annual report, as soon as it is able to calculate observed sea days versus the number of days fished in-zone.

72. FSM's National Oceanic Resource Management Authority (NORMA) achieved port sampling coverage rates of 82% for purse-seine vessels and 96% for longline vessels in 2009, based on unloading records. NORMA continues to strive for 100% port sampling coverage of longline transhipments in FSM's ports.

73. In total, 162 purse-seine vessels reported transhipping in FSM ports in 2009, with a volume of 106,209 mt of tuna transhipped. Skipjack accounted for 96%, with 3% consisting of mixed yellowfin and bigeye, and 1% other species. Pohnpei remains the only active port in FSM. The majority of the purse-seine vessels unloading in FSM were from Chinese Taipei, accounting for 94 transhipments, followed by China (24), FSMA (22), FSM (15), and Korea (7) unloading for 2009.

74. In total, 674 longline unloadings were indicated for 2009, for a total of 2,321 mt (56% bigeye, 18% yellowfin, and 26% other species). Most of the unloaded volume by longline vessels was by vessels flagged in China (60%), with 40% by FSM-flagged vessels. There were 419 unloadings by Chinese-flagged vessels, and 255 by FSM-flagged vessels.

Fiji

75. 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 at 15–25% of the total tuna catch, with the highest recorded in 2004. The percentage composition for bigeye has accounted for some 8% of the total catch. The 2009 catches of these three tuna species totaled 10,419 mt, or 75% of the total catch.

76. The nominal CPUE for albacore increased steadily from 1.03 in 2003 to 1.93 in 2006, before dropping to 1.49 in 2009. Bigeye nominal CPUE appears relatively stable over the time series. Yellowfin nominal CPUE remained consistent at and around the 0.2 levels in 2005 and 2006 before increasing to an average of 0.33 fish per 100 hooks in recent years.

77. National observer records for the interaction rates of species of special interest showed a higher level of interaction in 2009 compared with previous years. This is attributed to the improved reporting by the national observer programme. The following interactions were observed in 2009: two loggerhead sea turtles, one hawksbill turtle, one leatherback turtle, two olive ridley turtles, two dolphins and two toothed whales.

French Polynesia

78. The tuna fishery is a major component of French Polynesia's economy. The overall nominal catch for the commercial tuna fisheries in 2009 was estimated at 8,800 mt, of which 68% was caught by longline vessels and the remainder by artisanal coastal fisheries. Albacore, the target longline species, accounted for 43%, with yellowfin tuna comprising 15%, bigeye 7% and skipjack 15%, which is targeted by a part of the coastal fishery fleet.

79. 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 northern part of the EEZ (10–20°S and 140–150°W), and around Tahiti. Since 2001, no foreign fleets have operated in French Polynesia.

80. In 2009, 17 observers' trips were conducted on board of domestic longliners and 477 port sampling operations were conducted during fish unloading processes. The longline fleet is entirely based in Papeete, and this facilitates port sampling operations. Observers collected biological samples of albacore tuna (gonads and otoliths) during the year, with samples sent to SPC. During the year, observers were trained by staff from Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) to tag swordfish with popup markers. The first specimen was tagged in December 2009, and eight additional specimens should be tagged during 2010.

Indonesia

81. The Indonesia Fisheries Management Areas (FMAs) located within the Convention Area are: FMA 716 (Sulawesi Sea, Halmahera Sea), FMA 717 (Pacific Ocean). The main types of fishing gear targeting highly migratory species in these areas are purse-seine, longline, pole-and-line, surface and deep hook-and-line. The number of large purse-seine vessels increased by 46%, with 438 purse-seine vessels registered in FMA 716 and FMA 717. The number of tuna longline vessels decreased from 13.8% to 33.5%, with 264 longliners in FMA 716 and FMA 717. Trends are stable for other fishing gear types.

82. The fishing fleet size structure was as follows: <30 GRT (2.09%), 30 <50 GRT (12.50%), 50–100 GRT (54.50%), 100–200 GRT (21.38%), 200–300 GRT (1.56 %), 300–500 GRT (5.48%), 500–1,000 GRT (1.96 %) and >1,000 GRT (0.50%). Longline vessels of 300–500 GRT increased by 58%, with 21 vessels now operating.

83. Annual catches from 2003 to 2009 remained relatively stable, ranging from 105,403 mt to 151,554 mt. The catch composition was skipjack (52.4%), yellowfin (18.4%), longtail (8.9%), bigeye (6.7%), albacore (5.7%), frigate tuna (4.5%), eastern little tuna (3.4%), sailfish (0.1%) and black marlin (0.02%).

84. Research related to highly migratory species, particularly skipjack, yellowfin and bigeye tuna in the Convention Area of Indonesian waters, was conducted intensively in 1999. Since then, it has not been possible to regularly undertake research on highly migratory species. The research addressed biology dynamics and exploitation, mainly for yellowfin, bigeye and skipjack.

85. Indonesia faces difficulties in producing appropriate catch and effort data due to the complexities of its fisheries. Indonesia is participating in WPEAOFMP in an effort to resolve those shortfalls.

Japan

86. This discussion describes recent trends in Japanese tuna and billfish fishing activities by longline, pole-and-line, purse-seine and the other fisheries mostly in the Convention Area, including fleet size, catch and fishing effort statistics. There were 402 commercial longline vessels (larger than 10 GRT) in 2009, which is 63 vessels (14%) less than in 2008. There were 97 pole-and-line vessels (larger than 20 GRT) in 2009, or 2 vessels (2%) less than in 2008. In 2009, 38 purse-seine vessels over 200 GRT operated in equatorial waters, 3 vessels more than in 2008.Thirty-five distant-water purse-seine vessels were allowed to operate in tropical waters in 2009; this figure has stabilized since 1995.

87. The total Convention Area tuna catch (Pacific bluefin, albacore, bigeye, yellowfin and skipjack) by the Japanese fishery was 410,861 mt in 2009, corresponding to 91% of the 451,780 mt catch in 2008, although 2009 catch statistics are preliminary. In 2009, the catch of tunas by the purse-seine fishery was 237,599 mt (58% of the total tuna catch), with 104,282 mt (25%) by the pole-and-line, 53,738 mt (13%) by the longline, and the remaining (3%) by the other gear types.

88. Japan has conducted several research activities in relation to biological and stock assessment studies on tuna, billfish and other bycatch species in the Convention Area in 2009 and early 2010, including the tagging study for tropical tunas and sharks, several research cruises on Pacific bluefin tuna larval sampling, a research cruise to reduce the catch of juvenile bigeye by the purse-seine fishery, and bigeye migration. In addition, research was conducted related to bycatch species, including the experimental use of circle hooks to reduce hooking mortality of sea turtles, and at-sea experiments on the longline side-setting method, and a sea turtle nesting survey.

Kiribati

89. Tuna fishing in Kiribati consists of foreign fishing fleets licensed to fish tuna in Kiribati's EEZ and the artisanal fishery, which is important in providing food security for the local people. The licensing fees of foreign fishing fleets provided significant revenue to Kiribati. In 2009, this offshore licensing revenue comprised 35% of total government revenue.

90. The major types of licensed foreign fleets include purse-seine and pole-and-line vessels targeting skipjack and yellowfin tuna, and longline vessels, which mostly catch bigeye and yellowfin tuna. In 2009, Kiribati licensed over 500 foreign fishing vessels, including supporting vessels, the highest number recorded over the last five years.

91. Kiribati also engaged in a joint-venture fishing vessel, owning one purse-seine vessel (*Kao no.1*), which currently fishes under the FSM arrangement. In addition, three purse-seine and one pole-and-line vessels operated in the Convention Area under Kiribati's flag. The total catch from Kiribati's domestic fleet in 2009 was over 20,000 mt, which was three times larger than the average catch for the last 13 years. This increase results from the increase in the number of domestic vessels fishing during that period.

92. Tunas remain the most important of Kiribati's resources; therefore, the sustainable development and management of this resource is critical for the country. Kiribati will unite with other countries at both regional and international levels to ensure the sustainable management of these resources.

Korea

93. Two types of Korean tuna fisheries — distant-water purse-seine and distant-water longline — operate in the Convention Area. Over the past five years, the number of longline vessels decreased from 153 to 111, while the number of purse-seine vessel remained at 28. The size of purse-seine vessels ranged from 201 GRT to 2,023 GRT, with vessels larger than 2,000 GRT launched since 2006. The size of longline vessels ranged from 408 GRT to 498 GRT.

94. Purse-seine catch estimates over the past five years ranged from 204,500 mt to 283,300 mt, with an average of 249,585 mt; the trend was increasing. The main species caught were skipjack (82.6% of the total catch) and yellowfin tuna (17.2% of the total catch). Longline catch estimates for the past five years ranged from 22,900 mt to 38,400 mt, consisting of bigeye tuna (46.5%), yellowfin tuna (32.2%) and albacore (6.3%). Billfish (swordfish, blue marlin, striped marlin, black marlin and sailfish) comprised 12.6% of the total catch; blue marlin was the dominant billfish species caught, making up 44.5% of the billfish catch.

95. In 2009, three observers were deployed to monitor tuna fisheries in the Convention Area, and reported two shark species and one turtle species from purse-seine vessels, and five shark species from longline vessels. They conducted a tag-release on 19 yellowfin tunas and 6 bigeye tunas, with 223 tags recaptured by tuna purse-seine and longline vessels, and canneries reported to relevant tuna RFMOs and SPC. The National Fisheries Research and Development Institute (NFRDI) is currently developing

sampling methods for canneries. From 2010, NFRDI started a five-year research project on the biology and ecology of Pacific bluefin tuna in Korean waters. Fishers were directed to submit their logsheets to NFRDI electronically to improve catch data collection coverage rates.

Marshall Islands

96. The tuna fishery in RMI comprises foreign-flagged purse-seine, pole-and-line and longline vessels and RMI-flagged purse-seine and longline vessels. Most of the foreign-flagged longline vessels operate in support of domestic development activities and are based locally.

97. With a new purse-seine vessel joining the fishery in 2009, total catch by the national fleet operating throughout the WCPO was 44,342 mt, an increase of around 27% compared with the previous year. There was also an increase in catch from the national longline fleet, but the increase was not as pronounced.

98. Overall catch estimates from licensed foreign fleets operating in RMI's EEZ in 2009 amounted to just over 20,000 mt, with 76% of the catch attributed to purse-seine fleets. Skipjack tuna accounted for the majority of the catch.

Nauru

99. There were some new developments in Nauru's fisheries data and research activities since the last report. These include:

a) WCPFC gave interim authorization to the national observer programme to participate in WCPFC's Regional Observer Programme, after the programme demonstrated that it had met the minimum standards required by the Commission. In addition to the Parties of the Nauru Agreement (PNA) 3rd Implementing Agreement Observer requirements, this has given Nauru's observers more opportunity to expand their coverage rates and provide more useful data to the Commission.
b) Authorization was given to SPC to release operational logsheet data for fishing vessel activities in Nauru's EEZ to the WCPFC. There are no Nauru-flagged vessels operating in the WCPO, and this authorization will allow full and complete coverage of activities of all licensed fishing vessels operating within Nauru's EEZ, thereby meeting Nauru's reporting obligations.

New Caledonia

100. 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 (catches were 228 mt in 1981, 998 mt in 1982, and 492 mt in 1983). Longline vessels began operating at the same time. However, it took almost 20 years before this domestic fleet had significant activity.

101. In 2009, 21 domestic longline vessels fished within New Caledonia's EEZ. No licenses have been issued to foreign vessels since early 2001. A 7% increase in the total catch was reported in 2009 as a consequence of a similar increase in fishing effort. The annual catch of 2,545 mt mainly consisted of albacore, which accounted for 65% of the total (1,649 mt); yellowfin was second (at 487 mt and 19%).

102. No New Caledonian vessels target bigeye, shark, marlin or swordfish. Therefore, all catch reported for these species are bycatch. Shark catches have been decreasing since 2006, due to the increasing use of monofilament branch lines. The shortfin mako is the only shark retained and sold for consumption in New Caledonia, totaling less than 15 mt in both 2008 and 2009.

103. Observer coverage of longline sets reached 8% in 2009, during which only one turtle interaction was observed; there was 41% port sampling coverage. The main objective of these activities is to collect information to be checked with other data sources, particularly logsheets. The local VMS (which dates back to early 2005) also provides data for close monitoring of fishing activity. Through the ZoNéCo programme, New Caledonia continues to participate in regional efforts to improve the knowledge of tuna behavior, in particular South Pacific albacore as the species of major interest for its fishery. In particular, some funds are provided to help carry out tagging operations.

New Zealand

104. Since 2002, skipjack has comprised the greatest part of New Zealand's catch of all tuna species, both within and beyond New Zealand's fisheries waters. The 2009 catch totaled 26,676 mt, nearly all of which was taken by purse-seine vessels. Outside of New Zealand's fisheries waters, yellowfin (1,264 mt) made up most of the balance. Yellowfin are rarely part of the purse-seine catch within New Zealand's fisheries waters because the domestic purse-seine fishery targets only free schools of skipjack. The second most important component of New Zealand's domestic fisheries is albacore (1,115 mt), taken mostly by troll gear, but also landed as target and bycatch by the longline fishery. The domestic longline fleet targets both bigeye and southern bluefin tuna and, more recently, swordfish, but the greatest part of the catch consists of albacore. Almost 180 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; the destination of exports varies depending on the species.

105. New Zealand has four Class-6 purse-seine vessels fishing offshore in the EEZs of Pacific Island States and in high-seas areas of the equatorial WCPO. These vessels have also fished domestically from time to time along with six smaller capacity domestic-based purse-seine vessels. The number of purse-seine vessels has been relatively stable at between 10 and 13 vessels since 2005. New Zealand's longline tuna fleet consists of domestically owned and operated vessels (mostly between 15 m to 25 m in length) and a limited number of foreign-owned vessels that operate under charter. The number of longline vessels operating in New Zealand has declined from 151 vessels in 2002 to 40 in 2009.

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

107. Longline vessels fishing for tuna or swordfish in New Zealand's fishery waters are required to use tori lines, and may only set their lines at night unless using approved line weighting. New Zealand's longline vessels fishing on the high seas south of 30°S must use two mitigation measures as specified in CMM 2007-04. New Zealand's longline vessels have been provided with turtle de-hooking and mitigation equipment. As 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, marine mammals) have been observed in the purse-seine fishery.

108. New Zealand has an observer programme and two active domestic port sampling programmes. In 2009, 26% of longline effort (hooks) was observed, and almost 35% of New Zealand's purse-seine sets were observed; in addition six troll trips were observed. A considerable amount of research is directed at tunas, tuna-like 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 data collection systems in place to collect catch and effort data. New Zealand also has a system for collecting information on non-fish bycatch from fishers.

Niue

109. The development of a large-scale commercial fishery has long been an aspiration of Niue. Despite resource limitations, Niue has continued to work progressively over the years on researching and implementing viable operations, while factoring in some of the constraints in pursuing such a venture.

110. Fishing activity in Niue is undertaken within a relatively small EEZ and consists of three components: an artisanal boat and canoe fishery, a tourism-related sport fishery, and a developing commercial domestic longline fishery.

111. Niue's commercial domestic longline fishery operations within its EEZ target albacore tuna and associated bycatch. Since the commencement of the fishery in 2005, albacore has comprised the greatest part of catches for all tuna species within Niue's longline fishery. In mid-2009, Niue resumed operation under its joint fishing venture arrangement, and issued nine licenses for longline vessels.

112. The total longline catch from within Niue's EEZ over a four-month period was estimated to be approximately 202.5 mt, dominated by albacore (~147.2 mt) with lesser amounts of yellowfin (~19.5 mt) and bigeye (~10.0 mt). Catches of albacore and other pelagic species vary seasonally, impacting local abundances and, therefore, catch rates.

113. Longline vessels of Pacific Island countries and territories have operated within Niue's EEZ, including vessels from Samoa, American Samoa, Cook Islands, French Polynesia, Taiwan and Vanuatu under charter arrangements with Niue. Taiwanese, Korean and USA-flagged longline vessels have been licensed under access agreements to fish within Niue's EEZ in the past.

114. Niue aims to undertake a wahoo tagging project in late 2010 because wahoo is a significantly high-value fish of importance to food security in Niue. Catch rates have displayed relatively minor seasonal fluctuations, although a longer time series of data is required to better determine temporal and spatial patterns of catch rates in Niue's EEZ supported by biological data.

Papua New Guinea

115. The PNG tuna fishery is made up of both purse-seine and longline sectors with a small, but important handline sector. The longline and handline sectors are a citizen-only activity and all vessels fish exclusively in the waters under PNG national jurisdiction. The purse-seine sector is a mix of both domestic and foreign access vessels. The domestic sector comprises PNG-flagged vessels and PNG-chartered vessels, which support onshore processing facilities in PNG. While PNG-flagged vessels fish primarily in PNG's waters, although occasionally in adjacent high-seas areas, chartered vessels fish both in PNG's waters and waters outside of PNG. Foreign vessels under access arrangements fish in PNG's waters whenever there are fish to catch.

116. Total catch in 2009 within PNG's waters was 455,346 mt, a 9% drop from the 2008 catch of 500,433 mt. This catch was estimated to be about 11% of the global catch and 19% of the WCPO catch in 2009. The decline in total catch is attributed to the decline in total fishing effort. The catch contribution was, 71% by foreign vessels that fish under access arrangements, 21% from PNG-chartered vessels, and 8% from PNG-flagged vessels. A small amount of catch <0.5% (2,217 mt) was from the longline sector. Catch by PNG-flagged vessels outside of PNG's waters was 544 mt, and was from the high-sea pockets north and adjacent to PNG's EEZ. The catch by PNG-chartered vessels outside of PNG's waters was 70,855 mt and was mainly from the high seas and waters of other PNA countries.

117. In total, 227 vessels were active in PNG's waters in 2009: 32 longline and handline vessels, and 195 purse-seine vessels. Of the purse seine vessels, 9 were PNG-flagged vessels, 31 were PNG-chartered vessels, and 155 were foreign vessels fishing under access arrangements. Total purse-seine effort in 2009 was 13,348 days fished and searched, a 2% drop from 13,675 days in 2008. Longline effort also dropped from 42,805 hooks in 2008 to 36,574 hooks in 2009. Sets by purse-seine vessels in PNG were mainly on associated sets, which accounted for 81% of the total number of sets. About 60% of the associated sets were by foreign vessels and the other 40% by PNG-flagged and PNG-chartered vessels.

118. Data collection in PNG is very good, with above 80% of catch and effort data coverage for all fleets. For size and species composition data, PNG runs a port sampling programme as well as an observer programme that covers the vessels based out of PNG and foreign vessels fishing within PNG's EEZ. PNG's observer programme includes 200 observers. PNG intends to increase this number to 400 observers in the next three to four years. On average, observer coverage on vessels fishing in PNG's waters range from 30% on foreign vessels to 83% on PNG-flagged vessels. PNG-chartered vessels have, on average, 58% observer coverage.

119. PNG is striving towards building a fishing industry, and so fishing licenses are linked to onshore investment. At full capacity, PNG is looking to process all fish caught in PNG's waters within PNG. The rights to fish in PNG will also be linked to onshore investment in the near future.

Philippines

120. The Philippines expresses its strong commitment to promote effective management in order to achieve the long-term conservation and sustainable use of highly migratory fish stocks in the WCPO in accordance with the 1982 Law of the Sea Convention, the UN Fish Stocks Agreement, and the WCPF Convention. In giving effect to the provisions of the WCPF Convention, the Philippines upholds the conservation and management measures (CMMs) developed by the Commission, including CMM 2008-01 on the conservation and management of bigeye and yellowfin. On 31 May 2010, new Fisheries Administrative Order 236 was issued to regulate operations of Philippine purse-seine and ringnet vessels in order to reduce fishing mortality of bigeye and yellowfin tuna, as stated in the WCPFC CMM 2008-01.

121. Ongoing research activities of the National Stock Assessment Program (NSAP) have continued to collect data on species composition, length-frequency, and vessel catch and effort information on key tuna landing sites around the country. The WPEAOFMP, which began in January 2010, will help strengthen national capacity and international cooperation on priority transboundary concerns relating to the conservation and management of highly migratory fish stocks in the western Pacific and Southeast Asia (Indonesia, Philippines and Vietnam).

122. The Bureau of Fisheries and Aquatic Resources (BFAR) strongly encourages the tuna industry to continue supporting the catch documentation scheme, which includes the catch and effort logsheet system for all purse-seine and ringnet vessels. Aside from this, BFAR also requires canneries to submit monthly cannery unloading data. These efforts are geared towards improving tuna statistics and data gathering.

123. BFAR conducts regular (twice yearly) observer trainings. There are currently 86 trained observers ready to board vessels, especially those vessels intending to fish during the FAD closure period, 1 July–30 September 2010.

124. The provisional catch estimates for the three species of concern of the Convention Area in 2009 are: 251,254 mt of skipjack, 152,437 mt of yellowfin, and 5,735 mt of bigeye (information provided by the Bureau of Agricultural Statistics, 2009).

125. The Philippines, through BFAR-NFRDI and other concerned agencies, and with the tuna industry, is striving to improve data collection and strengthen its national capacity and international cooperation on transboundary concerns in relation to the sustainable conservation and management of highly migratory fish stocks.

Samoa

126. Samoa's tuna fisheries consist of longline and troll fishing fleets, both of which operate exclusively in Samoa's EEZ.

127. Albacore tuna continue to dominate the catch from Samoa's tuna longline fishing fleet, landing an estimated 2,816 mt of albacore in 2009, an increase of 474 mt (20%) from 2008. Albacore constitutes over 78% of the total longline catch for 2009 followed by yellowfin tuna (11% of total catch). An estimated 412 mt of yellowfin was landed in 2009, a 30% increase from the 2008 yellowfin catch and the highest recorded over the last five years. Bigeye catches also increased in 2009 by over 10% at 117 mt. An estimated 85 mt of skipjack tuna was caught from the troll fleet in 2009, comprising over 88% of the total troll catch. This is a decline of over 39% from the 2008 skipjack catch. Most of the skipjack catch was taken from free swimming schools. Skipjack catches increased steadily from 2006 to 2008 before falling in 2009, which was the lowest recorded catch in the last four years (2006–2009).

128. The number of fishing vessels actively fishing for albacore has dropped, from 44 in 2008 to 42 in 2009, and is the lowest recorded since the recovery of the fishery in 2006. The number of fishing vessels engaged in trolling is steadily increasing.

129. A new tuna management and development plan is currently being developed for Samoa's tuna fishery, which will see a reduction in the number of fishing licenses available.

Solomon Islands

130. Total catch estimates for the commercial tuna fishery in Solomon Islands increased slightly from 96,108 mt in 2008 to 105,186 mt in 2009. Total estimates were obtained from catch and effort logsheets for both national and foreign fleets. The total tuna catch for 2009 consisted of 79,312 mt of skipjack tuna, 24,383 mt of yellowfin and 1,490 mt of bigeye tuna. These catch estimates are for both foreign and national fleets.

131. In 2009, the foreign fleet recorded about 87,434 mt, consisting of 69,848 mt of skipjack tuna, 16,288 mt of yellowfin tuna and 1,298 mt of bigeye tuna. The national domestic fleet recorded only 17,752 mt, including 9,464 mt of skipjack tuna, 8,095 mt of yellowfin tuna and 193 mt of bigeye tuna. The majority of the tuna catch (97,477.2 mt) in Solomon Islands' EEZ in 2009 was taken by the purse-seine fishery; longline and pole-and-line fisheries caught the remaining 7,709 mt. Generally, most purse-seine fishing effort in 2009 was widely distributed, mainly in the northern part of Solomon Islands' EEZ, with the national fleet spreading towards the west, and foreign towards the east. The foreign longline fleet fishing effort distribution was scattered mostly to the south, towards the eastern edge of the EEZ.

Chinese Taipei

132. Three types of Taiwanese tuna fishing vessels operated in the Convention Area in 2009: 75 large tuna longline fishing vessels, 1,220 small tuna longline fishing vessels and 33 distant-water purse-seine fishing vessels. The total 2009 catch by the large tuna longline fishery was 22,318 mt, 38,704 mt for the small tuna longline fishery, and 192,075 mt for the distant-water purse-seine fishery. In 2009, the number of scientific observers was 21, with 31 observation trips conducted. Logbook data collection for the large

tuna longline fishery in 2009 was modified, and now includes more shark species (i.e. thresher shark, tiger shark, white shark, porbeagle, crocodile shark, hammerhead shark and oceanic white-tip shark).

Tokelau

133. There have been no significant changes to fisheries in Tokelau since 2008 except for a very slight increase in the local small-scale artisanal fleet that mainly targets free schools of skipjack by trolling, and yellowfin and bigeye tuna using the vertical handline method. Catches of skipjack, yellowfin and bigeye by artisanal fishers have fluctuated over time, and not as a result of fleet size.

134. The majority of commercial fishing activities in Tokelau waters are carried out by the USA's purse-seine fleet under the US Multilateral Treaty; the number of these treaty vessels fishing in Tokelauan waters for 2009 was unchanged from 2008, with an increase in total catch of 1,084 mt in 2008 (3,946 mt) to 5,030 mt in 2009.

135. In 2008, Tokelau licensed three NZ-flagged purse-seine vessels, three USA-flagged longline vessels and two Cook Islands longline vessels. In 2009, Tokelau licensed three NZ-flagged purse-seine vessels and one USA-flagged longline vessel. In October 2009, Tokelau deployed six nearshore FADs for the local artisanal fleet.

Tonga

136. The operation of the tuna longline fleet in Tonga in 2009 was similar to that in previous years, but was affected by various factors, particularly economic problems faced by fishing companies. Tonga's domestic longline fleet has been operating since 2005, and operates mainly within Tonga's EEZ.

137. The 2009 total tuna fishery catch declined in both quantity and value from 2008, and was the lowest recorded for the last five years; it peaked in 2007. This is due to various factors, including a 69% reduction in fishing effort (number of hooks) from 2007, and is consistent with the decline in the number of active fishing vessels. This reduction in effort was due to some fishing vessels switching to the beche-de-mer fishery, which started in Tonga in 2008; other factors such as environmental and oceanographic conditions also contributed. However, the total annual fishery CPUE increased from 2005 to 2008, and dropped in 2009, but seems irrelevant to the decline in catch. Total CPUE is mostly affected by the CPUE for yellowfin, with opposite CPUE trends for albacore and bigeye. Albacore accounted for the highest proportion of the total tuna catch for 2009, with additional high percentages of yellowfin and bigeye. The tuna catch composition indicated that most longline vessels and the structure of the fleet were targeting bigeye and yellowfin tuna for the fresh fish market, with a high proportion of albacore tuna in the catch. Dolphinfish and moonfish dominated the bycatch composition. From observer reports, Tonga's tuna fishery has no impacts on species of special conservation interest (e.g. turtle, marine mammals, seabirds).

138. SPC continued to provide assistance to Tonga Fisheries, including relevant information about tuna stocks in Tongan waters relative to the entire WCPO stock. The total 2009 tuna catch by the Tongan fleet continues to have an insignificant impact on the regional WCPO stock. Despite ample room for improvement and development of the tuna fleet in Tonga, high operational costs restricted the operation of fishing vessels to areas near the main fishing port of Nuku'alofa.

139. Tonga's research programme for tuna (i.e. data collection and observer deployment) was improved in 2009, with port sampling coverage at 86%, and the observer coverage at 12%. At the same time, measures and resolutions of the Commission are being implemented and monitored by Tonga Fisheries.

Tuvalu

140. The total number of fishing vessels licensed to fish in Tuvalu's EEZ has increased by 81% from 2008 to 2009, with 2009 having the highest record number with 217 licensed and flagged vessels. By contrast, the lowest records in 2006 constitute 69 licensed and flagged vessels; an increase of over 300% against 2009 records. The composition of fishing vessels in 2009 is such that purse-seine vessels constitute 63% of the total number of licensed vessels active in Tuvaluan waters, followed by 28% longline vessels. In 2009, Tuvalu had one flagged purse-seine vessel, one bunker and seven carriers. Tuvalu's fishing capacity continues to grow with fleets from the USA, New Zealand and Korea maintaining strong dominance.

141. A record catch of 66,819 mt of tuna was made in 2009 by the purse-seine and longline fleets. Of this total, the purse-seine fleet accounted for 99% of the catch. About 77% of this came from the three fleets (USA, New Zealand and Korea) combined. The longline fleet landed a total of 515 mt, which is the second lowest in recent years.

142. Tuvalu will engage in partnership arrangements through charters and joint ventures under its new fishery policy. This means level of effort and catch is expected to increase not only in Tuvalu's EEZ but also in the high-seas areas and other zones under bilateral arrangements. These domestic developments are responsible and legitimate. Tuvalu continues to enjoy more than30% of its total annual government revenue from its fishing sector.

USA

143. Large-scale fisheries of the USA and its participating territories for highly migratory species in the Pacific Ocean include purse-seine fisheries for skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacores*); longline fisheries for bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), albacore (*Thunnus alalunga*), and associated species; and a troll fishery for albacore. 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, mahimahi (*Coryphaena hippurus*), and wahoo (*Acanthocybium solandri*). The large-scale fisheries operate on the high seas, and some also operate within the USA's EEZ, and within the EEZs of other nations. The tropical troll fisheries operate in nearshore waters around Hawaii and the USA participating territories of American Samoa, the Commonwealth of the Northern Mariana Islands, and Guam. Other small-scale fisheries (tropical handline, pole-and-line) operate in Hawaiian waters.

144. Overall trends in estimated annual catch by USA and participating territory fisheries in the WCPFC statistical area in 2009 are dominated by the largest sector, the purse-seine fishery. Preliminary 2009 purse-seine estimates are known to be significant underestimates of actual catch due to data management delays. The USA purse-seine catch in 2008 has been revised upwards to 209,374 mt from last year's preliminary estimate of about 158,000 mt. Revised catch estimates include 159,740 mt of skipjack tuna, 45,363 mt of yellowfin tuna, and 4,220 mt of bigeye tuna. Updated estimates for 2009 are expected to be greater than the updated 2008 estimates. Longline catch estimates in 2009 decreased from 2008 after peaking in 2007. Bigeye tuna and albacore catch by longline vessels declined from record highs of 5,599 mt and 5,426 mt, respectively, in 2007 to 4,029 mt and 4,086 mt, respectively, in 2009. Excluding catch by USA participating territories (i.e. American Samoa), the longline catch of bigeye tuna declined to 3,709 mt in 2009 from 4,649 mt in 2008, and from a peak of 5,381 mt in 2007. The swordfish longline catch of 1,209 mt in 2009 remained virtually the same as in 2008, slightly less than the peak of 1,441 mt in 2007. Small-scale (tropical) trollers and handliners operating in Pacific Island waters

represented the largest number of USA-flagged vessels but contributed a small fraction of the catch. The longline fleet was the next largest fleet, numbering 151 in 2009.

145. The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) 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. NOAA Fisheries Service conducts fishery monitoring and socio-cultural research on tunas, billfishes, and animals caught as bycatch in those fisheries. In 2009, NOAA Fisheries Service continued to collect billfish distribution, catch and angler effort information for the International Billfish Angler Survey, summarized shark catch in the Hawaiian longline fishery, and began a study to understand the market impact of regulations on fisheries. Stock assessment research was conducted in collaboration with member scientists of the WCPFC and ISC. Stock assessment work is not described in this report.

146. NOAA Fisheries Service conducted biological and oceanographic research on tunas, billfishes, and sharks that addressed fish movements, habitat preferences, post-release survival, feeding habits, abundance, maturity, and age and growth. Oceanographic influences on American Samoa's longline fishery for albacore were studied, as well as billfish migration and life history. Several studies on sharks focused on their survival after capture and release. Shark tagging studies continued, and provide an increasing body of migration data. Research on sea turtles and sharks focused on bycatch mitigation. The change in seabird bycatch resulting from new regulations was also evaluated.

Vanuatu

147. Vanuatu is a member of RFMOs such as IATTC, the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Indian Ocean Tuna Commission (IOTC) and WCPFC. The membership of Vanuatu in these RFMOs has enabled Vanuatu's fishing fleet to fish waters of these RFMOs for tuna and other highly migratory fish species. Vanuatu's fleet is comprised of 19 purse seiners and 76 long-liner fishing vessels. Catch and effort coverage for the Vanuatu fleet has been high but the size data coverage is uncertain due to a lack of observers on board the vessels, particularly the long distant long-liners, and also due to lack of unloading data sought from the landing ports.

148. In Vanuatu's EEZ the only foreign fleet with high catch and effort data coverage is the Fijian fleet. In the period 2004–2009, annual catch estimates of the Vanuatu fleet generally increased, as did fishing effort (number of sets) and number of fish per 100 hooks. For the purse-seine fleet, there were more sets on unassociated than associated schools. The purse-seine fleet's total catches have increased from 52,304 mt to 144,893 mt, comprising 89.44% skipjack, 10.44% yellowfin and 0.12% bigeye. Unraised and provisional 2009 data show that catches of all major tuna species have increased, with around 129,000 mt of skipjack, 15,000 mt yellowfin and 174 mt of bigeye harvested. Some purse-seine vessels fished under the FSM Arrangement "home party" criteria (e.g. PNG), and therefore may have been included in PNG-fleet catch statistics. The major tuna species in the longline fleet catch were dominated by albacore (60%), yellowfin (16%) and bigeye (10%). Unraised and provisional estimates for the longline fleet in 2009 were 8,030 mt for albacore, 1,300 mt for bigeye, and 510 mt for yellowfin, but if raised could be higher.

149. Data for Vanuatu's EEZ were based on unraised logsheet data. Fishing within Vanuatu's EEZ was by foreign fleets from China, Fiji, Taiwan and Korea. The Taiwanese fleet has decreased but the Chinese and Fijian fleets have increased rapidly, based on the number of licenses issued in 2009. In 2009, Vanuatu had 100% observer coverage for locally based foreign fishing vessels, and 100% port sampling coverage during port unloading and transhipments.

150. Vanuatu's observer programme started in late 2008 to early 2009, with 100% observer coverage for locally based foreign fishing vessels, and 100% sampling coverage during unloadings in port and during transhipments. There have been 12 transhipments since 2008.

Vietnam

151. Vietnamese waters are also the distributions areas of tuna resources in the Pacific Ocean. Thus, in recent years, tuna fisheries in Vietnam have developed rapidly and are becoming a very important contributor to Vietnam's exports.

152. The three main fisheries targeting tuna species are longline, purse-seine and gillnet, and the main tuna species caught in Vietnamese waters are skipjack, yellowfin and bigeye. Average catches by longline fleets/trip reached 0.8–1.3 mt (trip duration was 14–24 days). In particular, some longline vessels gained 2.5–3 mt/trip; species composition of this fishery was 15.0% yellowfin and 10.5% bigeye tuna. For the purse-seine fishery, tuna species accounted for about 18–35% of the total catch, but most were frigate and spotted tuna, and small bigeye and yellowfin tuna. The fisheries data collection system for Vietnam's tuna fisheries is lacking and insufficient, and thus exact annual catch data for tuna fisheries are not available. It is very important to produce estimates of annual tuna catch by gear types, species and regions in order to provide relevant and essential advice for the management of these highly migratory species. This report seeks to provide some existing information referred from previous studies on Vietnamese tuna fisheries to support ongoing tasks in monitoring and management of tuna fisheries resources in Vietnam, as well as to contribute to management strategies in the WCPO.

Discussion

153. The following discussions and clarifications were offered during the presentation of national reports.

i. In response to an inquiry, Australia briefly outlined its current and previous initiatives to minimise sea turtle bycatch, and improve post-release survivorship. These included the development of a sea turtle mitigation plan that was approved at WCPFC6, circle hook trials, compulsory carriage of dehookers, and experiments on bait types deployed. Australia also indicated that its sea turtle mitigation plan highlighted low interaction rates with sea turtles in the ETBF.
ii. There was discussion regarding ambiguity regarding the spatial extent of data presented in the EU annual report, primarily due to the fact that fishing occurs in both the WCPFC and IATTC convention areas and in the overlap between the two. The EU advised that its interest was to present as comprehensive data as possible, and the SC agreed that this was informative and desirable. It was requested that future reports explicitly refer to the WCPFC Convention Area for clarity. In response to a comment, Indonesia provided additional information about the research and management programmes started in the northern part of its fishery, which have included biological and tagging studies and research on the impact of FADs.
iii. Japan clarified that it lacks data on the number of active small vessels as a result of government resourcing constraints.
iv. New Caledonia clarified that the use of monofilament branch lines in its fishery is currently voluntary but that a fisheries policy towards shark conservation will be imposed in the future. It was also noted that New Caledonia has a general catch rate of about 0.5 kg per hook, and catches have remained relatively stable from 2008 to 2009.
v. SPC advised that it holds a significant amount of logsheet data that may be useful to the USA in providing more accurate catch estimates.

2.4 Reports from regional fisheries bodies and other organizations

154. An observer made a presentation urging the SC to recommend the following measures to decision makers attending WCPFC7:

i. Ban all tuna fishing in the four high seas enclaves between Pacific Island countries;
ii. Implement an immediate and necessary 50% effort reduction in tuna fishing effort across the entire WCPO fisheries, based on average 2001–2004 levels;
iii. Immediately ban the use of FADs in association with purse-seine fishing;
iv. Implement the ecosystem-based approach to the management of tuna resources within well defined precautionary limits.

AGENDA ITEM 3 — FISH BIOLOGY THEME

155. The convener of the Fish Biology (BI) theme, M. Ogura (Japan), opened the session.

156. N. Davies (SPC) and S. Nicol (SPC) were appointed as rapporteurs.

3.1 Review of new biological information

157. The convenor of the BI theme presented the following paper on behalf of the authors, who were unable to attend: "Assessment of male skipjack tuna spawning activity in the tropical western and central Pacific Ocean. Rev. 1" (WCPFC-SC6-2010/BI-WP-02). Spawning activity of male skipjack tuna *Katsuwonus pelamis* in the tropical WCPO was examined. Testis maturity was classified on the basis of histological observation. The estimated minimum size at first maturity was 35.5 cm fork length (FL) and the size at 0.5 maturity (FL_{50}) was 40.7 cm FL. Mature individuals dominated throughout the year with no seasonal peak. All gonad index (GI) classes contained mature fish classified by testis observation. This indicated that it is difficult to differentiate the maturity stage based on GI class only.

Discussion

158. SC6 acknowledged the high quality of this work, and noted that it provided important information on male skipjack, and its direct relevance for stock assessment.

159. Clarification was provided on whether any analyses had been undertaken to determine if the differences in estimates from this study in comparison with others were related to the methods applied, environmental correlates, or fishing history. SC6 was advised that the differences between this and historical estimates were most likely due to more reliable histological methods used in this study and that presented for female skipjack at SC5. The differences in the estimated maturity schedule for male (this study) and female (presented at SC5) skipjack were not considered to be artefacts of any spatial bias, as the fish were sampled from the Japanese fleet, which operated in similar locations for both studies. Laboratory methods were the same for both studies. SC6 was advised that most samples come from areas where SST exceeds 25–26°C (the lower limit for spawning) but environmental correlates were not specifically evaluated in the study. It was not possible to speculate if fishing has caused the difference in estimates as no previous study using reliable histological methods is available for comparison.

160. SC6 acknowledged that the paper provided further evidence that the use of GI methods are not reliable for estimating maturity schedules for skipjack tuna.

3.2 Review of biological research projects

a. Project 35 (Bigeye tuna age and reproductive biology)

161. S. Nicol (SPC) presented "Bigeye tuna age, growth and reproductive biology (Project 35) – progress report, Rev.1" (WCPFC-SC6-2010/BI-WP-03), which reported on the progress of Project 35, a two-year pilot study in the EEZs of Palau and FSM to determine the sampling requirements for the broader Pacific-wide bigeye age, growth and reproductive biology project (Phase 2). The work plan for the pilot project scheduled sampling of bigeye for the period October 2009 to January 2010 with presentation of results and recommendations at SC6. In total, 73 observers have been trained in biological sampling procedures, however the low level of observer coverage on longline vessels over the past 12 months has restricted the opportunities for collection of otoliths and gonads from medium to larger individuals and the minimum sample size required for data analysis has not yet been achieved. This problem is being rectified through the assistance of the Luen Thai Fishing Venture (LTFV). LTFV operates in Palau, FSM and RMI and has negotiated with the vessels they manage to collect samples for the project. Sampling is expected to be completed in August 2010. Laboratory analysis is now scheduled for September to November 2010 and the final report provided to the WCPFC secretariat in December 2010. A consequence of the longer time frame required to collect samples for the pilot study is that no definitive advice can be provided to SC6 on the implementation of Phase 2. The SC may wish to postpone any decision on Phase 2 until it considers the final report. Consideration of this report could occur either out of session, at the pre-assessment workshop, or at SC7.

Discussion

162. SC6 noted the project's progress, and the difficulty in getting good observer coverage on longline vessels over the past 12 months due to priority given to placement of observers on purse-seine vessels arising from the FAD closure measure. SC6 expressed appreciation at the willingness of LTFV operating in Palau, FSM and RMI to support the collection of samples, which has temporarily rectified the situation. In general, however, SC6 would like priority to be given to using observers trained in this kind of work. In this regard, many longline vessels continue to operate primarily on the high seas.

163. Clarification on the use of frozen gonads was provided, and due to sample damage from freezing, the project is collecting double samples. This should ensure that the minimum number of samples required is available for analyses. The use of frozen samples prevents estimates of spawning frequency but is suitable for estimating batch fecundity.

164. SC6 noted that Phase 2 will require substantial financial resources to be fully implemented, and encouraged that the results from the pilot study identify not only the minimum number of samples required but also the size ranges of fish where sampling should be prioritized, or where sampling may not be needed (e.g. small fish less than 30 cm FL for maturity estimations).

165. SC6 expressed some concerns regarding postponing a decision on whether to fund Phase 2 of Project 35, as Phase 2 may then have to incur additional costs associated with re-establishing sampling infrastructure. However, the preference of the SC was to delay the scientific review of the pilot study and recommendations for implementation of Phase 2 until SC7.

b. Project 39 (South Pacific albacore age and reproductive biology)

166. S. Nicol presented "Regional study of South Pacific albacore population biology: Year 2 – biological sampling and analysis" (WCPFC-SC6-2010/BI-WP-01), a summary report on the progress of Project 39 (a regional study of South Pacific albacore population biology). The main activity for 2010–

2011 was the collection of biological samples of albacore in the southwest Pacific region, and to initiate otolith reading and histological analysis of gonads to ensure that unbiased estimates of biological parameters (age, growth and reproduction) can be obtained for albacore. Biological samples have been collected from over 2,500 albacore caught in the southwest Pacific since early 2007. Over the past 12 months, CSIRO continued to sample albacore caught in Australia's ETBF off Queensland and New South Wales, with supplementary sampling from recreational fisheries in Victoria and Tasmania. SPC continued to collect biological samples from albacore caught in the wider South Pacific through their SciFish project. Fish were sampled in New Caledonia, New Zealand, Fiji, American Samoa, French Polynesia, Tonga and the Cook Islands. In addition, New Zealand's Ministry of Fisheries and the National Institute of Water and Atmospheric Research sampled albacore caught by New Zealand's domestic troll fishery over the 2010 summer fishing season. The majority of the biological material sent to CSIRO has been processed in the laboratory (gonads), archived into CSIRO's "hardparts" collection (otoliths and dorsal spines), or frozen (muscle tissue). Some material remains in the sampling ports waiting for freighting to Hobart. Otoliths from fish caught in Australia, New Caledonia and New Zealand were sectioned for annual age (n=314) and daily age (n=18) estimation by laboratories in Australia. Age was estimated by one to three readers and an inter-laboratory comparison was undertaken to assess the level of precision of increment counts between readers and laboratories. There was clear evidence that past experience in reading tuna otoliths influenced age estimates. An additional 219 otoliths and 100 dorsal spines were selected for ageing. Histological sections prepared from 197 ovaries were read and staged. An additional 220 ovary samples have been sent for histological preparation. All ovaries selected for histological analysis so far were from fish >70 cm FL sampled in Australia, New Caledonia, New Zealand, Fiji and French Polynesia. Updated length–weight parameters were estimated for albacore caught in Australia and New Zealand. A significant difference was detected in the length–weight relationship between sexes, where females were heavier, on average, for their length compared with males.

Discussion

167. SC6 was very supportive of the two biological research projects currently being undertaken to identify and define regional variability of key biological processes in the WCPO, which will support stock assessments of bigeye and albacore tunas. The regional study of the stock structure and life history characteristics of South Pacific albacore involves tasks in which many WCPFC members are participating (mainly biological sampling and ageing), to ensure that unbiased estimates of biological parameters such as age, growth and reproduction are obtained. The aim of the first phase of the albacore project has been achieved. SC6 expressed appreciation to those involved, and looked forward to the successful completion of the albacore research project and of the work of the science services provider in taking into account such newly acquired biological parameters when next updating the albacore stock assessment.

168. SC6 acknowledged the close association between this project and efforts to tag South Pacific albacore to obtain information on movement and exploitation rates for use in stock assessments (GN-IP-06). SC6 understood the difficulties of tagging albacore and encouraged the science services provider to persist with their efforts to find a solution to this issue.

3.3 Other activities

169. SC6 noted that Project 38 (otolith microchemistry), funded by the Pelagic Fisheries Research Program, was near completion and was scheduled to be reported on at the next regular meeting of the BI theme.

Recommendations

170. To assist SC in determining the priority of Phase 2[6], SC6 requested that the report to the 2011 meeting include outcomes from three runs of the 2010 bigeye stock assessment model; specifically i) the use of the growth curve estimated from the pilot study; ii) the use of the maturity ogive estimated from the pilot study; and iii) a combination of i) and ii). SC6 encouraged all flag states to achieve the 5% observer coverage of such vessels as required by the observer CMM to facilitate the collection of biological samples.

171. SC6 also recommends that:

- Maturity schedules for stock assessments should be estimated using histological methods. Gonad index (GI) values can be used for evaluating spawning distributions but should not be used for estimating maturity schedules.
- Presentation of Project 35 (the bigeye age and reproductivity pilot study) be deferred to SC7. Included in the report to SC7 will be three sensitivity analyses (revised growth curve, new maturity ogive and both combined) using the 2010 bigeye assessment.

172. SC6 recognized the importance of South Pacific albacore biological sampling, and noted the progress of Project 39 (the South Pacific albacore age and reproductive biology study), and supports the project through to completion.

173. SC6 encouraged the science services provider to take any new biological parameters into account when next updating the South Pacific albacore assessment.

AGENDA ITEM 4 — FISHING TECHNOLOGY THEME

174. The convener of the Fishing Technology theme, D. Itano (USA), opened the session and reviewed the agenda, which focused on efforts to reduce non-target catch and small tuna captured by purse-seine floating object effort with an emphasis on reducing bigeye mortality.

175. S. Nicol (SPC) and K. Schaefer (IATTC) were appointed as rapporteurs.

4.1 Acoustic discrimination

a. FT WP-01(Application of broadband dolphin mimetic sonar for discriminating target fish species)

176. H. Okamoto presented "Application of broadband dolphin mimetic sonar for discriminating target fish species" (WCPFC-SC6-2010/FT WP-01), which describes research to investigate acoustic species discrimination. Broadband response was measured for three tuna species — bigeye tuna, yellowfin tuna and skipjack tuna — which were separated by species in each enclosure. Ultrasonic broadband sound (70 KHz–140 KHz) was projected nearly horizontal to the fish body. Three major echoes were detected from a fish. The delay time between earlier and last echo corresponded to the body width of the target fish. These echoes seemed to come from the left and right body surface of each fish when the acoustic beam projected transversally to the fish body. The dominant echo at the middle between body surface echoes was considered to come from the center of the body of each fish. Suspected reflectors were the swim bladder and the spine. As already known, bigeye tuna have a swim bladder where as skipjack tuna does not. Yellowfin tuna has a smaller swim bladder than that of bigeye tuna. The relative intensity of the body

[6] A four-year Pacific-wide study with a proposed total budget of USD 777,000.

surface echo to the body center echo was large for skipjack tuna and small for bigeye tuna. This is consistent with the large target strength of the swim bladder rather than the spine or other unidentified reflectors in the body of the fish. This could be a key for the species discrimination. Larger sample sizes and experiments including numerical simulation are needed.

Discussion

177. SC6 conveyed its appreciation to the authors for the work described in FT-WP-01. Sophisticated sonar, underwater cameras and other remotely operated vehicles with onboard camera systems were recognized as some of the latest technologies that could be useful in verifying the accuracy of acoustic estimates. Such instruments could also serve as a means by which to avoid catching small fish and unwanted bycatch often associated with floating objects. SC6 acknowledged the importance of this work and recommended further efforts to develop methods that estimate the number of individuals and aid in species discrimination.

178. SC6 noted that commercial multi-frequency echo sounders are used for species discrimination (such as between small pelagic fish species) and requested clarification on the reliability of these sounders for discriminating different tuna species. SC6 was advised that the data collected by commercial echo sounders were not generally suitable for tuna species discrimination and more work was needed in this field.

179. Clarification was sought on progress towards species discrimination and the sample sizes used in the experiment. The number of individuals used in the sonar experiment varied between 12 individuals and 20 individuals, with distances of several tens of centimetres between individual bigeye and yellowfin swimming in tanks; the distance between individual skipjack was smaller. SC6 supported further research on size and species discrimination using acoustic methods.

b. FT-IP-04 (Technical options for the utilization of underwater video)

180. The convenor noted the paper "Technical options for the utilization of underwater video to characterize species, size composition and spatial distribution of tunas and bycatch species aggregating around floating objects" (WCPFC-SC6-2010/FT-IP-04), which describes greatly improved image quality of tuna useful for size and species discrimination of tuna and bycatch on floating objects using higher resolution video equipment; he observed that field trials with the higher resolution gear would continue during 2010–2011 at no cost to the Commission.

4.2 Behavioral studies of tuna on FADs

181. The convener drew attention to two information papers on behavioral studies of tuna on FADs, which describe the use of electronic tagging technologies to reveal tuna behavior on FADs: "Vertical behavior and the observation of FAD effects on tropical tuna in the warm-pool of the Western Pacific Ocean" (WCPFC-SC6-2010/FT IP-01), and "Telemetry study on juvenile yellowfin tuna *Thunnus albacares* around a *payao* in the Philippines" (WCPFC-SC6-2010/FT-IP-05).

4.3 FAD and gear modifications to improve selectivity

182. The convener noted the paper "Analysis of the catch rate of juvenile bigeye depending on the depth of the purse-seine net used by the tropical fleet" (WCPFC-SC6-2010/FT-WP-03). The paper describes a large-scale study that documented purse-seine fishing characteristics using time and depth recorder equipment mounted on the chainline of purse-seine nets. The study determined that tuna seines used to target tropical tunas become fully pursed at an average depth equal to 56.7% of the maximum net

depth, which is comparable to the findings of similar studies. However, it was noted that the catchability of tuna that may be influenced by the net hanging deeper in the water before pursing remains unknown. The convener noted the importance and need to accurately document fishing depth characteristics of longline and purse-seine gear operating in the WCPO, which is useful for effort standardization.

4.4 Technical solutions to bycatch mitigation.

a. FT WP-02 (Study on the methods to reduce the bycatch of juvenile bigeye tuna by purse seine operation on FADs)

183. Y. Semba presented the paper "Study on the methods to reduce the bycatch of juvenile bigeye tuna by purse seine operation on FADs in the western and central Pacific Ocean" (WCPFC-SC6-2010/FT WP-02), which presents preliminary results of a research cruise for mitigating the catch of juvenile bigeye tuna caught by purse-seine operations on FADs in the WCPO. This research was conducted through collaboration between fisheries administrations, research institutions and industry. Observations on the response of fish and/or schools to large mesh netting, the purse-seine net and intermittent light were the main results. In the observation of large mesh size, the escape of tuna species was not observed while the escape of silky shark was documented by video camera. Vertical and horizontal movements of tuna schools inside the purse-seine net after the cessation of intermittent light was confirmed with experiments using coded transmitters. Behavioral response was different depending on the time of the experiment and distance between fish and the light source. The response of fish schools to the intermittent light stimulus was observed by scanning sonar, which indicated that fish schools dispersed "left and right" or "up and down" in apparent reaction to the intermittent light stimulus. Further work is necessary to confirm the general trend of bigeye tuna behavior in response to different stimuli.

Discussion

184. SC6 conveyed its appreciation to the authors for the research described in FT-WP-02. SC6 noted strong support for the bycatch mitigation work and would like to see more of this type of research. SC6 noted that PNG is also planning to support this type of work within PNG's waters and commended the Government of Japan for the collaborative nature of the research; SC6 encouraged other CCMs to initiate complementary studies in their waters. Studies such as these were considered important for addressing the issue of reducing catches of small tuna on floating objects (STFO) and other bycatch species.

185. It was noted that despite these research undertakings, no potential measure or methods have been identified that would avoid or reduce setting on associated schools with a high proportion of small fish at an industrial level, and no promising methods have been developed that would allow fishers to continue to set on such schools while avoiding the catch of juvenile fish. SC6 members supported maintaining the advice given to WCPFC6 on this issue — that collaborative projects with industry are a cost-effective and operationally sound approach — and requested the support of the Commission in facilitating such opportunities. The purse-seine industry has a strong record of innovation and development, and SC6 noted that it seeks to see those qualities used to find ways to reduce catches of unwanted bycatch and small tuna from FAD fishing. The Commission is already considering a range of restrictive management measures such as longer FAD closures, and it is hoped that these will provide incentives to industry, flag states, and markets to resolve the wider issue. Without any progress in these areas, there will be no option but to extend FAD closures.

186. SC6 members suggested that the Commission expand its focus beyond the identification of mitigation measures to include the provision of incentives for the tuna industry to proactively implement such mitigation measures. SC6 further commented that methods to avoid and reduce inadvertent catch of

STFO are urgently needed; CCMs suggested that any prolonged experimental studies in this area be closely focused on achieving solutions that can be applied at the commercial level.

187. Clarification was sought on whether purse-seine mesh acts as a visual barrier that tuna avoid despite the fact that experimental large mesh may be large enough for fish to easily pass through. SC6 was advised that this appears to be the case and that more studies under various light conditions are required to resolve this issue.

188. Clarification was also sought on the affect that movement of the net and currents may have on this type of experiment. SC6 was advised that these studies are verified by the use of underwater cameras and remotely operated vehicles to observe tuna behavior, and that gear and observations cannot be effectively deployed under strong current situations.

b. FT WP-04 (ISSF initiatives to develop and test bycatch mitigation options for tropical purse seine fisheries)

189. V. Restrepo (ISSF) presented the paper "International Seafood Sustainability Foundation initiatives to develop and test bycatch mitigation options for tropical purse seine fisheries" (WCPFC-SC6-2010/FT WP-04), which describes a research programme to test technical options to mitigate bycatch in tropical tuna purse-seine fisheries. The priority will be on seeking ways to reduce bycatch of bigeye tuna of undesirable sizes, but other bycatch issues will be addressed as well. The project will test multiple techniques that are being proposed by skippers and scientists worldwide, and is projected to last three years (including 24 months of dedicated purse-seine vessel charters) and cover all oceans. Overall guidance of the research plan will be provided by the ISSF Scientific Advisory Committee comprising scientists from major tuna RFMOs and other organizations. The development of detailed research plans will be the responsibility of a project steering committee while individual scientists will conduct approved research projects. Primary results from the project will be disseminated in peer reviewed journals as well as more timely cruise reports, research project reports and educational materials. Funding will include a significant component for training and capacity building.

190. The convenor noted two information papers that provide supplemental information relevant to FT-WP-04: "ISSF Meeting on mitigation of by-catches in the Tuna Purse seine Floating Object fisheries: Sukarrieta, Spain 24–27 November 2009" (WCPFC-SC6-2010/FT-IP-02), and "Purse seine by-catch mitigation techniques" (WCPFC-SC6-2010/FT-IP-03).

Discussion

191. SC6 expressed its support for the ISSF project, and advised ISSF of the importance of timely and open consultations with various entities of the WCPFC and FFA in order to facilitate obtaining necessary permits and notifications to successfully undertake the research. The presenter clarified that such consultations were seen as essential, and that ISSF would soon initiate contacts with the region through the WCPFC. SC6 was advised that ISSF proposes to use vessels that are already licensed and operating in the WCPO. The presenter and SC6 concurred with the importance and utility of using a fully chartered vessel that would allow complete scientific control of fishing and loading operations and enumeration of total catch without concern for economic loss.

192. Clarification was sought on the proposed experimental design, and how ISSF proposed to potentially test various FAD types. SC6 was advised that one proposal already received was to test the efficacy of "ecological FADs" that are designed to be biodegradable and bycatch friendly while noting that large numbers of experimental replicates for FAD experiments would be difficult to achieve. Details

of testing bycatch mitigation by area and between drifting and anchored FADs will be developed by the research steering committee with input from industry.

193. The WCPFC Science Manager stated that issues related with Project 55 were being funded through a USD 25,000 voluntary contribution from PNG, and that the Secretariat would advertise for proposals on its website. It was clarified that the PNA Chair would be consulted in the development of the terms of reference.

Recommendations

194. SC6 recommended the continuation of research or the review and analyses of research in the following areas:

- The use of "acoustic technology" for discriminating species on floating objects.
- Bycatch and STFO reduction research in collaboration with industry and Pacific Island nations.
- Studies on the behavior and distribution of target and non-target species around FADs, and on the various specifications and use of FADs and fishing gear in influencing purse-seine catches taken in association with FADs.

195. SC6 further recommended studies to: i) quantify changes in fishing efficiency; ii) identify and refine gear, vessel and operational attributes necessary for global standardization; iii) document and analyze fishing efficiency and historical changes in gear, vessel and operational characteristics of fisheries; and iv) quantify changes in fishing efficiency of purse-seine fisheries operating in the WCPO.

196. SC6, recommended, in principle, support for the proposal by ISSF and recommended that ISSF undertake a consultation process with "coastal state" Commission members to enable their full participation.

AGENDA ITEM 5 — METHODS THEME

197. The convener for the Methods theme, R. Campbell (Australia), opened the session and outlined the agenda.

198. D. Wilson (Australia) was selected as rapporteur.

5.1 Changes in MULTIFAN-CL

a. ME-WP-01 (Update of recent developments in MULTIFAN-CL and related software for stock assessment)

199. N. Davies (SPC) presented the paper "Update of recent developments in MULTIFAN-CL and related software for stock assessment" (WCPFC-SC6-2010/ME-WP-01). MULTIFAN-CL (MFCL) is a statistical, age-structured, length-based model routinely used for stock assessments of tuna and other pelagic species. The model was originally developed by Dave Fournier of Otter Research Ltd for application to South Pacific albacore tuna. Each year, the MFCL development team works to improve the model to accommodate changes in understanding of the fishery, to fix software errors, and to improve model features and usability. This paper reports on changes made since August 2009 to the model and other components of the MFCL project, and updates the report for the previous period, 2008–2009. These changes include the main developments to model functions, software management, and improvements to the utilities supporting MFCL.

200. The first and most significant development was to include stochasticity in the recruitments used for population projections. This feature facilitates using MFCL for risk analysis by incorporating natural variability in estimates of future biomass. The second main development was to extend the estimation of tag recapture reporting rates to be specific to individual tag release groups. This was to take into account factors affecting the voluntary reporting of recaptures that are unique to each release programme. Both of these developments have been applied in studies presented to SC6.

201. A formal procedure has also been developed for incorporating new developments in the source code, testing these calculations, compiling the new executables, and updating the software in the project repository. This ensures traceability of new developments and reversal if required.

202. Finally, substantial improvements have been made to the utilities supporting MFCL because increasingly, MFCL is being called within high-level analysis rather than simply from command line operations. For example, analyses such as management strategy evaluations, risk analysis, and the estimation of uncertainty due to structural assumptions. The library of R scripts that support these operations has been added to, the source code maintained, and further developments have been proposed for 2010–2011.

Discussion

203. SPC was requested to produce an operating manual for MFCL that would be made publicly available. This was regarded as an important issue given the complexity of MFCL software. SPC indicated that such a manual was currently in production and would be made available via their website in the near future.

5.2 Developments in CPUE analyses

a. ME-WP-02 (Application of the Tweedie distribution to zero-catch data in CPUE analysis)

204. H. Shono presented the paper "Application of the Tweedie distribution to zero-catch data in CPUE analysis" (WCPFC-SC6-2010/ME-WP-02), which focused on the zero-catch problem of CPUE standardization. Because the traditional CPUE model with a log-normal error structure cannot be applied in this case, three methods have often been used as follows: i) ad hoc method adds a small constant value to all response variables; ii) catch model with a Poisson or negative-binomial (NB) error structure; or iii) delta-type two-step method such as the delta-normal model (after estimating the ratio of zero-catch using a logit or probit model, a model such as CPUE log-normal or Catch-Poisson is applied to CPUE without zero-data).

205. However, there are some statistical problems associated with each of these methods. In this paper, an alternative fourth method based on the Tweedie distribution model was discussed together with its application to i) bycatch data (silky shark, *Carcharhimus falciformis*, in the North Pacific caught by Japanese training vessels) where most (more than two-thirds) of observations have a zero-catch, and ii) a target species data (yellowfin tuna, *Thunnus albacares*, in the Indian Ocean caught by Japanese commercial vessels) where the proportion of zero-catch observations is not so high (<one-third). The Tweedie model is an extension of the compound Poisson model derived from a stochastic process where the weight of counted objects (i.e. number of fish) has a gamma distribution and has an advantage of handling the zero-catch data in a unified way.

206. The statistical performance of the above four models was also compared using the mean square error and Pearson's correlation coefficient of the observed CPUE and the corresponding predicted CPUE using an n-fold cross-validation process. Differences in the trend of CPUE between years and model

performance between the ad hoc method and Tweedie model were found to be not so large in the example of yellowfin tuna (target species). However, the statistical performance of Tweedie distribution is rather better than delta-lognormal model, the Catch-NB distribution and ad hoc method in the example of silky shark (bycatch species). The standardized CPUE year trend for the ad hoc method was also found to be quite different from that of the Tweedie distribution and other two models. Model performance of the Tweedie distribution was found to be good judged from the five-fold cross-validation using the fishery data that included many zero-catch data, such as for bycatch species example presented.

207. The convener noted the need to develop statistical techniques to model catch and effort data having a high proportion of zero-catch records. This was particularly relevant given the new analyses being undertaken on operational level data where the proportion of zero-catch records is significantly higher than for aggregated data.

b. ME-WP-03 (Confidence interval estimation of CPUE year trend in delta-type two step models)

208. H. Shono presented the paper "Confidence interval estimation of CPUE year trend in delta-type two step models" (WCPFC-SC6-2010/ME-WP-03). This paper presented a procedure for estimating the approximate confidence intervals of the extracted CPUE year trend in the delta-type two-step model used for CPUE standardization with a high proportion of zero-catch data. This method is a simple way to combine the Taylor expansion and delta method and is suitable for practical use. This model was applied to catch and effort data with more than 80% zero catch for silky shark in the North Pacific caught by Japanese training vessels. As a result, realistic values of the 95% confidence interval of CPUE year trends are obtained. A method for left–right unsymmetrical interval estimation based on the asymptotic normality of the natural logarithm of CPUE is also suggested. In the example of silky shark, both CPUE year trends obtained from these two methods are similar.

Discussion

209. SC6 supported the development of the method presented for estimating confidence intervals of CPUE trends, and noted that it has direct utility to the analyses of CPUE being undertaken by SPC.

210. The convener noted the five research topics currently listed on the SC's work programme, which address methodological developments, and invited the meeting to identify additional projects. It was agreed to defer this issue until after discussion of the "Stock Assessment", and "Ecosystem and Bycatch Mitigation" themes.

Recommendations

211. SC6 noted the research presented and encouraged further research on technical questions related to analytical methods used for fishery management.

212. SC6 recommended that the methods-related projects currently included in the scientific research programme continue to be supported.

AGENDA ITEM 6 — STOCK ASSESSMENT THEME

6.1 WCPO bigeye tuna

213. K. Bigelow (USA) served as convener of the theme, with N. Davies, V. Chan, S. Nicol, K. Schaeffer, D. Tagami, H. Nakano, and H. Kiyofuji serving as rapporteurs.

214. Five Working Papers addressed the bigeye tuna stock assessment and evaluation of CMM 2008-01. Discussion on all five papers is integrated into one section and supplied after the abstract of SC6-SA-WP-05.

a. Summary of SA-WP-01 (Background information for the 2010 bigeye assessment)

215. S. Harley (SPC) presented the paper "Background analyses in the development of the 2010 WCPO bigeye tuna assessment" (WCPFC-SC6-2010/SA-WP-01), which describes background analyses undertaken in the development of the 2010 bigeye tuna stock assessment for the WCPO. Most of the analyses focus on attempting to resolve the principle concern in the 2008 and 2009 assessments, namely the strong recruitment patterns estimated in recent bigeye assessments. We attempt to identify the key data inputs and model assumptions that are responsible for the trends and see if improvements can be made. The document draws on work undertaken for the SPC pre-assessment workshop held in Noumea in April 2010 and subsequent analyses.

216. There were three steps to the analyses described in this paper:

i. Exploration of key data indicators (specifically catch, CPUE and size data) from the 2009 bigeye assessment;
ii. Evaluation of the current grouping of longline fleets within fisheries in the MFCL assessment; and
iii. An initial suite of sensitivity analyses using the 2009 bigeye assessment.

217. These analyses indicate that:

- There is significant data conflict among the various data sources (e.g. size, catch, CPUE data) in Region 3, which provide the model with conflicting signals regarding recruitment and ultimately stock status trends.
- Fleets flagged to the Federated States of Micronesia (FM), Marshall Islands (MH), and the Philippines (PH), previously included in the LL-ALL fishery, have fishing patterns more similar to the Taiwanese offshore (TW-OS) fleet, and hence would be more appropriately modeled as a separate fishery (from LL-ALL) in future assessments.
- There are strong patterns within the Japanese length data, which appear to be driven by spatial patterns in fish size.
- Japanese length data may not be representative of the catches in some regions or years.
- The CPUE trend in Region 3 appears to be the primary factor driving the recruitment trend in that region, and the relatively stable CPUE is strongly inconsistent with increased catches seen in that region at the estimated biomass level.
- Chinese (CN)/TW-OS size data are extremely influential on the assessment, in particular early estimates of recruitment and growth.
- The high (and incorrect) estimates of Indonesian (ID) longline and small fish catches were resulting in a more pessimistic view of stock status.

b. Summary of SC6-SA-WP-02 (Analysis of Japanese longline operational catch and effort for bigeye)

218. S. Hoyle (SPC) presented the paper "Analyses of Japanese longline operational catch and effort for bigeye tuna in the WCPO" (WCPFC-SC6-2010/SA-WP-02). Analyses of operational-level, longline catch and effort data for bigeye tuna in the WCPO were carried out under an agreement between SPC and the Japan National Research Institute of Far Seas Fisheries (NRIFSF). The objectives of the collaboration were to standardize bigeye CPUE, and to estimate the historical trend of longline catchability using a finer scale of data than had been previously available. The goal was to better understand the role of vessel effects, in particular the role of fleet composition and fishing behavior, which are otherwise concealed when using aggregated catch and effort data. In this analysis, vessel effects were estimated as the average effect over the fleet of factors such as engine type, vessel speed, well capacity, fishing techniques, targeting strategies, technology and crew effects during the modeled period.

219. The data used in this analysis consisted of Japanese longline logsheets from 1976–2009 with location set to the nearest 1-degree of latitude and longitude; depth of set represented by the variable "hooks between floats" (HBF); international call sign used as the vessel identifier; and fishing categories (offshore or distant-water); target (swordfish, shark, other); line type; and a number of other operational variables included. All sets south of 35˚S and with HBF < 5 were removed to avoid southern bluefin tuna and swordfish targeted effort, respectively. However, sets targeting albacore or yellowfin, rather than bigeye tuna, could not be easily distinguished. Delta lognormal and offset lognormal models were applied in the standardization with an explicit term for vessel effect. The WCPO was divided into six areas and an indicative regional scaling factor was estimated for each.

220. Results of the analysis revealed many new and interesting perspectives on catch trends. Region 3 (western Pacific between 20˚N and 10˚S) proved difficult to characterize due to the complexities of separating yellowfin targeted from bigeye targeting operations. The analysis suggests that the trends in catch rate in this region may be affected by market factors as well as abundance. Contrary to expectations, bigeye catch rates were higher at shallower depths in the equatorial area. Also it is suspected that differences in trends between Region 3 as a whole and its equatorial regions are likely to result from a combination of changes in the fleet, changes in fishing methods by individual vessels, and changes in the concentration of fishing effort. Due to the lack of sufficient fishing effort, regions 5 and 6 (south of 10˚S) were not allocated reliable regional scaling factors.

221. Vessel effects, which were estimated broadly for the first time in this analysis, reflected both fishing power increases and the fleet's ability and intention to target bigeye, and were found to have a potentially large effect on abundance indices. Significant changes in fishing power have been caused by vessels with poor catch rates exiting the fleet. Furthermore, it was noted that given a situation in which effort becomes increasingly concentrated over time, operational data may give a consistently more optimistic trend than aggregated data because they give more weight to regions with more sets and higher CPUE.

222. Given the great potential of operational data, they are recommended as the basis for abundance indices in future stock assessments. In addition to confirming several advantages arising from the use of operational catch and effort data for CPUE standardization, some areas requiring further research were identified. Multivariate techniques such as principal components analysis and cluster analysis are recommended to separate effort targeted at different species and, thus, identify alternative fishing strategies. In addition, simulation studies are recommended to examine bias arising from lack of independence among sets from factors such an increased focus of the fleet on hot spots, changes in fishing location in response to catch rates of different species, catch rates of other vessels, and ability to locate

oceanographic features. Finally, abundance indices estimated from operational data should be constructed to extend from the 1950s onward, and should be weighted by the number of strata per time-area stratum.

c. Summary of SC6-SA-WP-03 (CPUE standardization for bigeye and yellowfin tuna in the western and central Pacific Ocean)

223. S. Hoyle (SPC) presented "Analyses of Japanese longline operational catch and effort for bigeye tuna in the WCPO" WCPFC-SC6-2010/SA-WP-03).

224. Indices of CPUE are presented for bigeye and yellowfin tuna in the WCPO from 1952–2009, based on analyses of aggregated Japanese distant-water longline data. One change was made to the methods for estimating indices of abundance for the bigeye and yellowfin stock assessments, with removal of the targeting indicator based on CPUE of other species. This change had little effect on CPUE trends. An alternative CPUE trend for a subset of Region 3 was estimated based on the area south of 10N. The trend for this sub-regional model was more optimistic in recent years. The full Region 3 series may be biased by significant albacore-targeted effort in the north since 1995, so an index based on the southern region may be more reliable. Both the bigeye and yellowfin indices may be affected by increasing targeting of bigeye tuna in recent years.

d. Summary of SC6-SA-WP-04 (Stock assessment of bigeye tuna in the western and central Pacific Ocean)

225. S. Harley (SPC) presented "Stock assessment of bigeye tuna in the WCPO". The Executive Summary is as follows with several figures regarding stock status (WCPFC-SC6-2010/SA-WP-04)

226. This paper presented the 2010 assessment of bigeye tuna in the WCPO. This assessment is supported by several other analyses that are documented separately, but should be considered when reviewing this assessment. These include detailed examinations of input data and sensitivity analyses (Harley et al. 2010), evaluation of paired spill/grab sample trials leading to alternative purse-seine catch histories (Lawson 2010), reviews of the catch statistics of the Philippines and Indonesia (Williams 2010), and standardized CPUE analyses for both aggregate (Hoyle 2010) and operational level (Hoyle et al. 2010) longline catch and effort data.

227. The assessment includes several model runs describing stepwise changes from the 2009 assessment (run 14) to develop a new "base7" model (run3d) and then several other key model runs that represent a set of plausible model runs for consideration in developing management advice. These key model runs represent a single change from the base model run.

228. One of the major features of the 2010 assessment is that for the first time the assessment includes catch estimates for all fleets for the last year of the assessment (2009). This is a significant improvement, but data for several key fleets were submitted late and, therefore, the complete model inputs only became available in the first week of July. This delayed the assessment. Other data changes from the 2009 assessment include: revised longline fishery definitions to group together more similar fleets; revised catch estimates for all fleets from Indonesia and the Philippines; exclusion of further length samples from the Philippines "small fish" fishery, which include large bigeye tuna; 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; exclusion of

[7] While run3d is designated the "base" model for the purpose of structuring the modeling analyses, the most appropriate model run(s) upon which to base management advice will be determined by the Scientific Committee.

some early Japanese length data, which was inconsistent with other data; and revised spill sample purse-seine estimate incorporating the results of recent experimental work.

229. Other changes to the assessment included increased flexibility for temporal changes in purse-seine catchability, and decreased weight given to certain length and weight frequency data sets

230. The key assumptions from the "base" model from the 2009 assessment (run 10), the base model for the 2010 assessment (run3d), and the alternative assumptions in the other main model runs are provided below.

Component	2009 assessment (run 10)	2010 assessment (run 3d)	2010 alternatives
Longline CPUE	Aggregate indices	Aggregate indices	Excluding all CPUE prior to 1975
Steepness	Estimated	Estimated	0.55, 0.75, 0.95
Purse-seine catches	Grab sample (s_best)	Spill sample corrected	Grab sample (s_best)
Fleet catchability adjustment	None	None	0.47% per year (non-compounding)
Longline size data	Up-weighted	Down-weighted	Up-weighted
Natural mortality	Base	Base	Increased for juveniles

231. The main conclusions of the current assessment are as follows.

i. The estimated recruitment trends from recent bigeye assessments appear to be primarily the result of conflict (disagreement) among various data sources, in particular between longline CPUE indices and reported catch histories, and between and within some of the size composition data sets. The current assessment has indentified some of these conflicts and includes some model runs that begin to address them.

ii. Recruitment in all analyses is estimated to have been high during 1995–2005. This result was similar to that of previous assessments, and appears to be partly driven by conflicts between some of the CPUE, catch, and size data inputs. 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. If we consider recruitment estimates in the second half of the time series to be more plausible and representative of the overall productivity of the bigeye stock, then consideration might be given to basing stock status estimation only on this period. This could in effect be implemented simply by estimating the stock-recruitment relationship for this latter period and applying that in the yield analyses.

iii. Total and spawning biomass for the WCPO are estimated to have declined to about half of their initial levels by about 1970, with total biomass remaining relatively constant since then ($B_{current}/B_0$= 42%), while spawning biomass has continued to decline ($SB_{current}/SB_0$= 32%). Declines are larger for the model with increasing longline catchability and increased purse-seine catches.

iv. 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 potential is at 17% ($SB_{current}/SB_{(current,f=0)} = 0.17$) of the level predicted to exist in the absence of fishing considering the average over the period 2005–2008, and that value is reduced to 15% ($SB_{current}/SB_{(current,f=0)} = 0.15$) when we compare using the 2009 spawning potential levels.

v. The attribution of depletion to various fisheries or groups of fisheries indicates that the purse-seine and other surface fisheries have an equal or greater impact than longline fisheries on the

current bigeye tuna biomass. 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 lower purse-seine catches, longline fisheries are estimated to have a higher impact.

vi. Recent catches are well above the MSY level of 73,840 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 10% higher than the re-calculated *MSY*. **Based on these results, we conclude that current levels of catch are unlikely to be sustainable in the long term, even at the recent (high) levels of recruitment estimated for the last decade**.

vii. Fishing mortality for adult and juvenile bigeye tuna is estimated to have increased continuously since the beginning of industrial tuna fishing. For all of the model runs $F_{current}/F_{MSY}$ is considerably greater than 1. For run 3d (base) the ratio is estimated at 1.41, indicating that a 29% reduction in fishing mortality is required from the 2005–2008 level in order to reduce fishing mortality to sustainable levels. If we consider historical levels of fishing mortality, a 31% reduction in fishing mortality from 2004 levels is required (consistent with the aim of CMM 2008-01), and only a 20% reduction from average 2001–2004 levels. The results are far worse with lower values of steepness or when a higher weight is given to the size data. **Based on these results, we conclude that overfishing is occurring in the bigeye tuna stock, but possibly at a lower level than previously estimated**.

viii. The reference points (RPs) 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 biomass would be reduced to 64% and 56% of the level that supports MSY. In terms of the reduction against virgin biomass, the declines reach as low as 13% of spawning potential. Current stock status compared with these RPs indicates that the current total and spawning biomass are higher than associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.39$ and $\frac{SB_{current}}{SB_{MSY}} = 1.34$). The likelihood profile analysis indicates a 0.5% probability that $SB_{current} < SB_{MSY}$, which increases to 60% if a lower value of steepness is assumed. Some of the more plausible alternative models are more pessimistic as are the conclusions of the structural uncertainty analysis based on the grid. **Based on these results above, and the recent trend in spawning biomass, we conclude that bigeye tuna is approaching an overfished state, if it is not already slightly overfished.**

ix. Analysis of current levels of fishing mortality and historical patterns in the mix of fishing gear types indicates that MSY has been reduced to less than one-half of its levels prior to 1970 through the harvesting of juveniles. Because of that and overfishing, considerable potential yield from the bigeye tuna stock is being lost. Based on these results, we conclude that MSY levels would rise if mortality of small fish were reduced, which would allow greater overall yields to be sustainably obtained.

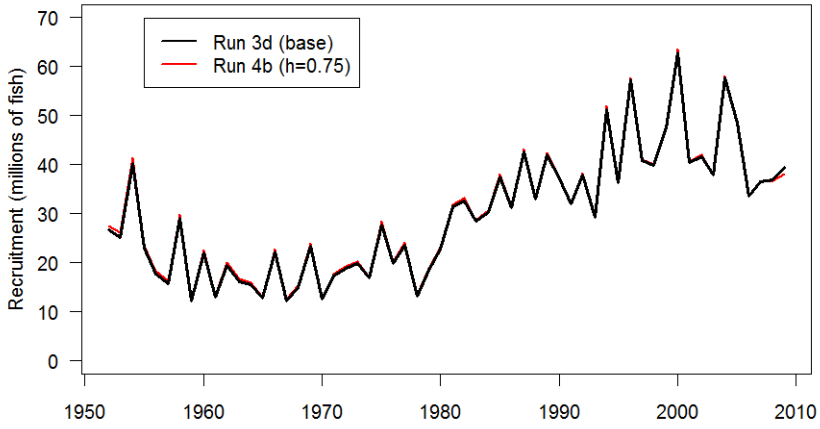

Figure BET1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the base model (run 3d) and alternative run 4b considering lower steepness (0.75).

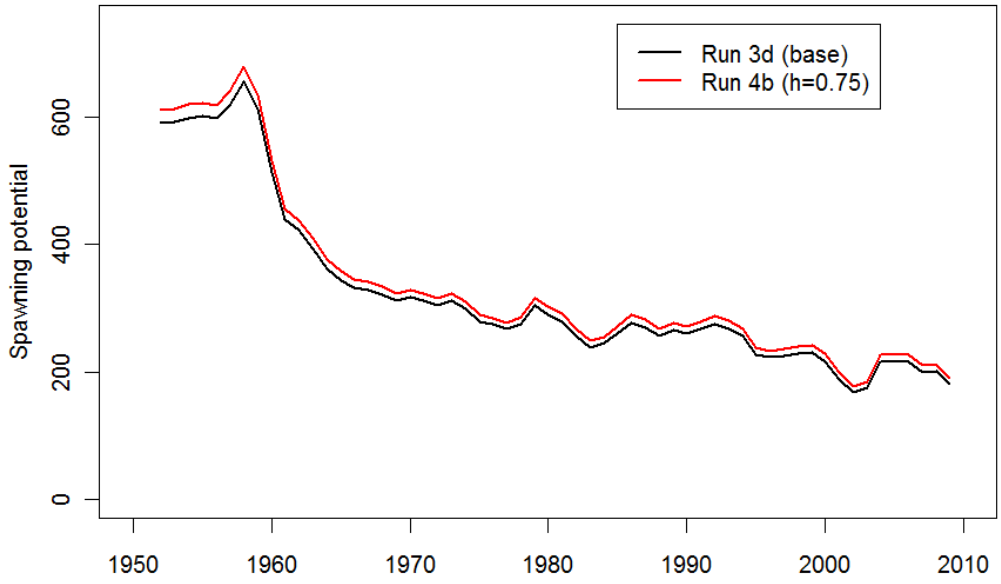

Figure BET2: Estimated average annual average spawning potential for the WCPO obtained from the base model (run 3d) and alternative run 4b considering lower steepness (0.75).

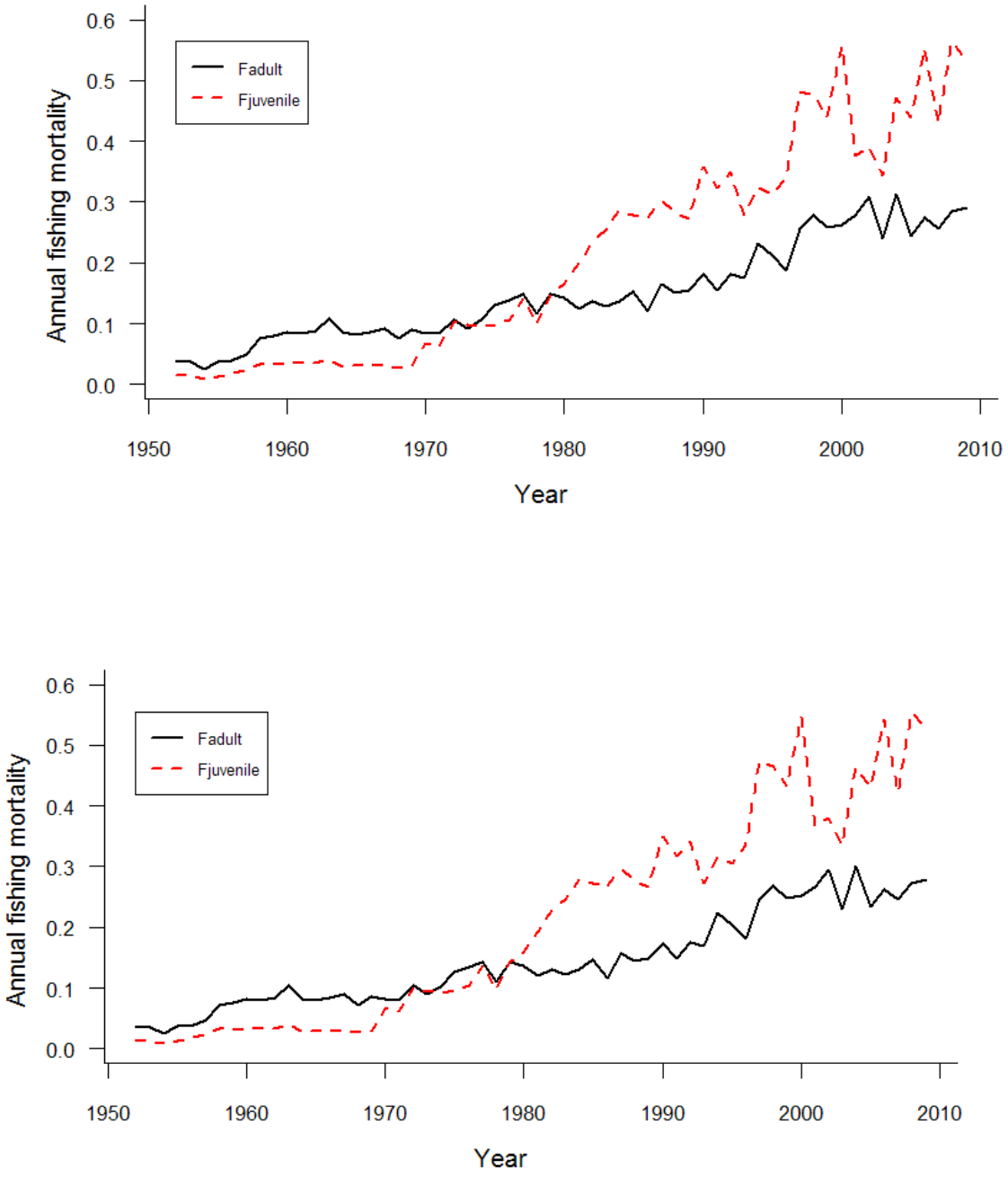

Figure BET3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base model (run 3d, top) and alternative run 4b (bottom), considering lower steepness (0.75).

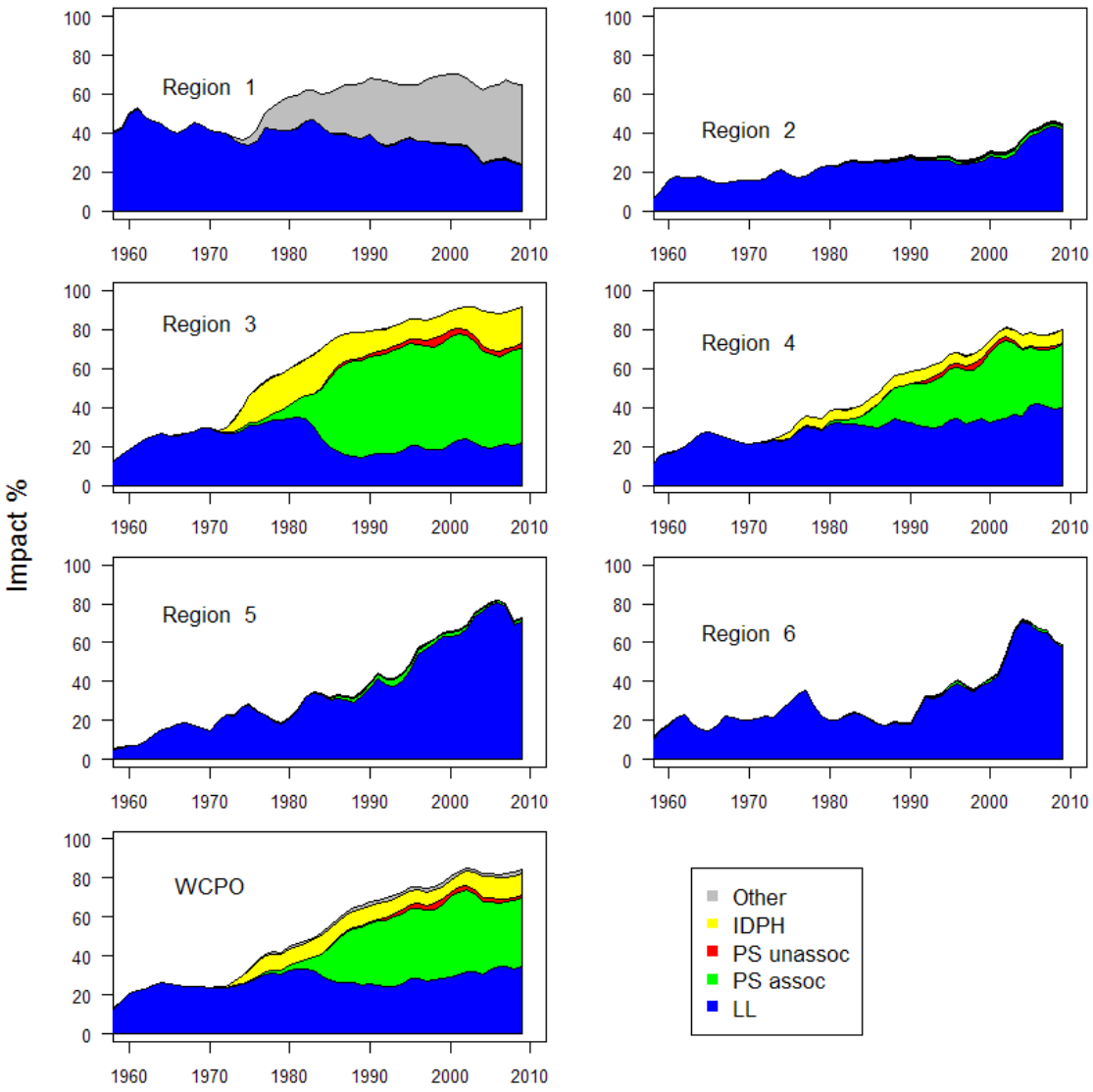

Figure BET4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base-case model). L = all longline fisheries; PH/ID = Philippines and Indonesian domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

e. Summary of SA-WP-05 (Further analysis of CMM 2008-01)

232. J. Hampton presented "Further analysis of CMM 2008-01" (WCPFC-SC6-2010/SA-WP-05), which presents a series of bigeye tuna stock projections to evaluate the effects of various exemptions and exclusions in CMM-2008-01, as requested at the fifth regular meeting of the WCPFC Scientific Committee. Consistent with previous work, the projections employed two key model runs from the 2009 bigeye tuna assessment (run10 and run14) combined with two assumptions regarding future bigeye tuna recruitment (stock recruitment relationship and AV recruit[8]). Eleven projection scenarios were devised

[8] AV recruit is the average recruitment over the period 1998–2007 in the bigeye stock assessment.

and key indicators (F/F_{MSY} *and* SB/SB_{MSY} in the terminal year of projections) estimated for each scenario/assessment model/recruitment assumption combination. For the most part, individual exemptions have a relatively modest impact on the indicators. It is again demonstrated that measures need to be implemented across all fishery sectors with significant bigeye catches if meaningful reductions of fishing mortality are to be achieved.

f. Discussion (Addressing four BET assessment working papers and evaluation of CMM 2008-01)

233. There was general agreement that the 2010 bigeye assessment made improvements to the population model used. These improvements included: incorporating analyses of operational level catch-effort data, excluding inconsistent catch size-composition observations; applying revised selectivity functions for the Philippine domestic fishery and longline fisheries; using purse-seine catches corrected for grab sampling bias; and revising the assumptions for the relative weight of longline catch size-composition data.

234. The developments respond to issues raised in relation to the 2009 assessment, in particular the conflicts among the input data, and the model's evolution was examined in a stepwise manner towards a base model from which a large number of sensitivity analyses were conducted to explore parameter and structural uncertainty, as well recommendations being provided for future research. An evaluation of CMM 2008-01, using the 2009 bigeye assessment model, investigated potential effects of hypothetical management measures on bigeye stock status. There followed discussion on five main topics: i) input data, ii) model structure and parameterization, iii) evaluation of CMM 2008-01, iv) management advice, and v) recommendations for future research, that are outlined below.

Input data

235. Descriptive examinations of input data were discussed to review the decisions made to exclude certain data from the assessment model. Concern was expressed for the possible effects of removing non-Japanese length observations from the LL-ALL fishery input data, but this was necessary because insufficient data were available to create a new fishery to hold these data, which were inconsistent with the rest of the fishery. This was recognized as being an interim step; ideally, new fisheries will be defined as the amount of data increases. Also, small-scale temporal and spatial variation in size data within model regions was noted as a complex feature in the catch size-composition data; however, this is difficult to investigate in the absence of associated operational data that would aid in defining fisheries that accommodate this variation.

236. Factors affecting long-term trends in size composition were discussed, including changes in sampling protocols, and operational factors such as set depth. It was suggested that historical sampling designs employed for bigeye be documented as they may assist with resolving trends in these data. Japan's assistance with this was requested. It was noted that a re-analysis of purse-seine catch size composition data is required in order to be consistent with the substantial adjustment made to the catch weights for grab sampling bias. This re-analysis is proposed for the next bigeye assessment.

237. The discussion of analyses of operational level catch-effort data highlighted suggested areas for additional work, although some were noted as not achievable. Despite being potentially very useful as covariates of catch rates, no information on the time of set or the introduction of technological aids (e.g. GPS) has been recorded. Similarly, data for the period before the 1970s may be usefully added to the analysis, but it currently includes no records for vessel identification. Fishing master is a potential covariate, but the records are either unreliable due to recording differences or simply unavailable. Areas noted as worthwhile for future analyses of these data included separating the records for distant-water and

offshore operations. It was noted that the analysis identified a spatial stratification within Region 3 in respect of areas north of 10°N where albacore are targeted. Although the bulk of the bigeye catch occurs south of this latitude, it was proposed for future assessments, that this stratification for other input data (i.e. catch size compositions) be stratified.

238. Discussion of analyses of aggregate catch-effort data identified the potentially unreliable steeply declining trends in standardized CPUE indices for regions 1 and 2 for the early period of the time series. This has not been investigated in detail, but may be related to the phenomenon of high initial catch abilities upon establishment of a large-scale fishery. However, assessing this feature within the standardization is not immediately tractable.

239. SC6 expressed appreciation regarding the information presented on data conflicts, and members encouraged the continued cooperation in improving the datasets used in the model.

240. CCMs noted the importance of the timely provision of input data to stock assessments, in order to ensure there is sufficient time to undertake comprehensive stock assessments for reporting to the Scientific Committee. Support was expressed for the WCPFC Technical and Compliance Committee to review the lateness in the provision of data for the 2010 assessments by some CCMs.

Model structure and parameterization

Recruitment and MSY

241. Steepness was identified as major source of uncertainty in the bigeye assessment, and there was a lengthy discussion of this point in exploring means for better estimating this parameter.

242. S. Harley (SPC) explained that the effect of overestimating steepness was to increase F_{MSY} and to reduce SB_{MSY} / SB_0 (i.e. to overestimate the population's productivity and resiliency). Using the results of the structural uncertainty analysis, the effect of varying steepness on estimates of stock status was illustrated. All model runs assuming low steepness (h = 0.55) indicated an overfished state, while almost all runs assuming high steepness (h = 0.95) indicated the stock not to be overfished. A direct relationship between steepness and the trend in annual recruitments was noted, where for low steepness the increasing trend in recruitments became magnified and implausible, making model results difficult to interpret. However, high values of steepness, as estimated in the base model, were also considered to be implausible. On this basis, it was not possible to regard any one of the assessment models presented as being "most plausible".

243. The relationship between steepness and annual recruitments was discussed, and most likely results from model parameters being estimated that attempt to reconcile conflicts among input data. The detailed analysis of longline operational catch-effort data showed the progressive spatial contraction of the fleet through time, which is consistent with the process of hyper stability in catch rates (i.e. CPUE may not be proportional to relative abundance). This was offered as a potential factor contributing to the model's estimate of an increasing trend in recruitment. Also, the one-off model runs indicated that, to some extent, resolving or accounting for conflicts among input data produces lower steepness values, and further work in this area may produce steepness estimates that are more plausible. In the absence of this, a detailed meta-analysis of recruitment estimates for tuna and tuna-like species was suggested as being useful for developing an approach to estimate steepness for bigeye, or to specify a range over which management advice would be robust. It was recognized that estimating steepness is a problem experienced globally among RFMOs, and has been an item considered within the Kobe process. Support was expressed for a meeting of RFMO representatives to examine this issue and draft guidelines for plausible values of steepness in the absence of supporting information.

244. Interpretations of estimated trends in recruitment, and hence biomass, should be made cautiously so as not to readily attribute these to real changes in stock productivity. These trends are sensitive to the CPUE time series used in the model fit, and it was noted that the trend commenced coincident with the introduction of large-scale purse seine operations in the mid-1980s. Given uncertainty in the causes of this trend, which may be related to data for the early period, it was suggested that estimates of stock status may be more reliable if they are based on data for the most recent period, which are more informative of the current population state.

245. The influence of the adjustment for grab sampling bias in purse-seine catches on MSY estimates was discussed, evident in a comparison of model runs including or excluding this adjustment. The higher adjusted catches result directly in higher estimates of *MSY*, but estimates of stock status are not substantially different. The effect of differences in recent trends in the adjusted and unadjusted catches is likely to account for this feature.

Growth

246. The importance of growth on model estimates of stock status was discussed, because in EPO tuna assessments, tuna population models exhibit high sensitivity to the L_{inf} parameter. It was explained that the growth parameterization in MFCL is specific to the model age classes such that L_{inf} is an extrapolation beyond this range. No explicit examination had been done of the sensitivity of the current bigeye assessment to this parameter. It was acknowledged that natural variability in growth occurs in tunas, with temporal trends observed for southern bluefin, and temporal-spatial differences in growth observed from inferences from length-frequency data for WCPO bigeye. This variability may be correlated to environmental changes, making growth difficult to estimate.

Selectivity

247. Some uncertainty in selectivity estimates was acknowledged that relates closely to the size composition data (i.e., lack of information on the sampling methods used) and to temporal-spatial variation in vessel operations using the same method. Consequently, differences in selectivity estimates for similar or related fisheries were identified in the assessment, but it is not clear what effect this has upon estimates of stock status.

248. The assumption for asymptotic selectivity for the Chinese-Taiwanese longline fleet was discussed, and it was explained as being reasonable given the generally larger catch size compositions compared to the Japanese longline fleet. No speculation was offered for the effects of an alternative assumption.

249. The impact on MSY associated with the introduction of large-scale, purse-seine fishing was well noted. This was illustrated through a comparison of the yield-per-recruit obtained under a purse-seine selectivity versus that from a longline selectivity. The significantly lower yield-per-recruit obtained from purse seining produced the precipitous decline in the dynamic or annual MSY at the time when this fishery commenced large scale operation in the WCPO.

Evaluation of CMM 2008-01

250. Following the presentation of an evaluation of the predicted effects of components of CMM 2008-01 in deterministic projections of the bigeye model, there was a discussion on the implications of this work and that compared differences in the projection scenario results.

251. It was clarified that the evaluations undertaken were simply to demonstrate the likely effects of components of the measure or other potential measures, and do not represent firm management recommendations.

252. The beneficial effect on stock status from reductions in sub-adult bigeye mortality in the Indonesian and Philippine fisheries was noted in a comparison of runs 6 and 11. This benefit is significantly offset by high potential fishing mortality in the longline fishery, which is latent when not constrained by catch limits in the future, evident in run 11. It was identified that model runs evaluating different measures could produce similar outcomes. For run 2 the longline fresh fish exemption was removed, and for run 8 purse-seine effort was decreased by 30%. Both runs produce similar, and relatively modest, reductions in fishing mortality. It was explained that run 11 implements the objective of the measure to reduce effort by 30% from 2001–2004 levels, whereas in practice under the measure, purse-seine effort levels can, and in fact have, increased relative to 2001–2004 levels; the provisional 2009 purse-seine catches of bigeye are already higher than 2008 levels.

253. It was agreed that this work would best be repeated using the updated 2010 assessment and the latest available data. A suggestion was made that future evaluations that include measures to close high-seas areas redistribute this effort to other areas (high-seas or EEZs), rather than completely removing this effort from the fishery, as this may be more realistic. It was also suggested that evaluations be repeated using stochastic projections; although this would be very informative, it would not be possible within the timeframe of the next Commission meeting.

254. Suggestions were made for considering other management measures in undertaking future model evaluations, including closures in the eastern high-seas areas, and extending FAD closures. Also suggested were substantive measures to reduce fishing mortality levels, involving complete closures to high-seas pockets to both purse-seine and longline fishing, and large (50%) reductions in fishing effort relative to 2001–2004 levels.

Recommendations for future research

255. Strong support was expressed for continuing the analyses of operational level catch-effort data. It was also accepted that for future analyses of these data that records for distant-water and offshore operations be separated.

256. It was suggested that when input data (including catch size compositions) are collated for the next assessment, Region 3 should be spatially stratified in respect of the areas north of 10°N, where albacore are targeted. Also, re-analysis of purse-seine catch size composition data is required in order to be consistent with the substantial adjustment to catch weights for grab sampling bias. This re-analysis is proposed for the next bigeye assessment.

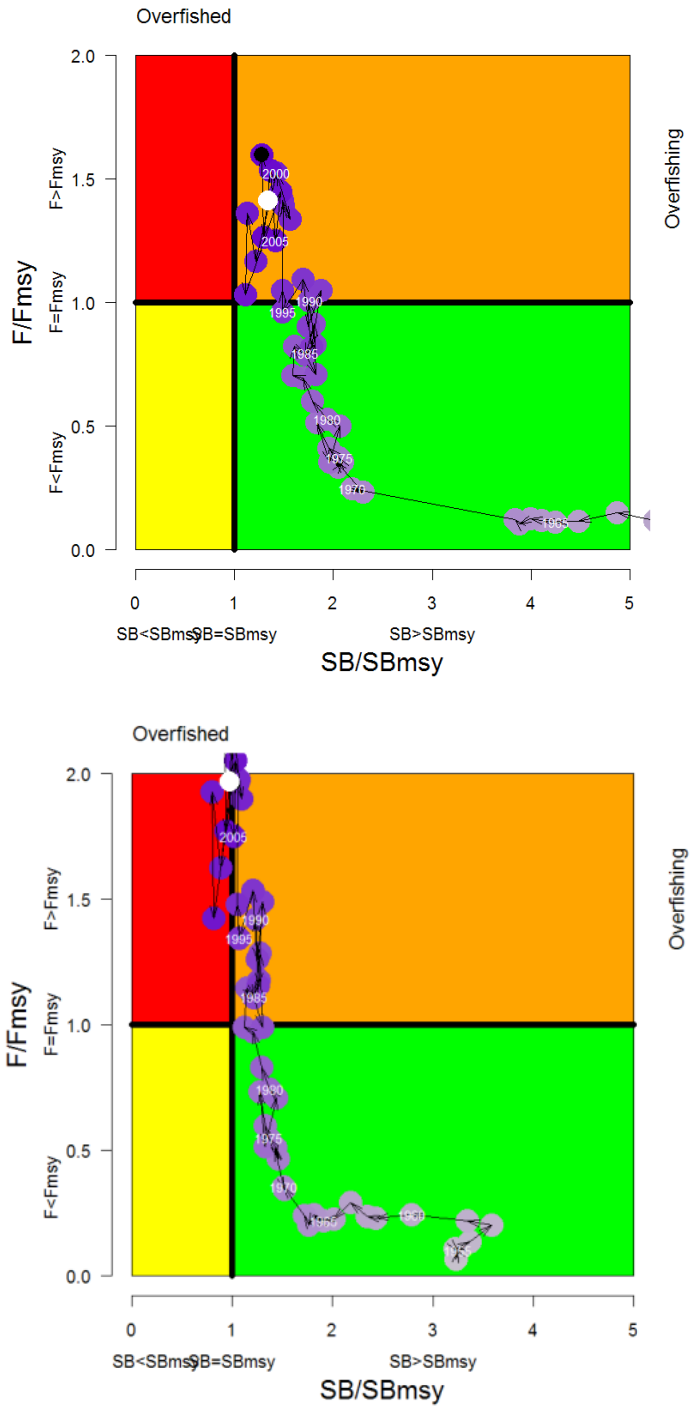

Figure BET5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base model (run 3d, top) and alternative run 4b (bottom) considering lower steepness (0.75).

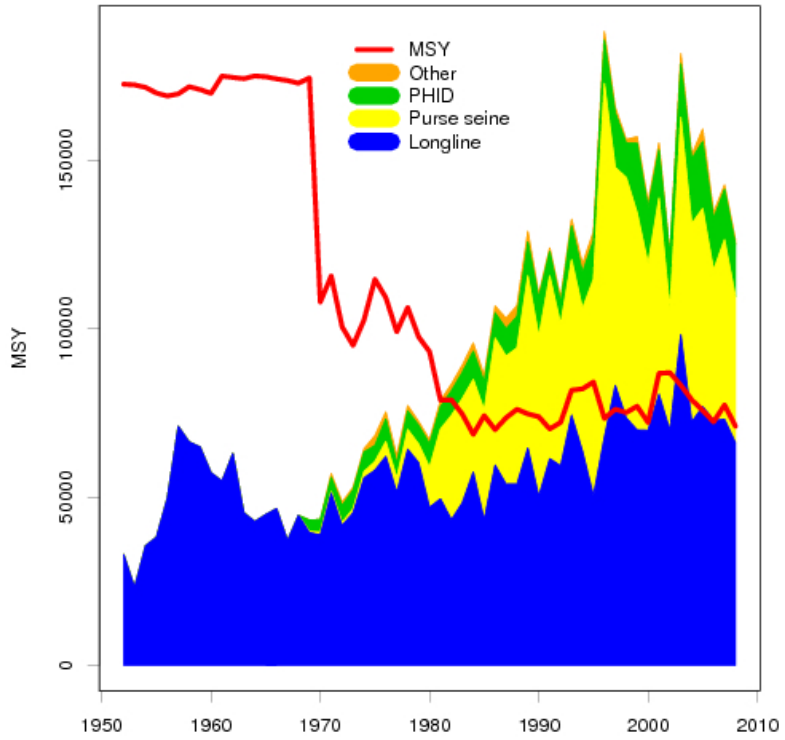

Figure BET6: History of annual estimates of MSY compared with catches of four major fisheries sectors. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small bigeye.

g. Stock status and trends

257. SC6 selected run 3d, which had a steepness estimated at 0.98 (hereafter referred to as the base model) to represent the stock status of bigeye tuna and considered run 4b to illustrate status assuming a lower value to steepness (0.75) (Table BET1).

258. SC6 agreed that the value of steepness is difficult to estimate in assessment models and the estimated value of 0.98 should be considered uncertain. Most estimated values of steepness in sensitivity runs were >0.95; however, the actual value of steepness for the WCPO bigeye stock currently remains unknown. As a comparison to the base model, SC6 chose to also represent stock status with a value of 0.75, which was the mid-point of five steepness values (representing the range 0.55–0.95 of plausible steepness values) considered in sensitivity runs in the 2010 assessment.

259. For the base model, $F_{current}/F_{MSY}$ is estimated at 1.41, indicating that overfishing is occurring for the WCPO bigeye tuna stock and that in order to reduce fishing mortality to $F_{MSY,}$ a 29% reduction in fishing mortality is required from the 2005–2008 level (Fig. BET5). Considering historical levels of fishing mortality, a 31% reduction in fishing mortality from 2004 levels is required (consistent with the aim of CMM 2008-01), and a 20% reduction from average 2001–2004 levels.

260. Current stock status in the base model indicates that the current total and spawning biomass are higher than associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.39$ and $\frac{SB_{current}}{SB_{MSY}} = 1.34$). This indicates that that the

WCPO bigeye stock is not in an overfished state (Table BET1, Fig. BET5 top) if the spawning biomass reference period is 2005–2008. However, if the spawning biomass period is considered to be 2009, then the spawning biomass is further reduced (SB_{latest}/SB_{MSY}=1.17).

261. Stock status results with regard to MSY RPs are far worse when a lower (0.75) value of steepness is assumed, run 4b requires a 49% reduction in fishing mortality is required from the 2005–2008 level to reduce fishing mortality to F_{MSY}. The stock is in a slightly overfished state (SB_{latest}/SB_{MSY} = 0.97) when the lower value of steepness (0.75) is assumed.

262. The bigeye assessment in 2010 is comparable to the 2008 and 2009 assessment (Table BET2) although there are differences in catch and effort data, size frequency and a few different structural assumptions. The primary differences are revised catch estimates for all fleets from Indonesia and the Philippines; exclusion of some size data from the Philippines; and increased purse-seine catches based on experimental spill samples.

263. In comparing the 2009 and 2010 assessment using the same MSY time window (2001–2004), the 2010 base model is more optimistic, with an $F_{current}/F_{MSY}$ estimate of 1.25 compared with 1.53 in run 14 of the 2009 assessment (Table BET3).

264. An analysis of current levels of fishing mortality and historical patterns in the mix of fishing gear types indicates that MSY has been reduced to less than one-half of its levels prior to 1970 through the harvesting of juveniles (Fig. BET6).

Table BET1. Estimates of management quantities for selected stock assessment models from the 2010 base model (run 3d) and alternative run 4b, considering lower steepness (0.75). For the purpose of this assessment, "current" is the average over the period 2005–2008 and "latest" is 2009.

	run3d (base)	run4b (h=0.75)
$C_{current}$	147,506	147,774
C_{latest}	126,769	127,040
MSY	73,840	65,840
$C_{current}/MSY$	2.00	2.24
C_{latest}/MSY	1.72	1.93
F_{mult}	0.71	0.51
$F_{current}/F_{MSY}$	1.41	1.97
SB_0	651,500	722,400
SB_{MSY}/SB_0	0.24	0.31
$SB_{current}/SB_0$	0.32	0.30
SB_{latest}/SB_0	0.28	0.26
$SB_{current}/SB_{MSY}$	1.34	0.97
SB_{latest}/SB_{MSY}	1.17	0.85
$SB_{curr}/SB_{curr_{F=0}}$	0.17	0.18
$SB_{latest}/SB_{latest_{F=0}}$	0.15	0.16
Steepness (h)	0.98	0.75

Table BET2. Comparison of WCPO bigeye tuna reference points from the 2010 base model (steepness estimated as 0.98); shown in parentheses is the alternative 2010 run (steepness assumed as 0.75), ranges of six sensitivity analyses in the 2009 assessment and base model and sensitivity analyses in the 2008 assessment.

Management quantity	**2010 assessment Run3d (Run4b)**	**2009 Assessment**	**2008 Assessment**
Most recent catch	126,769 mt (2009)	134,315 mt (2008)	143,059 mt (2007)
MSY and MSY (recent R)	73,840 mt (65,640 mt) 132,403 mt (131,495 mt)	Range: 52,120 ~ 67,800 mt Range:110,000 – 146,114 mt	Base case: 64,600 mt Range: 56,800~65,520 mt
$\boldsymbol{F_{current}/F_{MSY}}$	1.41 (1.97)	Range: 1.51 ~ 2.55	Base case: 1.44 Range: 1.33 ~ 2.09
$\boldsymbol{B_{current}/B_{MSY}}$	1.39 (1.09)	Range: 1.11 ~ 1.55	Base case: 1.37 Range: 1.02 ~ 1.37
$\boldsymbol{SB_{current}/SB_{MSY}}$	1.34 (0.97)	Range: 0.85 ~ 1.42	Base case: 1.19 Range: 0.76 ~ 1.20
$\boldsymbol{Y_{Fcurrent}/MSY}$	0.94 (0.56)	Range: 0.12 ~ 0.92	Base case: 0.94 Range: 0.50 ~ 0.97
$\boldsymbol{B_{current}/B_{current,\ F=0}}$	0.23 (0.24)	Range: 0.18 ~ 0.29	Base case: 0.26 Range: 0.20 ~ 0.28
$\boldsymbol{SB_{current}/SB_{current,\ F=0}}$	0.17 (0.18)	Range 0.11 – 0.19	Not available

Table BET3. Comparison of the fishing mortality-related quantities for assessments conducted in 2009 and 2010 bigeye stock assessments based on various *MSY*-calculation time periods.

	F_{mult} $(F/\boldsymbol{F_{current}})$			$\boldsymbol{F_{current}}/F_{MSY}$		
Run	2001-04	2004	2005-08	2001-04	2004	2005-08
2009 run14	0.65	0.50		1.53	1.99	
2010 base model run3d	0.80	0.69	0.71	1.25	1.45	1.41
2010 run4b (steepness=0.75)	0.57	0.49	0.51	1.76	2.05	1.97

h. Management advice and implications

265. SC6 recommended a minimum 29% reduction in fishing mortality from the average levels for 2005–2008, with the goal of returning the fishing mortality rate to F_{MSY}. Recommended reductions in fishing mortality change between stock assessments and between the time windows in which MSY levels are calculated. The current recommendation is equivalent to a minimum 31% reduction in fishing mortality from 2004 levels, and a minimum 20% reduction from average 2001–2004 levels. Current stock status indicates that the current total and spawning biomass are higher than associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.39$ and $\frac{SB_{current}}{SB_{MSY}} = 1.34$).

266. The base model estimate of the $F_{current}/F_{MSY}$ ratio in the 2010 assessment was 1.25 and lower than the estimate (1.53) in the run 14 of the 2009 assessment when estimated over the same MSY window (2001–2004), thus stock status is more optimistic in the 2010 assessment.

267. Interpretation of stock status with regard to MSY RPs and associated fishing mortality reductions are highly dependent on the steepness in the stock recruitment relationship. Steepness is difficult to estimate and, therefore, generally uncertain. SC6 noted that the current stock status may be overly optimistic as estimated steepness (0.98) is essentially one (1), whereby recruitment is completely independent of spawning biomass. If steepness is substantially less than 1, then the interpretation of stock status is more pessimistic and greater reductions in fishing mortality will be required to obtain F_{MSY}, suggesting that the stock may be in an overfished state.

268. Overfishing and the increase in catch of juvenile bigeye have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. SC6 concluded that MSY levels would increase if the mortality of juvenile bigeye was reduced.

269. Considering the late submission of bigeye data, SC6 highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes and encouraged all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.

270. SC6 reiterated the advice from SC5 on the efficacy of CMM-2008-01 in reducing fishing mortality:

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 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.

i. Further evaluation of CMM-2008-01

271. WCPFC6 requested that work be undertaken at SC6 and TCC6 to support bringing forward a new package of measures for consideration at WCPFC7. Some of the changes made to the assessment this year, such as the improved data on Philippine and Indonesian catches, may improve the quality of scientific advice.

272. In considering this request, SC6 recommended that the science services provider undertake the following analyses for WCPFC 7:

- A set of generic projections based on the following specifications
    - Based on bigeye run 3d from the 2010 assessment
    - Using recent average recruitment in deterministic projections
    - Considering stepped changes in catch and effort from 2012 (30% increase to 50% decreases) for:
        - longline catch
        - purse-seine associated effort
        - domestic fisheries in Indonesia and the Philippines[9]

[9] The term "domestic fisheries" is used to cover all fisheries based in Indonesia and the Philippines within the Convention Statistical Area that catch tuna. The scientific work of the WCPFC requires data from all fisheries (that is, through the range of the stocks), including archipelagic waters, to ensure that stock assessments are able to incorporate the total fishery removals from the stocks. However, the Commission's conservation and management

    - Repeated for the base-case model for yellowfin and skipjack tuna
- Additionally, three specific projections will be undertaken
    - Continuation of the provisions of CMM 2008-01 into the future, incorporating any new information regarding the implementation in 2009 and 2010.
    - As above, but with all the exemptions and special provisions removed.
    - Continuation of provisions of CMM 2008-01 into the future with the additional high-seas purse-seine closure as announced by the PNA (Attachment H) with an assumption of no redistribution of effort.
    - Assumed patterns of catch and effort for 2010 and 2011 will be based the provisions of CMM 2008-01. It will also incorporate fishery behavior observed during 2009 and 2010 under CMM 2008-01.
    - Changes in catch and effort for the generic projections will be from 2012 onwards and will be relative to 2011 levels (as allowed under CMM 2008-01 assuming full compliance), but will also be reported relative to "2001-2004 levels" from previous agreements (e.g. see Attachment F of CMM 2008-01 for longline values).

6.2 WCPO yellowfin tuna

273. No new information on the stock status of this species was presented to SC6; therefore, management recommendations from SC5 are maintained.

6.3 Requests from CMM-2008-01

274. The Secretariat reported that no information was submitted in accordance with paragraph 39 of CMM-2008-01 for fishing effort or proposals of effort data from other commercial tuna fisheries provided by CCMs.

275. The review of CMM-2008-01 and recommendations are contained under Agenda Item 6.1.

6.4 WCPO skipjack tuna

a. Summary of SC6-SA-WP-07 (Recent status of Japanese skipjack fishery in the vicinity of Japan)

276. K. Uosaki (Japan) presented the paper "Recent status of Japanese skipjack fishery in the vicinity of Japan" (WCPFC-SC6-2010/SA-WP-07).

277. Japan's fisheries indices are reviewed for skipjack in the vicinity of Japan. Although skipjack catch and nominal CPUE shows no sign of decrease in the skipjack population in the WCPO equatorial region, there was some signs that possibly indicate a decrease in the population in the vicinity of Japan. Those include i) a sharp decrease occurred in skipjack catch in 2009 in the region northeast for the middle-sized pole-and-line and offshore purse-seine fisheries; ii) the nominal CPUE for skipjack for the middle-sized pole-and-line fishery somewhat shifted from a high level during 2000–2006 to a lower level during 2007–2009; iii) the end of the fishing season came earlier for the middle-sized pole-and-line fishery in the most recent three years (2007–2009); and iv) the skipjack catch for the troll fishery has been at a low level at least since 2005. It is necessary to monitor fisheries indicators carefully for skipjack in the vicinity of Japan, and to conduct a stock assessment for the WCPO skipjack covering the entire

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measures (CMMs), including CMM 2008-01, do not extend to the domestic fisheries in archipelagic waters or territorial seas of the Convention Statistical Area, which are considered the sovereign territory of countries."

distribution of its population, so that population dynamics can be explained not only for the population in the equatorial region but for the northern region.

Discussion

278. SC6 noted that in 2009, and so far in 2010, tuna catches have also been low in Australia; it has also been hypothesised that the increase in exploitation in the equatorial region may be impacting the fisheries in the temperate region. An alternative hypothesis proposed is that the interannual variation observed is explained by changes in oceanography and environmental conditions. SC6 was advised that in Japan they expect the Kuroshio Current to impact the troll fishery in the coastal region; however, oceanography is unlikely to explain all variations, and it is likely that other environmental or population dynamics have impacted the catch over the last few years.

279. SC6 also noted that there was anecdotal evidence that 2010 skipjack catches may have improved in Japan. SC6 was advised that catches in the first half of 2010 are a little higher than those observed in the first half of 2009, but are less than those in the recent 10-year average; however, it is not yet possible to estimate the 2010 catch reliably.

280. SC6 also sought clarification on whether pole-and-line vessels used live bait, and whether bait availability may be impacting the catch. SC6 was advised that in Japan, live anchovy is the most commonly used bait and its population level is high. It is unlikely that any variation in the anchovy live bait supply is impacting skipjack catch.

b. Summary of SC6-SA-WP-08 (A standardized CPUE analysis of the Japanese distant-water skipjack pole-and-line fishery in the WCPO, 1972-2009)

281. A. Langley (consultant to SPC) presented the paper "A standardized CPUE analysis of the Japanese distant-water skipjack pole-and-line fishery in the western and central Pacific Ocean (WCPO), 1972–2009" (SC6-SA-WP-08).

282. Since 2000, stock assessments of skipjack tuna in the WCPO have incorporated standardized CPUE indices derived from the analysis of catch and effort data from the Japanese pole-and-line fishery. The resulting indices represent the principal index of stock abundance in each of the model regions and, consequently, are highly influential in the assessment. The methodology used to derive the skipjack CPUE indices was reviewed at the pre-assessment workshop held at SPC in April 2010. A key recommendation of the workshop was to initiate a collaborative study between SPC and NRIFSF to analyze the operational CPUE data and provide revised CPUE indices for inclusion in the 2010 skipjack stock assessment.

283. The study applied a delta-lognormal GLM approach to derive indices for the two equatorial regions of the WCPO from distant-water fleet logsheet data. The resulting indices differ considerably from the indices incorporated in previous assessments. The indices for the western equatorial region exhibit a decline over the study period (1972–2009), although most of the decline in the indices occurs during the late 1980s and early 1990s. There is concern regarding potential sources of bias in the indices related to large changes in the operation of the pole-and-line fleet during that period. The indices for the eastern equatorial region are relatively stable during 1972–2001 and then tend to be lower for 2002–2009. Despite concerns regarding the reliability of the indices, it is concluded that the current indices represent the best available indices for incorporation in the 2010 WCPO skipjack assessment.

Discussion

284. SC6 asked for clarification on whether operational data included zero catch, and if not, whether this would impact the use of the binomial component of the delta lognormal. SC6 was advised that the Japanese pole-and-line data includes zero catch and that for pole-and-line, schools consist predominately of skipjack with few bycatch species. Searching for schools is a very important factor for standardizing effort, and the zero in the binomial is useful as a proxy for encounter rate.

285. SC6 agreed that the use of the delta lognormal was sensible, because during periods of high abundance (with few zeros) the binomial can become saturated. Inclusion of the lognormal is an appropriate method for modeling such situations. SC6 also suggested that the use of WCPO tagging data (pole-and-line tagged fish) and Japanese training vessel data might be worth interrogating to provide insights into the dynamics of vessel operations and the frequency of school encounters. SC6 was advised that operational data only include a midday location and aggregated catch for that day, and consequently it is not possible to include time-of-day effects in the standardization.

286. SC6 noted that it was likely that the year and bird radar 1 effects may be confounded as evident through the tight confidence intervals on the index before 1986 and increased uncertainty after 1986 when the bird radar 1 was first introduced into the fishery. The GLM cannot disentangle such effects and it was noted that more work was required to resolve this issue.

287. SC6 also noted that careful attention needs to be applied when scaling the delta lognormal as an index of abundance.

c. Summary of SC6-SA-WP-09 (Standardized CPUE for a skipjack caught by Japanese offshore pole-and-line fishery in the northern region of the WCPO)

288. H. Kiyofuji (Japan) presented the paper "Standardized CPUE for a skipjack caught by Japanese offshore pole and line fishery in the northern region of western and central Pacific Ocean" (WCPFC-SC6-2010/SA-WP-09).

289. The same method used by WCPFC-SC6-2010/SA-WP-08 (Langley et al. 2010) was applied. CPUE indices showed different results from the last stock assessment in 2008 and the sharp increase after 1990 was not identified. This indicates that the effects of vessel identification (good or poor catchability) were highly considerable.

Discussion

290. No comments.

d. Summary of SC6-SA-WP-10 (Stock assessment of skipjack tuna in the WCPO)

291. Simon Hoyle (SPC) presented "Stock assessment of skipjack tuna in the western and central Pacific Ocean" (SC6-SA-WP-10). The executive summary follows.

292. This paper presented the 2010 assessment of skipjack tuna in the WCPO. The assessment uses the stock assessment model and computer software known as MFCL. The skipjack tuna model is age (16 quarterly age-classes) and spatially structured. The catch, effort, size composition, and tagging data used in the model are grouped into 17 fisheries (a change from 24 fisheries used in the 2008 assessment) and quarterly time periods from 1952 through 2009.

293. The current assessment incorporates a number of changes from the 2008 assessment, including:

- Updated catch and size data;
- Updated Japanese tagging data, which now include Japanese tags released in the southern regions. The final runs of the current assessment did not include tag releases and recoveries from the recent SPC-PTTP tagging programmes, but these data were considered during the assessment development.
- A revised (and considerably different) standardized effort series for each region was included based on a new GLM analysis of catch and effort data from the Japanese distant-water pole-and-line fishery.
- A new three-region spatial structure, which effectively condenses the previous multiple northern regions into a single northern region and imposes two equatorial regions that cover similar areas to the equatorial regions in the bigeye and yellowfin stock assessments (although they extend farther south to 20°S).

294. In addition to these changes, a large suite of additional models were run to aid the development of the final base model, which is considered the most plausible model and, therefore, the model on which management advice should be based. The sensitivity of the base model to key assumptions (i.e. regarding the stock recruitment relationship, natural mortality, CPUE time series, and purse-seine catch data) were explored via sensitivity analyses. The results of these analyses should also be considered when developing management advice.

295. A number of trends in key data inputs were noted as particularly influential for the assessment results. For the northern region, there was little contrast in the Japanese pole-and-line CPUE time-series. However, both the southern region Japanese pole-and-line CPUE time series showed declines, with greater decline in Region 2. This contrasts strongly with the trends apparent in the previous assessment, and is the main reason for the somewhat different results.

296. The large tagging dataset, and associated information on tag reporting rates, is relatively informative regarding stock size. The relative sizes of fish caught in different regions are also indicative of trends in stock size, mediated though growth, total mortality, and movement rates.

297. Overall, the main assessment results and conclusions are as follows.

1) As with other tropical tunas, estimates of natural mortality are strongly age-specific, with higher rates estimated for younger skipjack.

2) The model estimates significant seasonal movements between all three regions. The performance of the fishery in the eastern region has been shown by other studies to be strongly influenced by the prevailing environmental conditions with higher stock abundance and/or availability associated with El Niño conditions (Lehodey et al. 1997). This is likely to be at least partly attributable to an eastward displacement of the skipjack biomass due to the prevailing oceanographic conditions, although this interaction is not explicitly parameterised in the current model.

3) Recruitment showed an upward shift in the mid-1980s and is estimated to have remained at a higher level since that time. Recruitment in the eastern equatorial region is variable, with recent peaks in recruitment occurring in 1998 and 2004–2005 following strong El Niño events around that time. Conversely, the lower recruitment in 2001–2003 followed a period of sustained La Niña conditions. Recruitment since 2005 is estimated to have dipped and then recovered, but the most recent years are poorly determined due to limited observations from the fishery.

4) The biomass trends are driven by both fishing mortality and recruitment. The highest biomass estimates for the model period occurred in 1988–1990 and in 1998–2001, immediately following periods of high recruitment. Very high recruitment is estimated to have occurred in 2004–2006, but biomass has been constrained by higher catches. The model results suggest that recent skipjack population biomass has been lower than previously observed.

5) The biomass trajectory is influenced by the underlying assumptions regarding the treatment of the various fishery-specific catch and effort data sets within the model. The Japanese pole-and-line fisheries are all assumed to have constant catchability, with any temporal trend in efficiency assumed to have been accounted for by the standardization of the effort series. The estimated CPUE trends are influential regarding the general trend in both recruitment and total biomass over the model period. For all regions, there is a good fit to the observed CPUE data. This indicates reasonable consistency between the CPUE series and the other sources of data within the assessment model.

6) The model also incorporates a considerable amount of tagging data that provides information concerning absolute stock size during the main tag recovery period. For the equatorial regions, the most informative data in the model are from an intensive tagging programme that ceased in the early 1990s with most tag recoveries occurring over the following 18 months. This tagging programme occurred prior to the expansion of the fishery in Region 3 in the mid-late 1990s and, consequently, given the low exploitation rates, fewer tags were recovered from this region. On this basis, the level of absolute biomass in Region 3 is likely to be less well determined than for Region 2.

7) Data from the recent SPC-PTTP tagging programme were included in preliminary runs of the current assessment model, but the data need further preparation before they can be fully integrated. Analyses of the SPC-PTTP data outside the assessment model were consistent with the conclusions of this assessment.

8) Within the equatorial region, fishing mortality increased throughout the model period and is estimated to be highest in the western region in the most recent years. The impact of fishing is predicted to have reduced recent (2005–2008) biomass by about 50% in the western equatorial region and 25% in the northern and eastern regions. For the entire stock, the depletion is estimated to be approximately 40%.

9) A range of sensitivity analyses undertaken indicate that the main conclusions of the assessment are relatively insensitive to most of the model assumptions investigated.

10) ***Based on estimates of*** $F_{current}/\widetilde{F}_{MSY}$ ***and*** $B_{current}/\widetilde{B}_{MSY}$ ***from the base model and associated sensitivity grid, it is concluded that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state.*** These conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment. Although the current (2005–2008) level of exploitation is well below that which would provide the maximum sustainable yield, recent catches have increased strongly and the mean catch for 2005–2008 of 1.4 million mt is equivalent to the estimated MSY at the assumed steepness of 0.75. The maximum yield at the somewhat higher recruitment levels of the past ten years (1999–2008), and assuming steepness of 1, is 1.8 million mt. Fishing mortality and recruitment variability, influenced by environmental conditions, will both continue to affect stock size and fishery performance.

Discussion

298. SC6 thanked the science services provider for its presentation on the skipjack assessment, and supported the principal conclusions that skipjack is moderately exploited; that the stock is neither subject

to overfishing nor overfished; and that biomass trends are now more realistic. SC6 endorsed that the base case (run 41) of the stock assessment should be the basis for the Committee's advice on skipjack. SC6 appreciated the improvements made, particularly the revised standardized pole-and-line effort series, and thanked SPC, Japan, and the Japanese and SPC scientists for this work. SC6 noted that this was an excellent example of collaborative work. The skipjack stock is critically important to the sustainable development of many Pacific Island countries. Although the assessments continue to show that the stock is currently only moderately exploited and fishing levels are sustainable, they also indicate that current catch levels are supported by relatively high recruitment and could decline, and SC would like to see work to improve the skipjack model continued as a priority so that CCMs can clearly understand what is happening if there are any changes in the status of this stock. SC6 noted that it is important that future improvement includes the provision of information to assist with total allowable effort.

299. SC6 agreed with the identification of the run with steepness of 0.75 as the base case for the purpose of advice on stock status. SC6 recognized that steepness had previously been estimated at higher levels and that the steepness assumption is a large source of uncertainty in the assessment. However, as a matter of practice, given the influence of steepness, SC6 suggested that in general, when steepness is assumed for the base case, one model option could be run with estimated steepness. However, SC6 was advised not to interpret steepness estimates as informative about the true value of steepness.

300. SC6 noted that this assessment indicates that fishing is now having a significant effect on stock size, especially in the western equatorial region. The choice of steepness has important consequences for interpreting stock status; however, it was evident from SA-WP-10 that, although the stock may not be experiencing overfishing or be in an overfished state, it was likely that significant increases in effort would result in only minor increases in catch. Some CCMs stated that the management of fleet numbers in the WCPO should recognize this, because reducing existing capacity is a difficult task.

301. Clarification was provided that SA-WP-10 used run 41 as the base case, and that this model included Japanese, the Regional Tuna Tagging Project and the Skipjack Survey and Assessment Project tagging data. SC6 noted that the inclusion of smaller-scale or opportunistic tagging campaigns in the skipjack stock assessment was an excellent development, and encouraged further work to include such data in future stock assessments.

302. SC6 encouraged prompt data preparation and analyses on PTTP data in order to allow its use in future stock assessments, possibly in the next year. SC6 discussed that improving the modeling of the large number of tag returns occurring during the mixing period in PTTP data may be an initial area of work to pursue. SC6 noted that estimating F level using PTTP data (as well as RTTP and SSAP data), independently of the MFCL model estimate, will provide information for understanding the status of stock utilization.

303. SC6 suggested that work should be undertaken to develop a usable purse-seine CPUE index, recognizing the difficulties that this might entail, and would appreciate further information on how this might be approached.

304. SC6 noted that the addition to MFCL to include reporting rates associated with fisheries and tagging programmes was an excellent development, and has significantly improved the skipjack assessment. SC6 was informed that different growth rates for different regions could not be modeled explicitly in MFCL. This is currently managed by modeling the data outside of MFCL or by excluding particular datasets. SC6 was also informed that there are plans to modify MFCL to include priors on movement rates. This will allow for time variant movement rates and the option of including environmental covariates on this prior.

305. SC6 discussed the strong influence that the growth curve has on the stock assessment for skipjack and the difference between that estimated by the stock assessment model and that estimated from otoliths in the study by Tanabe et al 2003. SC6 did note that the growth rate estimated by Tanabe et al. 2003 may be more suited to temperate habitats where the majority of the fish were sampled. MFCL currently uses length data for estimating the growth curve, and the inclusion of supplementary age-at-length data would be beneficial. The commencement of an otolith collection programme for skipjack was identified as an important future task of the SC. SC6 was informed that an estimate of skipjack growth from fish collected in the waters of Vietnam is apparently higher.

306. SC6 was advised that natural mortality estimates for fish <6 months of age are poorly estimated as they do not enter the fishery until a later age.

307. SC6 was also advised that the base case recommended in SA-WP-10 modeled the entire stock. This was considered an improvement to the 2008 base case, which was restricted to equatorial regions. The revised spatial structure of the 2010 stock assessment removes many of the issues (e.g. cryptic biomass) that restricted the 2008 stock assessment base case to equatorial regions. It was noted that MSY estimates for 2008 and 2010 for equatorial regions were similar.

308. SC6 noted that it would be desirable for the assessment team to conduct a future projection considering that fishing mortality has increased significantly in recent years, and gave greater impact to the stock biomass in the western equatorial region. It was agreed that run 41 would be used for this projection. Projections for skipjack in MI-WP-01 use the 2008 stock assessment and are presented to illustrate the stochastic projection methodology only.

309. SC6 was informed that spawning biomass estimates were not provided because skipjack are estimated to be mature in the model at age 1, and consequently estimates differ little from total biomass. SC6 was also advised that spawning biomass estimates are likely to vary when the maturity ogive is altered to include spawning potential, but this has not yet been included in the skipjack stock assessment.

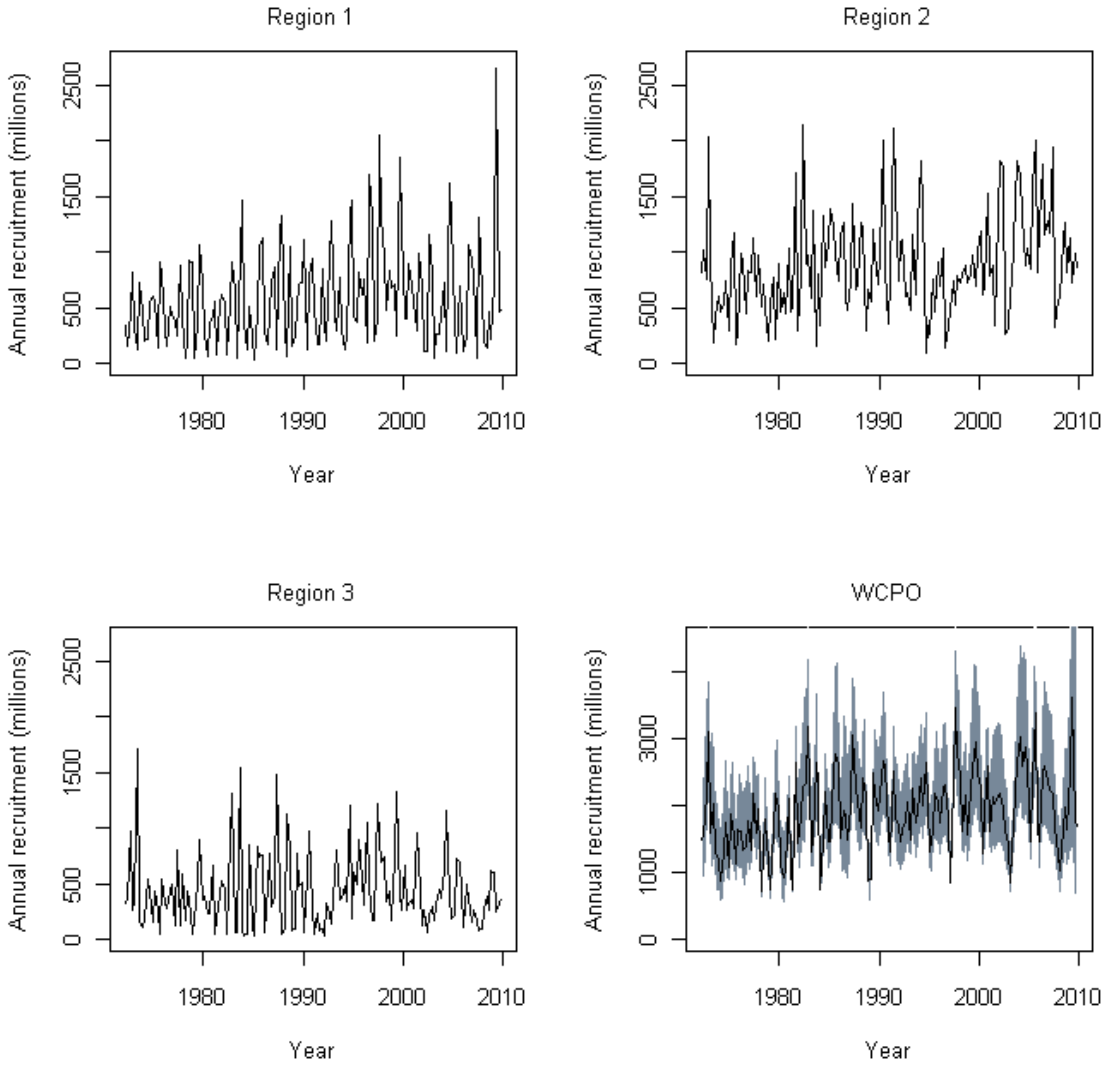

Figure SKJ1: Estimated quarterly recruitment (millions) by region and for the WCPO for the base-case analysis. The dashed line represents the average recruitment for the entire period. The shaded area for the WCPO indicates the approximate 95% confidence intervals.

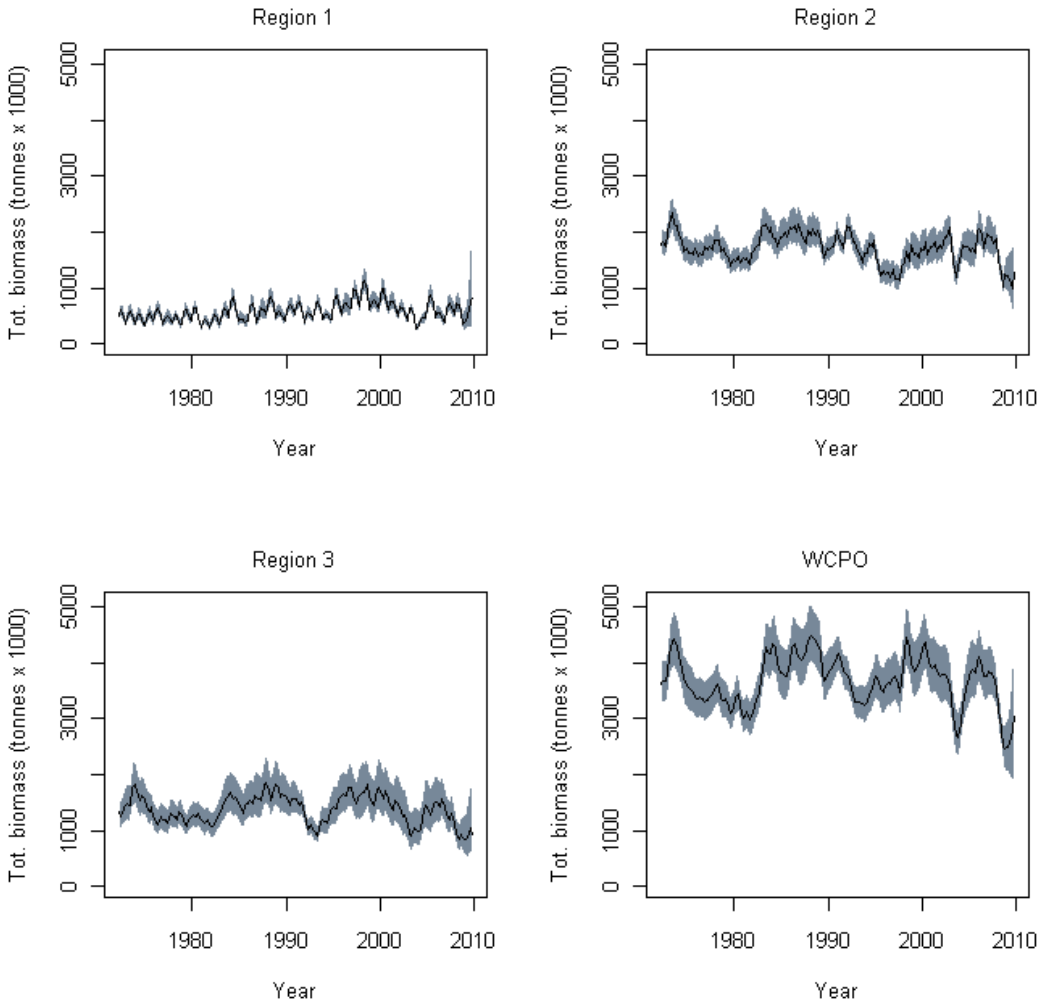

Figure SKJ2: Estimated annual average total biomass (thousands of tonnes) by region and for the WCPO for the base-case analysis. Shaded areas indicate the approximate 95% confidence intervals.

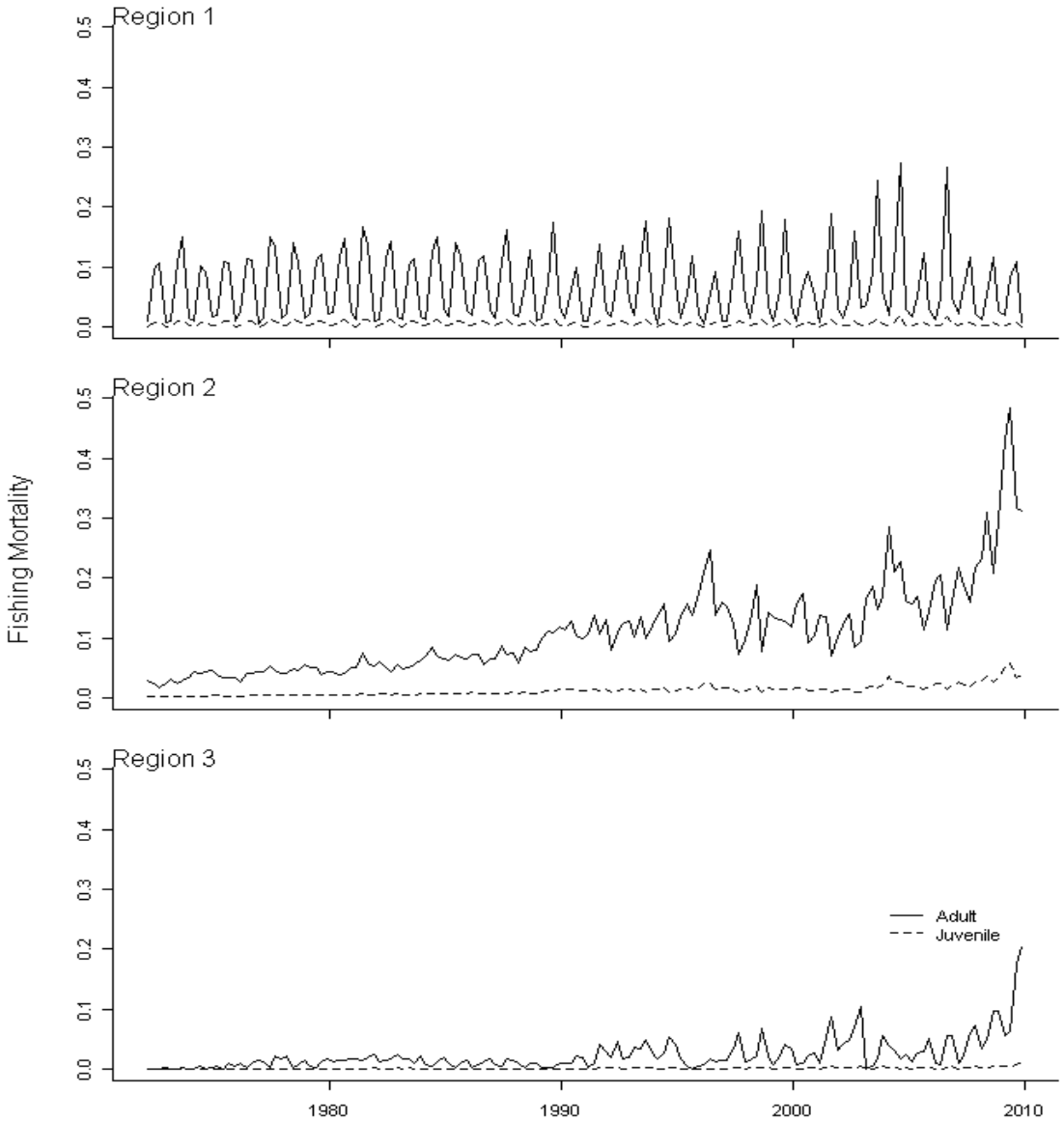

Figure SKJ3: Estimated quarterly average fishing mortality rates for juvenile (age classes 1 and 2) (dashed line) and adult age-classes (solid line).

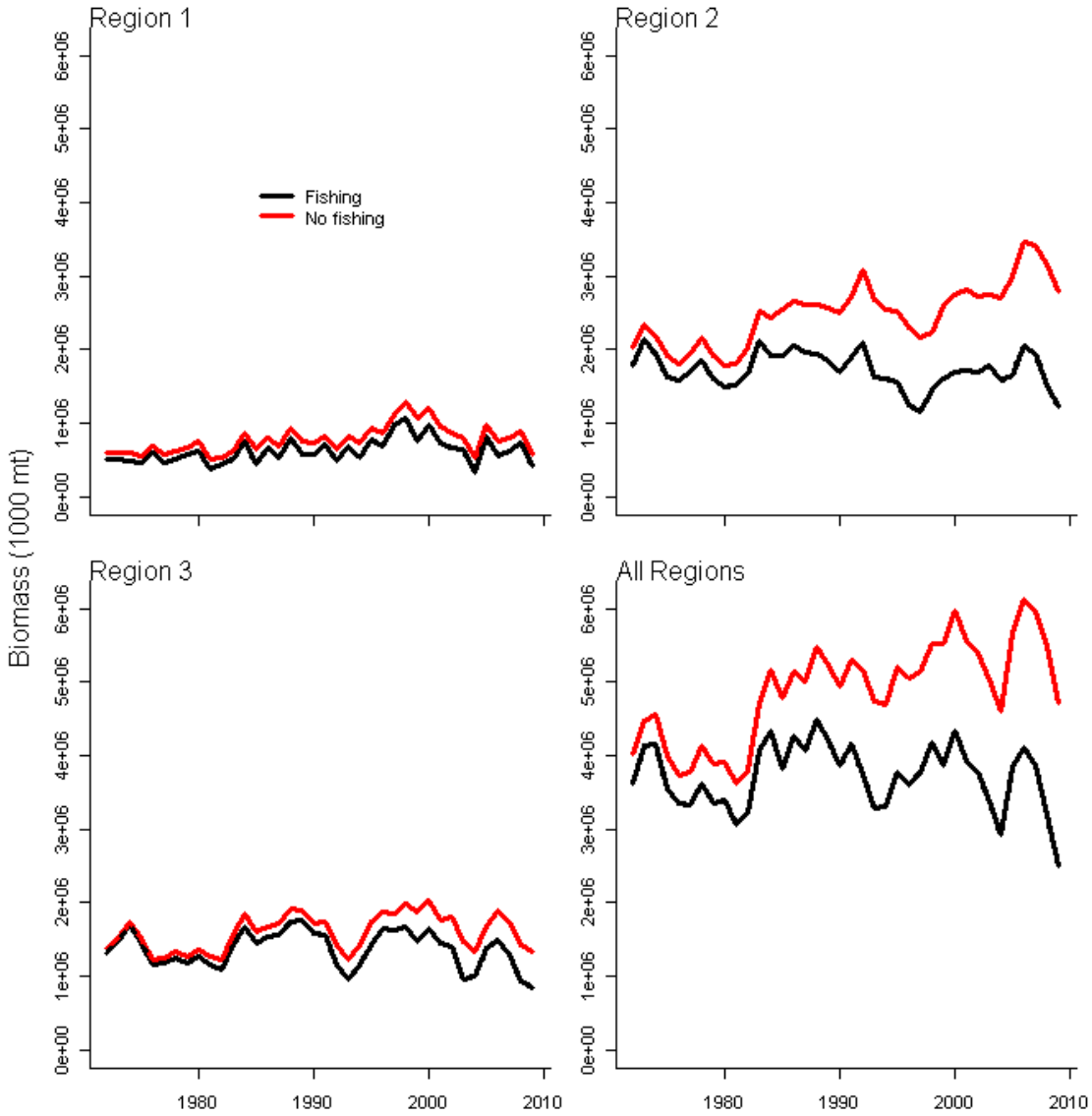

Figure SKJ4: Comparison of the estimated biomass trajectories (lower black lines) with biomass trajectories that would have occurred in the absence of fishing (red lines) for each region and for the WCPO as a whole.

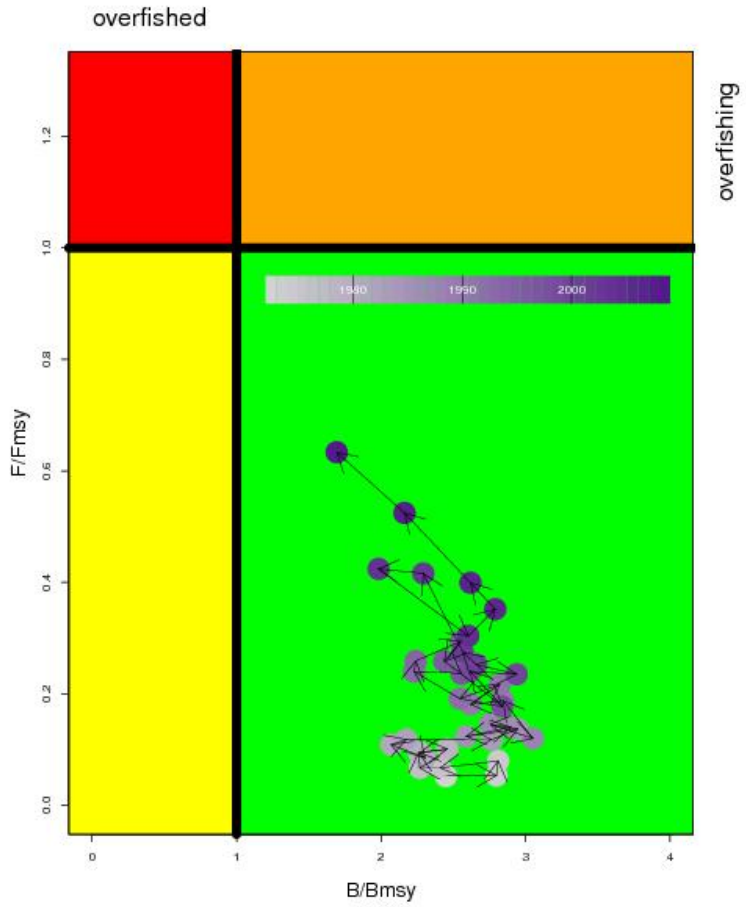

Figure SKJ5: Temporal trend in annual stock status, relative to B_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (1972–2009). The color of the points is graduated from white (1972) to dark purple (2009).

e. Stock status and trends

310. SC6 selected run 41 as the base model to represent the stock status and Committee's advice on skipjack tuna. A value of 0.75 was chosen as the mid-point of the range of steepness values considered in the 2010 assessment. Similar to bigeye tuna, the actual value of steepness for WCPO skipjack currently remains unknown.

311. Fishing mortality rates tended to be higher during the last decade than for the preceding period, and fishing mortality and biomass indicators relative to MSY started to move to 1.0, although they remained substantially below the F_{MSY} level ($F_{current}/\tilde{F}_{MSY}$ = 0.34) (Table SKJ1). The stock is not in an overfished state because biomass is above the B_{MSY} ($B_{current}/\tilde{B}_{MSY}$ = 2.42). Table SKJ2 compares RPs between the 2010 and 2008 assessments, and the key conclusions based on MSY quantities between assessments are similar.

Table SKJ1: Estimates of management quantities for the 2010 base model. For the purpose of this assessment, "current" is the average over the period 2005–2008 and "latest" is 2009.

	2010 base case
$C_{current}$	1,406,358
C_{latest}	1,575,287 (spill sampling)
MSY	1,375,600
$C_{current}/MSY$	1.02
C_{latest}/MSY	1.15
F_{mult}	2.94
$F_{current}/F_{MSY}$	0.34
SB_0	4,433,000
SB_{MSY}/SB_0	0.27
$SB_{current}/SB_0$	0.72
SB_{latest}/SB_0	0.61
$SB_{current}/SB_{MSY}$	2.67
SB_{latest}/SB_{MSY}	2.27
$SB_{curr}/SB_{curr_{F=0}}$	0.60
$SB_{latest}/SB_{latest_{F=0}}$	0.55
Steepness (h)	0.75

Table SKJ2: Estimates of reference points from the 2010 and 2008 skipjack tuna stock assessments. The spatial domain of the 2008 assessment was limited to the equatorial region of the WCPO.

Management quantity	2010 Assessment	2008 Assessment
Most recent catch	1,575,287 mt (catch based on spill sampling)[a]	1,546,436 mt (2007[b]) 1,726,702 mt (2007[c]) 1,410,389 (WCPO catch based on spill sampling)
MSY	1,375,600 mt	1,280,000 mt
$\boldsymbol{Y_{Fcurrent}/MSY}$	0.80	0.70
$\boldsymbol{B_{current}/B_{current,\ F=0}}$	0.63	0.66
$\boldsymbol{F_{current}/F_{MSY}}$	0.34	0.26
$\boldsymbol{B_{current}/B_{MSY}}$	2.24	2.99
$\boldsymbol{SB_{current}/SB_{MSY}}$	2.67	3.82

[a] Total catch in 2009 of 1,789,979 mt based on grab sampling.
[b] Equatorial region, based on grab sampling.
[c] WCPFC region mt, based on grab sampling.

f. Management advice and implications

312. Catches in 2009 increased to a historical high of ~1.8 million mt. This is significantly above the estimated MSY of ~1.35 million mt. The assessment continues to show that the stock is currently only moderately exploited and fishing mortality levels are sustainable. Catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of the fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored.

313. Fishing is having a significant impact on stock size, especially in the western equatorial region and can be expected to affect catch rates. Additional purse-seine effort will yield only modest gains in skipjack catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

314. There is concern, yet to be substantiated, that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand) fisheries.

315. Noting the uncertainty in purse-seine species composition, SC6 urged the Commission to continue improving estimates of purse-seine composition data. SC6 requested CCMs, port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with the effort to collect cannery data.

6.5 South Pacific albacore

a. Stock status and trends

316. SC6 noted that it may be necessary to obtain progress on some of the biological studies that were discussed in the Biology theme before useful results can be obtained from a new assessment, but noted that there have been substantial differences between different assessments over time and between model configurations, and it is important to reduce the uncertainty in the assessment to support work on more comprehensive management arrangements than those included in CMM 2005-02.

317. SC6 noted that the albacore assessment should be kept up to date because of increasing effort on this stock. CCMs also encouraged that any future work on South Pacific albacore tuna should include effects of oceanographic change, and address possible local depletion.

b. Management advice and implications

318. No new information on the stock status of this species was presented to SC6; therefore, management recommendations from SC5 are maintained.

6.6 South Pacific swordfish

a. Stock status and trends

319. WCPFC8 is anticipated to review CMM 2009-03 in 2011. Several CCMs noted that a new assessment for South Pacific swordfish should be planned for next year, and that additional discussions should consider any information available on this assessment, including how it may be possible to extend the spatial scope of previous assessments to include the south-central Pacific.

b. Management advice and implications

320. The advice from SC5 should be maintained, pending a new assessment or other new information.

6.7 Southwest Pacific striped marlin

a. Stock status and trends

321. SC6 noted that following Australia's request to SC5 to add southwest Pacific striped marlin to its work plan as a high priority, Australia, New Zealand and SPC collaborated in the development of two funding proposals in 2010. However, despite the high priority ranking for such an assessment, both from WCPFC's SC and AFMA, proposals did not receive funding in 2010. SC6 noted that Australia has sought domestic funding for a revised southwest Pacific striped marlin stock assessment several times since the last assessment but without success. It was noted that given the last stock assessment was carried out in 2006, an updated assessment is urgently needed. It was proposed that SPC be tasked with carrying out a revised stock assessment for presentation at SC7.

b. Management advice and implications

322. SC6 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.

6.8 North Pacific striped marlin

a. Stock status and trends

323. A 2010 published study refined the ISC 2007 assessment by conducting two assessment scenarios to account for different hypotheses about the steepness (0.7 and 1.0) of the stock-recruitment dynamics. The probable status of North Pacific striped marlin indicated that F/F_{MSY} (2001–2003) was 3.67 under scenario 1, and was 1.90 under scenario 2. Corresponding estimates of striped marlin biomass were below S_{MSY} and ranged from 29% of S_{MSY} under scenario 1 to 44% of S_{MSY} under scenario 2. In relation to *MSY*-based RPs, striped marlin was experiencing overfishing and the stock was considered depleted under each steepness scenario. The ISC reported that a two-stock scenario (WCPO and EPO) stock assessment for striped marlin will be completed in 2011.

b. Management advice and implications

324. SC6 recommended that WCPFC7 further develop a measure for the conservation of North Pacific striped marlin given the high fishing mortality of this species.

325. SC6 noted that considerable effort towards a CMM was made by an informal working group at WCPFC6. However, after four rounds of revisions, the proposed CMM was unsuccessful. As a consequence, this species was identified at that meeting as a priority for CCMs' consideration this year towards the development of a CMM. A new stock assessment is scheduled for 2011 under a different stock scenario. SC6 recommended as a precautionary measure that the Commission consider adopting an interim measure for 2011, which would be revised pending a new striped marlin assessment.

326. If the WCPFC decides to control the fishing mortality rate of North Pacific striped marlin as advised by ISC, it could do so through limits either on fishing effort or on catch, or through other controls. If it decides to limit catches, it would be helpful to know the levels of catch that correspond to a range of reference fishing mortality rates. Therefore, pending a new striped marlin assessment to be

conducted by ISC, SC6 recommended that WCPFC7 request ISC to provide estimated catch levels corresponding to average fishing mortality during 2001–2003, and fishing mortality RPs, including F_{MSY} and F at various spawning potential ratios.

327. SC6 requested a clear direction on how the WCPFC's science services provider will work with ISC scientists on the assessment planned for 2011. The stock assessment report on this species must be discussed in full at SC7 like any other new stock assessments.

6.9 Northern stocks

328. An ISC representative, per SC's request, agreed to provide SC7 with an overview of ISC recent assessments for each stock and management advice.

6.9.1 North Pacific albacore

a. Stock status and trends

329. The most recent ISC stock assessment for North Pacific albacore was completed in 2006 and a full stock assessment will be conducted by ISC in 2011 and reviewed at ISC11. No formal update of stock status has been conducted since the 2006 assessment. However, at its 12–13 July 2010 meeting, the albacore working group (ALBWG) undertook a qualitative update using available fisheries data from 2006 to 2009 and an index of spawning stock biomass (SSB) (Japanese longline CPUE age 6–9+). Based on this update, the ALBWG concluded that:

i. A new stock assessment will be necessary to fully understand the implications of the new data available since the last stock assessment;
ii. The 2006 stock assessment estimated that albacore spawning biomass reached an historical high in 2005 and then projected a decline thereafter. The age 6–9+ index shows that SSB has declined from previous high levels and appears to be relatively stable since the last stock assessment;
iii. The ALBWG did not focus on recruitment in its latest qualitative review and is unable to provide insight into recruitment in recent years beyond observations in previous plenary reports; and
iv. Nominal effort in most fisheries (as measured by the number of vessels) appears to have declined slightly or been stable since 2005. Although catches exhibit more interannual variability than effort, with the largest variation occurring in the Japan pole-and-line fisheries, most fisheries catches have declined or remained relatively stable over the same period. This could mean that F2009 is less than the F2002–2004 (0.75 yr^{-1}) used in the 2006 stock assessment projections. Alternatively, F2009 may be as high as the value used in the stock assessment projections because the level of recruitment after 2005 is not known.

330. Based on analyses conducted by the ALBWG since ISC9, the following points are highlighted.

i. Both the ISC9 and ISC10 plenaries note that there is increasing uncertainty concerning the status of North Pacific albacore in the absence of a new stock assessment.
ii. The ISC10 plenary notes that there are no strong positive or negative signals in the age 6–9+ SSB index since the last stock assessment.
iii. The next stock assessment is expected to be completed in early 2011 and the results will be presented at ISC11.
iv. The ISC9 plenary reported that the estimated value of $F_{SSB\text{-}ATHL}$ (F that maintains SSB above the average level of its 10 historically lowest points) is 0.75yr^{-1} for a 25-year projection period using fishery data through 2008. This value is similar to F2002–2004 = 0.75 yr^{-1}, estimated in the last stock assessment.

Discussion

331. SC6 thanked the ISC Chair for his report on North Pacific albacore, and supported decisions taken by ISC10 that the next stock assessment is expected to be completed in early 2011 and the results will be presented at ISC11. Concern was expressed that there is increasing uncertainty concerning the status of North Pacific albacore in the absence of a new stock assessment.

b. Management advice and implications

332. ISC10 had no new information to alter its conservation advice from that provided at ISC9 in July 2009. SC6 recommended that the WCPFC adopt ISC's conservation advice provided on North Pacific albacore.

6.9.2 Pacific bluefin tuna

a. Stock status and trends

333. In 2010, ISC's Pacific bluefin working group (PBFWG) conducted an update of the 2009 analysis along with a complete set of sensitivity analyses and stock projections using data through 2007. Data used in the 2010 update were analyzed using the same methods and parameters in the stock assessment model as in 2009.

334. The updated "current" fishing mortality rate was calculated as a three-year average (2004–2006) with the terminal year of the model results (2007) excluded due to unreliable estimates. The PBFWG reviewed the results of the update with the objectives of characterizing the recent relative change in fishing mortality rate and spawning biomass. It should be noted that even the most recent estimates of fishing mortality would not yet reflect any actions with regard to the fishery management decision for Pacific bluefin taken by WCPFC6 (CMM 2009-07, Dec. 2009).

335. A summary of the 2010 update is as follows.

i. A number of sensitivity runs were conducted in 2010 to investigate uncertainties in biological assumptions and fishery data. Results indicate that the assumption of adult M is particularly influential to the estimate of absolute spawning biomass and fishing mortality. Although absolute estimates from the stock assessment model were sensitive to different assumptions of M, relative measures were less sensitive.
ii. The estimate of spawning biomass in 2008 (at the end of the 2007 fishing year) declined from 2006 and is estimated to be in the range of the 40–60 percentile of the historically observed spawning biomasses.
iii. Average fishing mortality for 2004–2006 (F2004–2006) had increased from F2002–2004 by 6% for age-0, approximately 30% for ages 1–4, and 6% for ages 5+.
iv. 30-year projections predict that at F2004–2006 median spawning biomass is likely to decline to levels around the 25^{th} percentile of historical spawning biomass with approximately 5% of the projections declining to or below the lowest previously observed spawning biomass. At F2002–2004 median spawning biomass is likely to decline in subsequent years but recover to levels near the median of the historically observed levels. In contrast to F2004–2006, F2002–2004 had no projections (0%) declining to the lowest observed spawning biomass. In both projections long-term average yield is expected to be lower than recent levels.

Discussion

332. SC6 thanked ISC for the report on Pacific bluefin tuna and indicated that it would be beneficial to see further analyses in 2010, including a complete set of sensitivity analyses and stock projections using data through 2007. It is also encouraging to see consistency in the methodology used to generate estimates of recruitment for the years 2008, 2009 and 2010. Similarly, the same analytical methods and stock assessment model parameterization was used in the 2010 update of 2009 analysis. Results on the characterization of the recent relative change in fishing mortality rate and spawning biomass were noted. The updated "current" fishing mortality rates calculated as a three-year average (2004–2006) has increased from the average fishing mortality 2002–2004: by 30% for ages 1–4, and 6% for the other age groups.

333. Recent estimates of fishing mortality would not yet reflect any actions in relation to limits in the new measure. Despite that, the SC remained concerned that the impact of the new measure in reversing trends in spawning stock biomass and fishing mortality of this species, particularly on juvenile age classes (ages 0–3), remains to be seen.

b. Management advice and implications

334. ISC's plenary reached consensus on the management advice for Pacific bluefin tuna as follows: given the conclusions of the July 2010 PBFWG workshop, the current (2004–2006) level of F relative to potential biological RPs, and the increasing trend of F, it is important that the level of F is decreased below 2002–2004 levels, particularly on juvenile age classes.

335. SC6 recommended that WCPFC adopt ISC's conservation advice provided on Pacific bluefin tuna.

6.9.3 North Pacific swordfish

a. Stock status and trends

336. In 2010, the EPO stock assessment was updated to include missing swordfish catch from the IATTC area. Results of the updated EPO stock assessment were consistent with the previous 2009 EPO stock assessment.

337. Based on 2009 stock assessment results, the exploitable biomass of the WCPO swordfish stock was estimated to be about 75,000 mt in 2006 (B_{2006}), roughly 30% above B_{MSY}. The exploitation rate on the WCPO stock in 2006 was estimated to be 14% with a total catch of roughly 9,900 mt or roughly 69% of MSY (MSY=14,400 mt). There was very high probability that B_{2006} was above B_{MSY}, a 93 out of 100 chance, and there was a 0 out of 100 chances that the exploitation rate in 2006 exceeded the rate to produce *MSY*. Based on the 2010 stock assessment update results for the EPO stock only, the exploitable biomass of the EPO swordfish stock was estimated to be about 69,000 mt in 2006, over 200% above $B_{MSY.}$

338. The exploitation rate on the EPO stock in 2006 was estimated to be 6% with a total catch of roughly 3,900 mt or roughly 78% of MSY (MSY=5,000 mt). There was very high probability that B_{2006} was above B_{MSY}, a 99 out of 100 chance, and there was a two out of 100 chance that the exploitation rate in 2006 exceeded the rate to produce *MSY*. The exploitable biomass of the WCPO swordfish stock was 31% above B_{MSY} and the exploitation rate was 46% below F_{MSY} in 2006. Similarly, exploitable biomass of the EPO swordfish stock was over two-fold greater than B_{MSY} and the exploitation rate was 62% below F_{MSY} in 2006. Based on results of the updated North Pacific EPO stock assessment and the 2009 North

Pacific WCPO stock assessment, the billfish working group proposed that the ISC plenary maintain the existing conservation advice for this species.

Discussion

339. SC6 noted from the ISC10 report that the exploitable biomass of the WCPO swordfish stock estimated in 2006 is roughly 30% above B_{MSY}; and that the exploitable rate on the WCPO stock in 2006 estimated at 69% of F_{MSY}. In contrast, the EPO swordfish exploitable biomass stock was over two-fold greater than B_{MSY} and the exploitation rate was 62% below F_{MSY} in 2006. These estimates point to the healthy state of this species both in the WCPO and EPO, and above the level required to sustain recent catches.

340. Despite the results of the updated 2010 assessments, it was not clear if any progress had been made on investigating the two-stock structure assumptions in the updated assessment. As discussed last year, there is uncertainty on the use of fishery data by the southern boundary of the EPO stock and if this boundary has been reviewed at ISC10.

b. Management advice and implications

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

342. SC6 recommended that the WCPFC note ISC's conservation advice provided on North Pacific swordfish stocks.

General discussion

343. SC6 noted that the ISC had dissolved its bycatch working group and formed a shark working group. When questioned on who would provide advice to the WCPFC Northern Committee pertaining to seabirds and sea turtles, the ISC representative advised SC6 that the Northern Committee will consider advice on seabirds and sea turtles from the SC.

6.10 Responses to Commission's requests

344. SC6 reviewed the further evaluation of CMM 2008-01 as requested by the Commission. The review of CMM-2008-01 and recommendations are contained under Agenda Item 6.1.

6.11 Research planning

345. Following the consideration of the stock assessment working papers, a number of suggestions were made in relation to future research priorities. The following areas of further research were suggested for incorporation into assessments.

346. It was proposed that the following changes be made to MFCL for undertaking the next bigeye assessment:

i. MFCL be modified to allow the incorporation of direct ageing observations to improve the estimation of growth.
ii. MFCL be modified to allow the estimation of the spawner recruitment relationship over a given time period rather than the entire model domain.
iii. Alternative functional forms, including length-based selectivity, be considered for the Indonesian and Philippine small-fish domestic fisheries (fisheries 18 and 24).

iv. Any available tagging data, in particular from the PTTP, be incorporated into the next assessment.

347. A number of recommendations for future research were made in SA-WP.4. In undertaking the next assessment for bigeye tuna, and improving bigeye tuna assessments undertaken in the medium to long term, the following activities should be considered.

Data analysis

- Alternative approaches to the modeling of CPUE data that incorporate the spatial extent of fishing operations should be considered. This is the highest priority activity to support the assessment.
- Detailed investigations be undertaken of the Japanese longline length data throughout the WCPO and other length and weight frequency data from longline fisheries in regions 3 and 4. Such investigations will require details of sampling protocols and operational level CPUE data. Collaborations with national scientists will be important.
- Analyses of operational data for the fishery 5 fleets ("off-shore" operations) to determine the most appropriate grouping of the fleets and time periods into MFCL fisheries.
- Analysis of available tagging data to further examine the differences in juvenile mortality of bigeye and yellowfin tuna.

Research

- Continued experiments and activities to improve purse-seine catch estimates, in particular spill sampling trials with consideration of corrections to length-frequency samples. Further development of cannery data sources may also be useful.
- Continuation of the work to refine both the species composition and total catches from the domestic fisheries that occur in Indonesia and the Philippines.
- Direct ageing of bigeye tuna, in particular large bigeye tuna in different regions throughout the WCPO.

348. A number of recommendations for future research were made in SA-WP-10. In undertaking the next assessment for skipjack tuna, and improving skipjack tuna assessments undertaken in the medium to long term, the following activities should be considered. Recommended research and monitoring required to improve the skipjack tuna assessment include the following:

- Further development of the PTTP dataset for inclusion in the assessment. Critical work includes maximizing the number of returns that can be assigned to recapture fisheries with reasonable certainty and the further development of estimates of the tag reporting rates, particularly for PTTP releases, and also Japanese tag releases in northern waters. Incorporating more tagging data into the assessment, as they become available, will provide additional information on recent levels of fishing mortality, refine estimates of natural mortality, and possibly allow some time-series behavior in movement to be incorporated into the model. Additional tagging in the northern region would provide additional information to parameterize relative stock levels among model regions.
- This and recent skipjack assessments have used standardized CPUE from the Japanese pole-and-line fisheries as the key abundance index that drives trends in estimated abundance in the model. However, this fishery now makes up less than 4% of the total WCPO skipjack catch, and an even smaller percentage in the main equatorial zone. Future research is required to better understand the factors impacting CPUE in the purse-seine fishery, which now comprises 88% of the total WCPO skipjack catch, with a view to developing an index of abundance based on this major fishery.
- Assessment model estimates of skipjack growth are not well determined by the available data. The estimation of growth would be assisted by the development of the MFCL software to

incorporate age-length and length-increment observations, and the inclusion of such data into the assessment.

- Further research on environmental and biological influences on skipjack tuna recruitment, distribution, and movement are required. The application of fine-scale spatial models such as the spatial ecosystem and population dynamics model (SEAPODYM) to skipjack tuna could potentially provide a useful source of auxiliary information that could be included in MFCL-based assessments.

Recommendations relating to future stock assessments

349. SC6 requested that the science services provider continue to:

- resolve data and methodological issues associated with bigeye and yellowfin fisheries as assessment inputs; and
- advance the analyses of PTTP data to incorporate these into the skipjack assessment.

350. SC6 requested stock assessments in 2011 for WCPO bigeye and skipjack tuna, to be reviewed at SC7.

351. If the external peer review of yellowfin tuna assessment can be provided by December 2010, a decision will be made at WCPFC7 on the feasibility of conducting an assessment for SC7.

352. SC6 recommended that the South Pacific albacore base model assessment be updated and include catch and effort data from 2009 and 2010, and be presented to SC7 with improved biological data parameters that may be available.

353. For future assessments:

i. SC6 requested that following the completion of the biological study in 2011, that South Pacific albacore be considered for a full assessment in 2012, and that a stock assessment be conducted in 2012 for South Pacific striped marlin because the most recent assessment was in 2006. SC6 recommended that data preparations occur in 2011 to support the assessment.
ii. If a yellowfin assessment is not conducted in 2011, SC6 then requests that a stock assessment be conducted in 2012.
iii. SC6 recommended that a review of data holdings relating to swordfish in the South Pacific, together with the resolution of any outstanding data issues, be undertaken during 2011 and reported to SC7. If data for the assessments are deemed sufficient, SC7 can make a recommendation to conduct the swordfish assessment during 2012, with a presentation to SC8.

AGENDA ITEM 7 — MANAGEMENT ISSUES THEME

354. The convenor for the Management Issues theme, R. Campbell (Australia) opened this session and outlined the agenda.

355. F. Forrestal (ISSF) and T. Lawson (SPC) were selected as rapporteurs.

356. The convenor informed the meeting that because this was the first meeting of this new theme, he was acting as an interim convenor on the invitation of the SC Chair. He noted that a convenor would be elected under Agenda Item 13 (Administrative Matters).

357. The convenor also informed the meeting that there were no terms of reference for this theme, and recommended that after a convenor was elected, the terms of reference for the theme should be drafted,

and that this draft be presented to SC7 for discussion, review and adoption. SC6 supported this recommendation.

7.1 Identifying limit reference points for the WCPFC

358. The convenor introduced this topic by reminding the meeting that, acting on a directive agreed by the Commission at WCPFC5 in December 2008, a special workshop on RPs had been held at SC5. The aims of this workshop were to provide capacity building on this issue and review some of the technical characteristics of RPs. SC5 had endorsed the recommendation from this workshop that a work programme be undertaken during 2010 to assist SC6 with identifying candidate RPs (both type and value) for each of the key target species in the WCPFC and make suitable recommendations to the Commission.

359. The convenor listed the intersessional work programme agreed on at SC5 and identified as Project 57 on the Scientific Research Plan.

1. Identify candidate indicators (e.g. $B_{current}/B_o$, SB/SB_{MSY}) and related limit reference points (LRPs) (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.
2. Using past assessments, evaluate the probabilities that related performance indictors exceed the values associated with candidate RPs.
3. Evaluate the consequences of adopting particular LRPs based on stochastic projections using the stock assessment models.
4. Undertake a literature review or 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).

360. The convenor noted that this work programme had unfortunately not been completed before SC6 as initially hoped, but that some progress had been made on aspects of issues (1–3). The following two presentations could, therefore, be viewed as progress reports.

a. MI-WP-02 (Identifying possible limit reference points for the key target species in the WCPF)

361. R. Campbell (Australia) presented "Identifying possible limit reference points for the key target species in the WCPFC" (WCPFC-SC6-2010/MI-WP-02). This presentation provided an outline of the rationale behind the use of LRPs in fisheries management, and provided some examples of LRPs that could be considered within the WCPFC. These examples were drawn from two recently completed reviews on reference points as well as LRPs incorporated into the harvest strategies adopted by Australia and New Zealand in recent years. LRPs attempt to constrain harvesting within safe biological limits for a stock (i.e. to protect the stock from serious, slowly reversible or irreversible fishing impacts), and are usually expressed as fishing mortality rates (F) or biomass levels (B) that must not be exceeded. Six general classes of reference points were identified, but three of these (those based on economic, empirical or historical observations of the spawner-recruit relation) were not seen as been possible to use or applicable for identifying LRPs in the WCPFC. The remaining three types of reference points are those based on *MSY*, yield-per-recruit or depletion indicators. The two reviews both identified F_{MSY} as an appropriate LRP while the review undertaken by Sainsbury (2008) also recommended three biomass-based LRPs (including 30% of the unfished biomass). The two harvest strategies both used 50% B_{MSY} (or 20%B_o as a proxy) as LRPs, with New Zealand also using 25% B_{MSY} (or 10%B_o) as a hard LRP. The results of past assessments undertaken on key target species in the WCPO are then used to evaluate the performance of the fisheries in the WCPO against five example LRPs. These examples were provided for illustrative purposes only, and as each example used only a small number of point estimates for each

indicator they do not provide a full evaluation of the probably that the indicator is in breach of the related LRP.

Discussion

362. A query was raised regarding what would trigger stock rebuilding when using both an F-based LRP and a B-based LRP. In the case of bigeye, current estimates of F exceed F_{MSY} but as biomass is estimated to be about at the level of *MSY*, rebuilding wouldn't be needed if an LRP was based on biomass alone. The presenter was also asked whether institutions that made use of RPs used F-based RPs as limits or targets, and how uncertainty was to be considered in placing a probability on breaching the RP, as greater uncertainty would mean the RP would be breached more often.

363. R. Campbell responded that *MSY*-based RPs historically were generally used as target RPs. However, in recent times there has been a shift towards using F_{MSY} as an LRP, although he was not sure if any organization had actually adopted that as an LRP to date. He noted that although the recommendation from the Sainsbury review was that the "best practice" should have both F-based and B-based reference points, he acknowledged that in the case of bigeye in the WCPO, the stock may be in breach of one reference point but above it in respect to the other. He agreed that of the things that need to be looked at is whether the WCPFC should use both types or just focus on one type of reference point. He suggested that the biomass based reference point may be the more appropriate option for a LRP as protecting biomass is perhaps the more important aspect in this situation.

364. In response to the second question, R. Campbell acknowledged that if uncertainty in the stock assessment is high, then there would be a greater chance of exceeding the probability associated with breaching an LRP even thought the true state of the stock may be the same if the uncertainty is less. He acknowledged that there is a trade-off between uncertainty in stock assessment outcomes and the probability of breaching an LRP, and this would need to be considered carefully when defining the situations when a RP is breached.

365. A question was raised in respect of the uncertainty of initial biomass estimations and the use of B_0-related points, citing stocks that show very wide stock fluctuations due to environmental shifts. As the MSY of the stock experiences large fluctuations, it was considered very difficult to apply an LRP. R. Campbell noted that it was interesting to mention natural fluctuations in populations, as this point had been considered by the comprehensive review undertaken by Sainsbury. Where the estimated unfished biomass is estimated to fluctuate widely, the value of B_0 does not seem to have much meaning in regards to being an appropriate reference point and the unfished biomass level was perhaps more appropriate. An example was provided in presentation by the IATTC, which indicated that the EPO bigeye stock appears to exhibit large natural variation. He also noted that while several different considerations should be taken into account when setting reference points, the focus for identifying appropriate LRPs should be largely on the biology of the species in question in order to provide adequate protection of the stock. On the other hand, when discussing target reference points, there is the opportunity to take into account broader consideration, such as socioeconomic impacts.

b. MI-WP-01 (A framework to evaluate the potential impacts of limit reference points, including multi-species considerations)

366. S. Harley (SPC) presented "Stochastic and deterministic projections: A framework to evaluate the potential impacts of limit reference points, including multi-species considerations" (WCPFC-SC6-2010/MI-WP-01). This paper describes alternative approaches to addressing activity 3 in the intersessional work programme listed above. It provides a brief overview of some of the theoretical bases for LRPs and then describes how the question of the consequences of adopting particular LRPs can be

addressed using stochastic projections. This approach is applied to bigeye tuna using run 14 from the 2009 bigeye tuna stock assessment. This example involves some hypothetical LRPs because the outcomes from activities 1 and 4 listed above were not available at the time of writing. Finally, using the results of the bigeye tuna example, estimates of effort reductions required to achieve the hypothetical LRPs were applied to yellowfin and skipjack tuna to determine the potential multi-species implications of adopting particular LRPs for bigeye tuna. The focus of the paper is on the theoretical and methodological aspects of the analysis rather than the LRPs themselves. Subject to the approval of this approach by the SC, and the selection of some candidate LRPs, it would be possible to apply this methodology to the latest assessments of bigeye, yellowfin, and skipjack tuna. This information could assist the WCPFC in its consideration of reference points.

Discussion

367. It was noted that placing limitations on fishing effort for one species would likely result in a change in fishing patterns on other species, so that the effects on these other species may not be as large as modeled. S. Harley responded that the situations modeled in the paper could be viewed as representing the worst-case scenarios as fleets could change targeting practices.

368. The time period used in the projection to compute risk was queried, as the time period choice is an important factor in how risk is treated. S. Harley agreed, noting that the time period used was the last three years. If the stock is experiencing low recruitment, a narrower time window would be used in projections than if there were no clear, recent pattern in recruitment.

369. WCPFC's Science Manager queried whether the SC could provide the most plausible types of reference points and the rationale behind their use at the next Commission meeting. However, the convener noted that the presentation was used to show a methodology for assessing reference points, rather than to provide any explicit recommendations. At this stage, there is more work to be done before making recommendations to the Commission on reference points for WCPFC stocks. The Science Manager also asked whether simulations could be presented to the managers as options of what type of work is possible. The convener noted that a request had been made to provide SC6 with a biological basis for identifying LRPs, but that this task that had not been completed. The SC could inform the Commission what managers in other areas have done, but not with regard to the specific stocks in the region. The convener further noted that SPC has developed a good methodology, and that further analyses could be undertaken to help identify candidate LRPs, for presentation to SC7.

370. CCMs noted that, following the reference point workshop at SC5 and the series of recommendations made to WCPFC6, they expected work on reference points to be somewhat further advanced by this time. They thanked SPC for the working paper, and noted its application to the two reference points selected for demonstration purposes. It was indicated that the technical changes made to MFCL and the modeling framework, particularly the recognition of multi-species implications, will provide a good basis for future work on reference points. Members also thanked R. Campbell for the supplementary paper submitted in the last few days, which will provide a useful perspective for the completion of tasks identified by SC5; more detailed comments would have to await a more detailed review of the results. In the absence of more comprehensive information on the suite of potential reference points and their implications for stock assessment and management recommendations, CCMs noted they were not in a position to progress this issue. As such, it was recommended that part of the work (tasks 1 and 4) be put to tender as a priority in order to provide information regarding the pros and cons of various indicators and reference points. The more specific modeling tasks in items 2 and 3 were seen as best suited for completion by SPC after the initial work is completed.

371. Concern was expressed regarding the use of RPs based on virgin biomass, noting that in the case of bigeye tuna, B_0 appears to be an artefact of the model, and it was requested that more effort be put towards proper estimation of B_0 for use in establishing an RP.

372. A query was raised about how exceptions and special areas would be treated if LRPs are accepted and implemented as conservation measures. S. Harley responded that all projections would be of a particular management strategy, and while these can be quite complex the simulation would be able to account for these special cases.

373. A query addressed the sources of uncertainty used in the stochastic model as well as the length of the projection period. S. Harley responded that rather than make several projections from a single model, a grid of models could be used to make projections from each model. He noted that it was an interesting question in regards to using that type of approach. He then addressed the second query, noting that in the case presented, the long projection resulted in the stock coming towards a sort of equilibrium. It would not be useful to do a short projection starting from the same point, as in the short term, all the models would behave similarly.

Recommendations

374. Based on the above discussion, the SC6 made the following recommendations:

- SC6 recommended that Project 57 on RPs, identified at SC5, be completed. Specifically, tasks 1 and 4 to be put out to tender and tasks 2 and 3 to be completed by SPC. The results are to be reported to SC7 and, if appropriate, to the proposed Management Objectives Workshop to be held in 2011.
- After reviewing the results of the above Project, that SC7 make a recommendation to the Commission on candidate RPs (both type and value) for each of the key target species in WCPFC.

375. It was noted that the Management Objectives Workshop should occur after SC7 in order to allow the results of Project 57 to be first reviewed by SC.

7.2 Limiting catches of juvenile bigeye: Assessment of the FAD closure

376. The convenor introduced this agenda item by informing the meeting that the aim of this issue was to allow the SC to assess the objective of conservation and management measure CMM-2008-01 to reduce the mortality of juvenile bigeye tuna by investigating the effectiveness of FAD closures during 2009.

a. MI-WP-03 (Analysis of fishing activities during the 2009 FAD closure)

377. Shelton Harley (SPC) presented "Analysis of fishing activities during the 2009 FAD closure" (WCPFC-SC6-2010/ MI-WP-03). The seasonal restriction (two months in 2009, and three months during 2010–2011) on the use of FADs is one of the key measures within the WCPFC conservation and management measure for bigeye and yellowfin tunas (CMM2008-01). Predicting the impact of this restriction on the catches and stock status of bigeye, yellowfin and skipjack tunas is difficult because the way in which vessels choose to comply with the measure could differ by fleet and depend on the prevailing fishing conditions at the time of the restriction. This paper compares fishing activities during the 2009 two-month FAD closure (1 August–30 September) to the fishing activities that have taken place during the same period in previous years (2001–2008). The key findings were that:

- Overall effort in terms of sets and days fished was the highest on record (2001–2009) during the 2009 FAD closure.

- Almost all effort from associated sets was transferred to unassociated sets, but there was some evidence of non-compliance.
- Total catches of skipjack, yellowfin and bigeye tuna combined were comparable to previous years, although bigeye tuna catches were the lowest on record.

378. This analysis was based on logsheet data because not all relevant observer data were available for the time of the closure and, therefore, it is critical that the conclusions made in the paper be verified. For example, logsheet-reported positional data need to be verified with VMS data and logsheet-reported positional, set type and species composition data need to be verified with observer data, when available.

Discussion

379. There was a comment that during the FAD closure, the CPUE on unassociated schools could be expected to be lower than normal because some skippers would be unused to setting on unassociated schools, and a question was posed whether available information reflected that fact. The point was also raised that the industry feels that the FAD closure occurred at a time when it was inappropriate to be avoiding small fish. S. Harley noted that Figure 5 in the paper addresses unassociated school set CPUEs for August and September, and that the value of skipjack catch/day in 2009 is comparable to the highest levels previously seen in the fishery.

380. SPC noted that the observer reports for this time period were not yet available, and consequently that the reported low catch of bigeye during the FAD closure was an estimate based on past data that would need to be verified when new observer data became available. S. Harley noted that immediately after the FAD closure ended, the catch was high across all set types, almost double the average monthly catch of the past 10-year period. It appeared that skipjack had been aggregating at unfished FADs during the closure, making skipjack catches very high after the end of the closure, although this is not the case for yellowfin.

381. FFA members expressed their thanks, and noted that while these conservation efforts are in the early stages, it is useful to see an analysis that shows that apparently the FAD closure had achieved the aim of reducing incidental catch of small bigeye tuna while maintaining continuity of fishing opportunities and product supply.

382. Support was offered for the preliminary analyses, and a comment was made that it would be useful to examine trends in fish size. There was also a query as to whether there was any information on the level of compliance within Indonesia's EEZ for the FAD closure. It was pointed out that this closure only applied to PNA members, and that other non-PNA members have agreed to adopt similar measures, but that this wording is open to interpretation.

383. An observer thanked SPC for its work in providing these results from the FAD ban period and looked forward to the verification of this data, noting that it is excellent to know just how effective the FAD ban is on reducing the catch of bigeye tuna. The observer noted that even with greatly increased fishing pressure during the ban period, bigeye catch levels were estimated to be greatly reduced. To ensure that annual FAD-caught bigeye remains low they asked the SC to consider an extension to the seasonal closure of FADs to ban their use in association with purse-seine fishing as an effective means of meeting the objective of reducing fishing mortality of bigeye tuna.

384. A query was raised regarding the high catches of skipjack after the FAD closure. The presenter noted the FAD closure had not increased fishing effort on skipjack but rather that previous effort would have been related to FADs and that effort would have been transferred to unassociated schools of

skipjack. It was noted that CPUE effort on free schools was much lower than on FADS, and that there was less fishing mortality on skipjack during the FAD closure.

385. Members of PNA joined other CCMs in noting that it was encouraging to observe reduced catches of bigeye without reducing the flow of skipjack to consumers, and stated that they will consider the impacts of a FAD closure in their waters. PNA members noted the SPC-OFP's explanation on the lack of impact of FAD closure in totality throughout the year. However, PNA members reiterated that the short window during the FAD closure achieved a specific objective and the alternative of doing nothing would be undesirable.

386. The presenter noted that as an overall measure, the FAD closure did not have an impact over the entire year but was effective only during the small window of the actual closure. He also noted that the overall year had FAD effort sets higher than in the past five years. The convenor also commented that the estimated bigeye purse-seine catch during 2009 was the second highest on record and around 40% higher than the average over the period 2001–2004, while the aim of the CMM had been to reduce catches by 10% below this level.

387. It was observed that one feature of large aggregations of skipjack on FADs is that the school will be in residence in the night but may move away from the FAD during the day. This feature has been proposed by IATTC scientists as a way to potentially avoid the capture of bigeye but still target skipjack, and SPC noted that this behavior has been documented in observer reports. SPC commented that this information is only included in observers' narrative reports, and that these reports should be queried on these points.

388. Indonesia stated in response to a previous query about the use of the FAD closure in the EEZs of countries not affiliated with the PNA that they required more time to study and understand the possible socioeconomic impacts on fishermen. In response, a CCM encouraged all CCMs to adopt comparable methods in their EEZs.

389. It was noted that while the catch/set may appear low, it could be the result of zero catches throughout the day until the entire school is caught in one set.

390. A CCM thanked R. Campbell for his presentation on the work done on RPs and noted that in regards to the FAD issue, they believed the time period for the closure was based on when the highest catch of small bigeye were taken. PNG suggested that this work be continued to determine the best time for the FAD the closure.

Recommendations

391. Following the discussion on this issue, SC6 made the following recommendations:

- The Commission and TCC should note the analysis of fishing activities during the 2009 FAD closure presented in working paper MI-WP-03 when reviewing the implementation of CMM-2008-01.
- Further analyses should be undertaken as additional data and information comes forward to investigate the effectiveness of FAD closures on reducing juvenile bigeye mortality.
- Observer reports that document purse-seine effort during the 2009 FAD closure should be examined to investigate the setting characteristics of unassociated effort in proximity to drifting objects.
- Observer reports should be used to characterize the details of FAD sets made in contravention to CMM-2008-01.

- The Commission should give additional support to allow the timely analysis of observer data, including the analysis of size-trends in the catch to assist with the understanding of the FAD closure.

7.3 Review of Kobe II joint RFMOs workshop outcomes

392. SC6 reviewed the outputs of the Kobe II Workshop on the Provision of Scientific Advice and Workshop on Tuna Management. P. Flewwelling (WCPFC Compliance Manager) presented a draft report of the small working group that had met the previous day to consider Working Paper WCPFC-SC6-2010/GN–WP–06, "Joint tuna RFMOs workshops in 2010: Reports and recommendation". The small working group completed the columns "SC Response" and "SC Comments" in the table of recommendations in the working paper. Most of the recommendations considered by the small group concerned the Workshop on the Provision of Scientific Advice, but some recommendations from the Workshop on RFMO Management of Tuna Fisheries were also considered. Consideration of the recommendations from the Workshop on Bycatch had been deferred until the meeting of the Ecosystems and Bycatch theme.

393. SC6 considered each recommendation in turn, except for those concerning the Workshop on Bycatch, which were again deferred for consideration during the Ecosystem and Bycatch Mitigation theme.

394. Regarding recommendation #14 from the Workshop on the Provision of Scientific Advice, which states "Chairs of Scientific Committees should jointly develop checklists and minimum standards for stock assessments," the small group could not reach a consensus on exactly what was being requested and SC6 agreed to request clarification from the chair of the workshop.

395. Regarding recommendation #19, which states "Chairs of Scientific Committees should establish an annotated list of common issues that could be addressed jointly by tuna RFMOs and prioritize them for discussion at the Kobe III meeting," the WCPFC's Compliance Manager noted that SPC had been asked to prepare the list, rather than the Chair of the SC, but that this could be justified because the SC Chair could delegate the task to SPC. The list will be finalized by October 2010 and discussed at WCPFC7 and at Kobe III in July 2011.

396. Regarding recommendations from the Workshop on RFMO Management of Tuna Fisheries, it was decided to agree on recommendations 4–7 and defer the others to TCC. Regarding recommendation #11 concerning measures of capacity, it was agreed that in the absence of a WCPFC definition of capacity, the FAO definition should be used in the interim.

397. The table of recommendations, together with SC6's response and comments, is presented in Attachment M.

7.4 Workshop on management objectives

398. The convenor introduced this topic by noting that at the Special Workshop on Reference Points held at SC5, it had been recommended that the Commission hold a workshop on management objectives. The purposes of the workshop were to i) assist managers in identifying the information required to guide management decisions, and how these can be quantified; ii) provide guidance on identifying stock-specific limit and target reference points; and iii) provide advice on how uncertainty in estimating performance indicators can be incorporated into management decisions. He also noted that at WCPFC6 CCMs had stated their strong support for articulation of the Commission's fisheries management objectives and the development of RPs as tools for effective implementation of these objectives. To this

end, the 2010 budget approved at WCPFC6 included USD 90,000 to support a Management Objectives Workshop.

399. The convenor stated that the intent of this agenda item was to consider what guidance the SC could provide to preparing and convening the Commission's proposed workshop on Management Objectives, which is now scheduled for 2011. He noted that issues that would need to be considered included identifying the organiser of the workshop, the agenda, the venue, the timing, appointment of a chair, list of participants, and what preparatory work may need to be conducted. However, he stated that the Secretariat would likely organize the workshop and would be in the best position to choose a venue. Following some discussion, it was agreed that the logistical details could be left to the Secretariat (or other workshop organizer).

400. Regarding the timing of the meeting, the convenor noted that during the discussion on RPs, it was suggested that the workshop be held after SC7 had first reviewed the intersessional research to be undertaken and prior to WCPFC8 in December 2011. Several CCMs provided comments supporting this suggestion. The WCPFC Science Manager also informed the meeting that if the USD 90,000 is not used during 2010, then the Commission would have to re-allocate an amount to support this workshop to the budget for 2011.

401. The convenor also suggested that in addition to preparatory work that may be done by SPC, it may be useful for additional international experts on RPs and fisheries management issues to be invited to participate. He suggested that Dr Keith Sainsbury could be a candidate, and referred to the recent review of RPs that K. Sainsbury had completed. One delegate stated that it would be best for any invited experts to be seen as being independent.

402. Following the discussion, SC6 reiterated its support from SC5 for holding a Workshop on Management Objectives and agreed that such a workshop would provide an excellent opportunity for scientists and managers to jointly consider and discuss this important topic.

Recommendations

403. In supporting this Management Objectives Workshop, SC6 made the following recommendations, and requested that the Commission take these recommendations into consideration when organizing the workshop.

i. That WCPFC7 renew their support and the required funding provided at WCPFC6 for holding a Workshop on Management Objectives.
ii. In order to allow SC7 to first review the results of the intersessional work project on RPs, the workshop should be held between SC7 and WCPFC8.
iii. That an independent international expert(s) be invited to the workshop to provide expert guidance on the use of RPs and other issues of relevance to identifying fisheries management objectives. The science services provider (SPC), with the assistance of other regional scientists, contributes to the Management Objectives Workshop in order to provide technical advice on the adoption of RPs to key WCPFC stocks.
iv. SC6 also noted that in order to assist with the success of the workshop, some preparatory scientific work would need to be undertaken. It identified SPC as the agency in the best position to undertake this preparatory work. The Commission is requested to take this into consideration when addressing the level of funding support required for the workshop.

AGENDA ITEM 8 — ECOSYSTEM AND BYCATCH MITIGATION THEME

404. The Ecosystem and Bycatch Mitigation theme was convened by P. Dalzell (USA). V. Chan (USA) was selected as the rapporteur.

8.1 Fisheries impacts

a. EB-IP-02 (SEAPODYM applications in WCPO – progress report)

405. J. Hampton (SPC) reported that work on SEAPODYM is continuing, and that applications of SEAPODYM are becoming more extensive. SPC hopes to use this tool to document environmental and fishing impacts in EEZs of member countries, to hone in on impacts occurring in individual subregions, and to discriminate between effects of fishing and the environment.

b. Kobe II workshop on bycatch

406. SC6 agreed in principle to all the Kobe II workshop recommendations developed for bycatch, and recommended that the Commission consider the appropriate participation for the working group described in recommendation #12 in WCPFC-SC6-2010/GN-WP-06 (p. 5). A comment was added to recommendation #2 stating, "The rules of scientific data to be provided by CCMs should be expanded to include bycatch data reporting." A recommendation was also made that the WCPFC take a lead on the formation and organization of a bycatch working group.

8.1.1 Sharks

a. EB-WP-01 (A proposal for a research plan to determine the status of the key shark species)

407. S. Clarke (SPC) presented "A proposal for a research plan to determine the status of the key shark species" (EB-WP-01). The Fifth Regular Session of the Scientific Committee (SC5) in August 2009 considered the feasibility of quantitative stock assessments for sharks, and recommended that preliminary assessments should proceed in parallel with the development of a shark research plan to fill data gaps. The paper presents a proposed shark research plan in response to the Commission's approval in December 2009 of SC5's recommendation.

408. An introduction to the Commission's eight current key shark species was presented, including a brief review of the history of their designation and species profiles containing information on habitat, life history and ecological risk, conservation status, current catches in the WCPO, and existing assessments or management. A review of existing fishery and biological information was then presented and data gaps were summarized. Major difficulties in the use of logsheet data for shark assessment are anticipated due to lack of data provision, as well as issues of species mis-identification, under-reporting and changes in targeting strategies. Observer data coverage, especially for longline fleets, is low and may not be representative of all areas where sharks are caught. Other commercial, research and recreational fishery data sources have some potential to inform analyses but will require further work. Fishery-specific biological data are available mainly in the form of observer data on shark lengths, sex, fate and condition, and through a limited number of studies on bycatch mitigation methods (i.e. post-release mortality rates). It was concluded that there is a reasonable amount of information available on the biology of most key shark species although studies are concentrated in a few geographic regions.

409. The extent of shark tagging data was difficult to characterize but appears primarily available for blue and mako sharks. A number of proposed shark assessments by other organizations were noted,

including silky and oceanic whitetip assessments for the EPO by IATTC; assessments of blue, mako and potentially bigeye and pelagic threshers by ISC; and data compilation for makos by CSIRO.

410. A research plan is proposed as three phases: assessment, research coordination and fishery statistics improvement. Progress in all three phases will be necessary to assist the Commission in meeting its responsibilities for ensuring the sustainability of shark stocks. Phase 1 consists of three assessment steps to be undertaken on the basis of existing data. The first step will involve constructing indicators of the degree of fishing pressure on the key shark species. The second step will involve plotting these indicators against various measures of shark species' productivity. The third step will involve stock assessments using simple surplus production and age structured models, if possible. However, without additional inputs from Phases 2 and 3, stock assessments for some species will be severely compromised and may not be able to provide a meaningful basis for Commission decision-making. For this reason, CCMs are invited to consider potential activities identified under Phases 2 and 3 (i.e. research coordination and fishery statistics improvement) as collaborative work and in-kind contributions.

Discussion

411. SC6 expressed support for the shark research plan and recommended it to be forwarded to WCPFC7 for approval. CCMs were encouraged to comply with relevant data provisions of the current shark measure during the plan's implementation.

412. It was clarified that the science services provider was currently unable to provide an assessment on shark stocks, and would provide preliminary information on the eight shark species identified in the shark research plan to WCPFC7. SC6 noted that this would make it impossible to determine the status of key shark species as requested by WCPFC6, and indicated this could be addressed in detail by SC7. CCMs noted that, in the absence of shark stock assessments, the Regional Plan of Action (RPOA) for sharks and the FAO IPOA on sharks could be usefully applied to potentially develop and implement appropriate measures and address requirements under the shark CMM, as a proactive approach to shark conservation and management. It was also noted that the only official stock assessment for sharks in the Pacific is for the North Pacific blue shark.

413. A discussion was held regarding which species should be given priority for future assessments, with agreement reached to place priority on assessing the status of blue, silky and oceanic white tip sharks.

414. The problems associated with collecting data on some species (e.g. thresher sharks, which are in some instance caught by the tail and released without being landed) were discussed. It was noted that observer data are generally more reliable than logbook data, and that expanding observer coverage is a slow process. Problems with data collection — including the difficulty faced by many observers in identifying non-target shark species — were noted, and SC6 agreed on the need to ensure logbook data and observer data are reliable. Support was also expressed for collaboration to improve access to data sources beyond that collected by observers, including shark catch data from commercial fisheries managed by the WCPFC.

415. The science services provider stated that CCMs likely hold valuable logbook and observer data that has not been analyzed, and suggested that a review and consolidation of this data be undertaken. SC6 encouraged CCMs to ensure that all available data be reported to the Commission in a timely manner. Both New Zealand and China indicated that they had data on sharks that they would be willing to share with SPC. A CCM expressed concern that it does not currently make measurements on sharks caught as bycatch in its tuna fisheries.

416. Concern was expressed regarding potential duplication of effort in shark assessments to be made using Commission shark data in the WCPO by i) the ISC's Shark Task Force Group and, ii) the WCPFC's science services provider. It was noted that no shark species had been defined as northern stocks, and the view expressed that any work undertaken on sharks should be in the context of the entire Convention Area. The ISC chair indicated that ISC is working with RFMOs on assessment of shortfin mako and blue sharks, and are considering assessment of other species; they will restrict their involvement to species where ISC can contribute to meeting the requirements of interested parties. It was requested that ISC coordinate shark data sharing and shark stock assessments with SPC-OFP, particularly on key shark species assessments undertaken by ISC, and present these in full to SC.

417. It was noted that the last year of the ecological risk assessment (ERA) was used to fund work on the shark plan, and if SC wishes to move forward with the shark plan, that monies will need to be allocated for 2011–2012.

418. SC6 agreed to hold an informal working group to discuss the programming of actions listed under phases 2 and 3 of the timetable, which include actions to be conducted by CCMs and other interested parties, as the timing of these activities may influence the scheduling of the planned shark assessments.

b. Addition of porbeagle and hammerhead sharks to list of key species under CMM-2009-04 (conservation and management of sharks)

419. A discussion was held regarding the distribution of porbeagle and hammerhead shark species. It was noted that some fisheries have no catch of these species, and that most porbeagle data are from the New Zealand and Australian fisheries, with some catch by Japanese vessels operating in those waters. SPC indicated that a review of observer data revealed no porbeagle interactions north of about 25°S over the last 13 years. There are very little hammerhead data in the logsheet database; observer data that are present appear to be a function of certain fisheries. There are hammerhead data from Fiji, USA (Hawaii), PNG and Australia, with few sharks reported, from very disparate locations. It was noted that the absence of data made accurate determination of the actual distribution difficult, and that both species were recently discussed at CITES.

420. The SC expressed support for including porbeagle and hammerhead shark species in the list of key species, while noting that any reporting requirements relating to porbeagle should be worded in a manner that limits applicability to the area where this species is found, in order to avoid placing unnecessary reporting burdens on CCMs. SPC observed that the addition of these species would add 5 species to the key species list as there are four species of pelagic hammerhead sharks in the Pacific.

c. Update of CMM-2009-04

421. A discussion was held regarding whether the reporting of shark species should be made mandatory; changing the rules in the "Scientific Data to be provided to the Commission" was thought to be more effective than modifying the management measure.

422. CCMs explored options for ensuring that data on key species (including commercial species and species of concern) would be collected, while avoiding placing unnecessary burdens on members. It was recognized that collecting data on a species would not necessarily result in the preparation of an assessment, and that there was a need to provide direction regarding which species would be priorities for preparation of stock assessments. Concern was expressed for several non-commercial species, including pelagic stingray, hammerheads and crocodile sharks.

423. SC6 agreed that a method for future nomination of key shark bycatch species was needed.

Recommendations

424. SC6 recommended to the Commission that:

- The shark research plan be approved.
- WCPFC7 add porbeagle (south of 20°S)[10] and hammerhead sharks to the list of key shark species.
- The "key shark species" listed in CMM 2009-04 be added to relevant sections of the Commission Rules on Scientific Data to be Provided to the Commission, namely: i) Section 1 on estimates of annual catches; ii) paragraphs 1.3 to 1.6 of Annex 1 on operational level data; and iii) where possible, recreational catch and effort information.
- CCMs should endeavour to collect catch and effort data for porbeagle sharks (south of 20°S)[11] and hammerhead sharks that reflect the spatial and temporal extent of their longline and purse-seine fisheries. Together with advice from the Kobe II specialist bycatch working group on data reporting requirement in 2011, SC7 will consider adding these two species to paragraphs 1.3 to 1.6 of Annex 1.
- SPC-OFP develop a process for the nomination of a key shark species for consideration at SC7, and identify a subgroup of key shark species for which stock assessments will be conducted.
- Any work undertaken on sharks should be in the context of the entire Commission area, given that no shark species have been defined as northern stocks.
- The Commission requested that ISC coordinate shark data sharing and shark stock assessments with SPC-OFP, and present the results of the shark stock assessments in full at SC.

8.1.2 Seabirds

a. EB-WP-02 (Experimental comparison among four types of tori line designs in the western North Pacific)

425. D. Ochi (Japan) presented "Experimental comparison among four types of tori line designs in the western North Pacific" (WCPFC-SC6-2010/EB-WP-02). This paper presented results of two experiments to evaluate four tori line designs using both commercial and research longline boats. The first experiment was conducted by 20 offshore commercial longliners with 567 sets, and seabird abundance and bycatch number was compared between tori lines with long and light streamers, as well as between ones with red and yellow colored light streamers. During line setting, albatross species (black-footed and Laysan) were mainly aggregated and other seabirds, including shearwater species, were rarely observed. There were no significant differences in albatross bycatch numbers among different streamer types, and no bycatch of petrels and shearwaters were observed. During deployment of long streamer tori lines, serious tangling problems were reported many times. The second experiment was conducted by a chartered longline boat deploying three types of tori lines (light, hybrid and modified light streamers) tested in each set. Differences in seabird attacking behavior and bycatch number were compared among these tori lines with data of 72 observations obtained by 24 operations. The most primary attacks were recorded by albatrosses while those by shearwaters were rare, and also, most secondary attacks were caused by albatrosses. There were no differences in the primary attacking rate and bycatch number of albatrosses among the three tori lines. The results in this study indicated that four types of tori lines have same ability of seabird bycatch mitigation. It was also revealed that further improvement of design would attain that further reduction of seabird bycatch as the effective design of tori line supposed to be changed by area, season as well as the shape and size of vessel. Observed rather low interaction of shearwaters and petrels with longline baits

[10] Until biological data show this or another geographic limit to be appropriate.
[11] Until biological data show this or another geographic limit to be appropriate.

indicated that the bycatch system in the North Pacific may different from South Africa, where many albatross bycatch caused by petrels. From a sighting study during gear setting, improvement of bait casting method supposed to reduce the seabird bycatch. Further studies should be needed to develop appropriate mitigations majors of seabird in the North Pacific.

Discussion

426. A discussion was held regarding tori line research, and clarification requested regarding the attack rates by shearwaters and albatrosses, which were lower immediately aft of the fishing vessel, as compared to 25–100 m astern. The presenter indicated they were awaiting additional data from the fishing master, which might help explain this. It was noted that small, low-powered vessels experienced problems with long streamers, and that the presence of streamers appeared to be the most important factor in reducing seabird interactions. Attack rates have been observed to vary spatially, by seabird species and feeding behavior. There appears to be a correlation between the length of the tori line and the depth to which baited hooks sink. Once large tuna are caught, lines have been observed to rise to the surface. The need to conduct research beyond the wake zone and during hauls was noted. CCMs observed that there is a need for additional research, and spoke in favor of improvements in methodology, continued collaborations and peer review in such studies.

b. EB-WP-05 (Options for differential management and monitoring of seabird bycatch)

Seabird spatial ecological risk assessment

427. W. Papworth (ACAP) presented "Options for differential management and monitoring of seabird bycatch" (WCPFC-SC6-2010/EB-WP-05). At SC5 it was agreed to undertake further work to validate the spatial risk assessment (ERA) on seabirds to determine initial spatial zones for the differential management and monitoring of seabird bycatch. This paper considers some of the management options available to reduce seabird bycatch, including areal or seasonal closures, application of bycatch mitigation measures, and monitoring and data collection. Some recommendations are also provided on the type and level of monitoring that may be required to further validate the spatial risk assessment.

Discussion

428. It was commented that results of ERAs indicate that the area in the South Pacific where the capture of vulnerable birds was most likely to occur extends north to 25° S. The IOTC recently passed a resolution extending the region where management measures are required to 25°S, and it was suggested that SC6 recommend modifying its CMM to include the area between 25°S and 30°S to bring the WCPFC in line with IOTC practices. It was noted that the annual reports from CCMs do not include an assessment of data on the number of seabirds caught, and that including this would help to validate and support the ERA process. Japan indicated it was undertaking a regional observer programme, and expected to collect a wider range of information on seabird interactions; it stressed the importance of adequate data in evaluating the need for additional mitigation measures.

429. Potential differences in the effectiveness of mitigation measures between the northern and southern hemispheres were noted, and the possibility was raised of adopting different mitigation measures in the northern and southern parts of the Convention Area, as appropriate. Difficulties in determining vulnerability in areas with low observer coverage (e.g. south of 20°S and east of New Zealand) were noted, as were seasonal changes in vulnerability. CCMs welcomed further analyses that include more observer data in order to better validate spatial risk assessments, and the view was expressed that current findings do not justify the need to extend the area of application of mitigation measures into equatorial waters. CCMs recognized that observer data can be used to validate spatial risk assessment, although

coverage rates in some areas may be insufficient to achieve this, and limited budgets may preclude expansion of observer programmes.

c. Update of CMM-2007-04 (CMM to mitigate the impact of fishing for highly migratory fish stocks on seabirds)

(i) EB-WP-04 (Review of seabird bycatch mitigation measures for pelagic longline fishing)

430. W. Papworth (ACAP) presented "Review of seabird bycatch mitigation measures for pelagic longline fishing" (WCPFC-SC6-2010/EB-WP-04). Since SC5, a considerable amount of research has been undertaken on seabird bycatch mitigation measures for pelagic longline fishing operations. Evidence is emerging that the use of appropriate configurations of weights on branch lines is currently the most effective means of reducing seabird access to baits, although it still needs to be used in conjunction with other measures, such as tori lines and night setting. The results of this research have been reviewed by ACAP's Seabird Bycatch Working Group, and a summary of key findings are provided to assist SC6 in its consideration of the efficacy of seabird bycatch mitigation measures currently in use within the Convention Area, in accordance with CMM 2007-04.

431. W. Papworth highlighted results from two papers: "Effect of line shooter and mainline tension on the sink rates of pelagic longlines and implications for seabird interactions" (WCPFC-SC6-2010/EB-WP-07), and "Shrink and defend: A comparison of two streamer line designs in the 2009 South Africa tuna fishery" (WCPFC-SC6-2010/EB-IP-09). It was noted that recent research shows that combinations of mitigation measures are still required, and only combinations that take bait to depths of 10 m, or removing access to baited hooks will be effective in some fisheries. The need to modify CMM 2007-04 to focus on combinations that achieve this was emphasized.

(ii) EB-WP-06 (Experimental determinations of factors affecting the sink rates of baited hooks to minimize seabird mortality in pelagic longline fisheries)

432. D. Wilson (Australia) presented "Experimental determinations of factors affecting the sink rates of baited hooks to minimize seabird mortality in pelagic longline fisheries" (WCPFC-SC6-2010/EB-WP-06) on behalf of the authors.

i. While line weighting and other mitigation measures are required in the pelagic longline fishery off Australia's east coast, some seabirds are still caught, suggesting that mitigation measures are not fully effective in all conditions. An experiment was conducted in that fishery to establish a scientific basis for potential changes to reduce seabird mortality; in particular, by evaluating different combinations of line weighting and other variables affecting line sink rates.
ii. The experiment examined the effects of different bait species (blue mackerel, yellowtail mackerel and squid), bait life status (dead or alive), weight of leaded swivels (60 g, 100 g and 160 g) and leader length (distance between leaded swivel and hooks: 2 m, 3 m and 4 m) on the sink rates of baited hooks from 0–6 m deep.
iii. On average, live bait sank much slower than dead bait, greatly increasing the exposure of baited hooks to seabirds. Sink rates of individual live bait were highly variable. Many were <2 m underwater 18 seconds after deployment, including some on the heaviest swivels, and some were <10 m deep after 120 seconds.
iv. Within the dead bait group, gear with 60-g and 100-g swivels on the same leader length sank at similar rates, as did all three swivel weights on 4-m leaders. The 160 g x 2 m combination sank the fastest, averaging 0.27 m/s and 0.74 m/s from 0–2 m and 4–6 m, respectively. The 60 g x 4 m combination sank the slowest, averaging 0.16 m/s to 2 m depth and failing to attain 6 m depth

after 18 seconds. Initial sink rates (0–2 m) were increased by placing leaded swivels close to hooks and final sink rates (>4 m) by increasing the weight of the swivels.

v. The results indicate that the small (incremental) changes to the weight of leaded swivels and the length of leaders typically preferred by the fishing industry are unlikely to make an appreciable reduction in seabird mortality because resultant increases in sink rates will be insubstantial.

vi. rates close to the surface (i.e. 0–2 m) in addition to cumulative rates to the deeper depths. It is suggested that to substantially reduce seabird mortality compared with that associated with 60-g swivels and ~3.5-m leaders (the preferred option by industry) may require branch lines be configured with swivels ≥120 g ≤2 m from hooks. An alternative to the latter regime would be to place a smaller amount of weight at, or very close to the hook. The exact amount of weight would have to be determined experimentally.

(iii) EB-WP-07 (Effect of line shooter and mainline tension on the sink rates of pelagic longlines, and implications for seabird interactions)

433. D. Wilson also spoke about the "Effect of line shooter and mainline tension on the sink rates of pelagic longlines, and implications for seabird interactions" (WCPFC-SC6-2010/EB-WP-07).

i. The likelihood that seabirds will be hooked and drowned in longline fisheries increases when baited hooks sink slowly. Fishermen target different fishing depths by setting mainline through a line shooter that controls the tension (or slackness) in the line. An experiment was conducted in Australia's pelagic longline fishery to test the hypothesis of no difference in sink rates of baited hooks attached to mainline set under varying degrees of tension.

ii. Mainline was set in three configurations typically used in the fishery: a) surface set tight with no slackness astern; b) surface set loose with two seconds of slack astern and; c) deep set loose with seven seconds of slack astern. Sink rates of baited hooks were measured using time depth recorders.

iii. Tension on the mainline had a powerful effect on sink rates. Baited hooks on branch lines attached to tight mainlines reached 2 m depth nearly twice as fast as those on the two loose mainline tensions, averaging 5.8 s (0.35 m/s) compared with 9.9 s (0.20 m/s) and 11.0 s (0.18 m/s) for surface set loose and deep set loose tensions, respectively. The likely reason for the difference is propeller turbulence. The tight mainline entered the water aft of the area and was affected by turbulence, whereas the two loose mainlines and the clip ends of branch lines were set directly into it about 1 m astern of the vessel. The turbulence presumably slowed the sink rates of baited hooks at the other end of the branch lines.

iv. The results suggest that a mainline deployed with a line shooter (as in deep setting) into propeller turbulence at the vessel stern slows the sink rates of baited hooks, potentially increasing their availability to seabirds. Unless the mainline can be set to avoid propeller turbulence, the use of line shooters for deep setting should not be accepted as an effective deterrent to seabirds.

v. It is recommended that WCPFC revise CMM 2007-04 by deleting deep setting line shooter from the list of accepted seabird bycatch mitigation measures in Table 1 of that measure.

(iv) EB-IP-07 (Progress in development and testing of an underwater bait setter for pelagic longline fisheries)

434. D. Wilson spoke briefly to "Progress in development and testing of an underwater bait setter for pelagic longline fisheries" (WCPFC-SC6-2010/EB-IP-07). He noted that it has the potential to:

- eliminate mortality of surface-seizing seabirds (e.g. albatrosses);
- reduce or eliminate mortality of diving seabirds (e.g. petrels, shearwaters);
- eliminate bait loss to seabirds;
- allow fishing at any time of the day or night, potentially without tori line;
- remove the threat of seasonal closures;

- allow the use of line weighting options more acceptable to fishers;
- undertake tamper-resistant data gathering on secure digital (SD) cards; and
- reduce the need for observers to monitor mitigation measures.

435. Preliminary trials are encouraging, compared with those for hand setting. There is slightly improved bait retention, and similar setting speed. It is currently being tested in a bird "hot spot" in a pelagic longline fishery in Uruguay, with further work planned in Australia later in 2010 and early 2011. Australia will report on progress to SC7 in 2011.

Discussion

436. CCMs thanked scientists for their research on seabirds, including work on seabird interactions, hot spot identification and spatial risk assessment. It was noted that CCMs have slowly adapted the binding technical specifications of the seabird measure in their national policies and the operation of their fleets, both in areas with historical seabird interactions and other locations. They welcomed research and trials of existing or alternative seabird mitigation measures by CCMs, particularly those that illustrate decreases in interaction rates without impacts on or reductions in catches of target species. A discussion was held on various methods of line weighting, and their impact on the sink rate of live vs. dead bait and the potential impact on seabird interactions.

437. The importance of line-weighting research was acknowledged, and the need for additional research on the effectiveness of line shooters highlighted, in particular their effectiveness across different fisheries sectors. A discussion was held on the utility of deep-setting line shooters in reducing seabird interactions, with differing views expressed regarding their efficacy. It was noted that the deep-setting line shooters, in combination with weighted hooks, are very effective in the Hawaiian longline fishery, and that different situations may demand different remedies. Some CCMs suggested that a review of the way that line shooters are used may be needed by TCC. The potential burdens on fishermen, from the increase of observer coverage were noted, and the possibility that catch rates or fishing operations may be affected.

438. CCMs suggested consideration be given to monitoring and mitigating measures in relation to flag vessels, to ensure that those flag states that are likely to contribute the most to risk, are adequately monitored.

Recommendations

439. SC6 made the following recommendations.

i. SC6 noted that extensive research is currently underway, aimed at providing a scientific basis for additional changes to CMM 2007-04. SC6 agreed that minor proposed amendments to CMM 2007-04, as recommended by the SC, should not be incorporated into the CMM until such time as there are sufficient changes to warrant revision.

ii. *On the use of weighted branch lines:*
    a. SC6 agreed that line weighting of pelagic longlines is likely to be one of the most effective mitigation measures in reducing or eliminating seabird interactions with baited hooks, and that further research should be undertaken to refine "weighted branch lines" specifications contained in CMM 2007-04.

iii. *On the use of dead baits versus live bait:*

a. SC6 noted the findings in EB-WP-06, carried out in the southern hemisphere, that indicate the use of live bait in pelagic longline fisheries may increase seabird mortality above that associated with the use of dead bait, based on slower sink rates of live bait.
b. SC6 agreed that the use of live bait should be discouraged in fisheries operating in areas of high seabird abundance that do not already use live bait.
c. SC6 recommended that additional research be undertaken to confirm the findings presented in EB-WP-06, and to include different line weighting regimes, in areas north of 23°N and in areas south of 30°S, for consideration by SC. Seabird interaction rates for these experiments should also be reported.

iv. *On the use of blue-dyed bait:*

a. SC6 noted that recent research suggests that blue-dyed squid bait may be more likely to decrease seabird bycatch in pelagic longline fisheries than other blue-dyed baits such as fish.
b. SC6 recommended that additional research be carried out on the efficacy of blue-dyed squid bait over other blue-dyed baits, including during both setting and hauling, for consideration by SC.

v. *On the location of the southern latitudinal boundary:*

a. SC6 noted that the purpose of the productivity-susceptibility analysis in EB-IP-01 was to determine the probability of seabird-fisheries interactions and the risk of adverse effects of fishing-induced mortality on seabird populations. The results suggest that the southern boundary (30°S) of the seabird mitigation measure (CMM 2007-04) may need to be moved farther north to ensure adequate spatial protection for seabird high-risk areas.
b. SC6 recommended that SPC-OFP and ACAP provide advice on observer data and information on seabird distribution to the Secretariat, after which a decision could be made on whether to proceed with a formal new analysis of risk levels of longline fishing to seabirds in the southern hemisphere. Members with observer programmes in this area should collaborate with SPC to assist in improving data holdings for assessing risk levels of longline fishing to seabirds.

vi. *On the use of deep setting line shooter:*

a. SC6 noted the findings in EB-WP-07, carried out south of 25°S, which suggest that a mainline deployed with a line shooter (as in deep setting) into propeller turbulence at the vessel stern slows the sink rates of baited hooks.
b. SC6 recommended that testing of the deep setting line shooter be carried out north of 23°N, to determine its utility in mitigating seabird interactions and other at-risk species (e.g. marine turtles, marine mammals, sharks) in that area.
c. SC6 noted that there are currently no specifications for the use of deep setting line shooters in CMM 2007-04.
d. SC6 recommended that TCC consider the development of specifications for "deep setting line shooter", for inclusion in CMM 2007-04.

vii. *On the format of Table 1 in CMM 2007-04:*

a. SC6 noted that there are clear operational differences in longline fleets and seabird species composition in the areas north of 23°N and south of 30°S.
b. SC6 recommended that when CMM 2007-04 is next modified, TCC should consider the utility of separating Table 1 into two separate tables, one each for the area north of 23° N and the area south of 30°S.

8.1.3 Other species

a. EB-WP-03 (Evaluation of longline mitigation to reduce catches of North Pacific striped marlin in the Hawaii-based tuna fishery)

440. K. Bigelow presented "Evaluation of longline mitigation to reduce catches of North Pacific striped marlin in the Hawaii-based tuna fishery" (WCPFC-SC6-2010/EB-WP-03). Given the high estimated fishing mortality of the North Pacific's stock of striped marlin, the objectives of this study were to conduct analyses of potential longline catch reductions of North Pacific striped marlin while maintaining target bigeye tuna catches. The analysis was conducted on the Hawaii-based longline fishery and is well suited to analyses of longline mitigation because detailed operational and catch data have been gathered by the Pacific Islands Regional Observer Programme since 1994. Aspects of gear mitigation considered in the study were the efficacy of removing shallow hooks adjacent to longline floats and converting terminal gear from Japanese style tuna hooks to 18/0 circle hooks. A spatial and temporal analysis was conducted to investigate the existence of striped marlin catch rate (CPUE) hot spots. An evaluation of establishing tuna longline fishery closures was conducted with the trade-off between striped marlin catch reductions and loss of target bigeye catch. The largest longline catch reductions in terms of percentage occurred for striped marlin of 19%, 34%, and 47% by removing hooks #1, hooks #1−2 and hooks #1−3 adjacent to the float. Target bigeye catches declined 1.5%, 4.0% and 7.8% by removing similar hooks. Using large (18/0) circle hooks instead of tuna hooks had a larger effect on striped marlin catch rates (42% reduction) than removing shallow hooks. The spatial and temporal analysis did not identify any consistent areas of catch rate hot spots. The closure analysis did not identify areas of potentially high striped marlin reductions with minimal reductions of target bigeye catch as there is a co-occurrence in catch of both species.

Discussion

441. In response to inquiries, the presenter noted that all sets were deployed at 06:00 h, with a median depth of 250 m (bigeye fishery), and 60 m (swordfish fishery), with a branch line length of 15 m. Japan indicated that it recently developed a similar approach that seeks to place gear in deeper water throughout the set. A CMM asked if branch lines could be placed closer together to reduce time for line deployment, but the USA indicated that this would not be practical because the baiting process is already quite efficient.

AGENDA ITEM 9 — DATA AND STATISTICS THEME

442. K. Duckworth (New Zealand) convened the Data and Statistics theme. V. Jollands was selected as the rapporteur.

9.1 Data gaps

a. Progress in addressing data gaps

443. P. Williams (SPC) presented "Scientific data available to the Western and Central Pacific Fisheries Commission" (WCPFC-SC6-2010/ST-WP-01) and reported on the major developments over the past year with regard to filling data gaps**.** These included:

i) For Indonesia, the first annual catch estimates workshop was convened in March 2010 and produced annual catch estimates by gear and species for years 2000–2009. There was also continued progress with the implementation of their logbook data collection programme over the past year;

ii) For the Philippines, a WCPFC study investigating sources of bigeye catch estimates was conducted in late 2009. This study identified several issues that contributed to the revision of the national bigeye tuna catch estimate to a more realistic level;
iii) For Vietnam, the first tuna data collection workshop was held in March 2010 and resulted in a plan to establish logsheets and port sampling in longline fisheries immediately, extending to the other gear types (purse-seine and gill net) in 2011.

444. Another recent development relates to the WCPFC6 decision to add a paragraph in section 4 (aggregate catch/effort data) of "Scientific Data to be Provided to the Commission", to facilitate the generation of WCPFC public domain data: "CCMs are to provide, to the extent possible, the number of individual vessels per stratum and area covered by their operational data with the aggregated catch and effort data they submit to the Commission." Chinese Taipei was the only CCM with a distant-water longline fleet to have provided information on the number of individual vessels per stratum in their provisional 2010 submission of data (covering fishing activity for 2007, 2008 and 2009). However, their data submission had been filtered to remove cells representing the activities of fewer than four vessels. It was noted that the three-vessel rule only applies to the dissemination of public domain data, and not to submissions of data to WCPFC. Submissions of data should be complete (unfiltered) data.

445. Two new types of data were made available to WCPFC in the past year to assist verification and estimation of purse seine catches: i) Japanese purse-seine landings data for 2009, comprising weighed catch by species and size composition; and ii) ISSF requested their participating fishing companies to provide WCPFC with cannery receipt data, by vessel trip, species and size category on a quarterly basis.

446. The timeliness and quality of annual catch estimates and aggregate data were clearly better than last year (e.g. 92% of CCMs had provided annual catch estimates by the 30 April 2010 deadline compared with only 66% in 2009), but late submissions of some aggregate data delayed the stock assessments that were being prepared for SC6.

447. Substantial Regional Observer Programme (ROP) purse-seine data were collected during 2010 as a result of the CMM 2008-01 requirement for 100% observer coverage, but there were significant delays in the availability of ROP data to WCPFC, mainly due to the lack of resources to manage the submission of hard-copy data for processing and the lack of data entry staff.

448. SPC, as the designated WCPFC data-managing agency, continued to transmit the scientific data (annual catch estimates, aggregate and operational catch/effort data, size data and ROP data) to the WCPFC Secretariat on a regular basis (e.g. November 2009, April 2010 and July 2010).

Discussion

449. The full and timely submission of data was discussed. CCMs noted that full data submission is critical to the functioning of the Commission; both for science and compliance purposes. The working paper was noted to demonstrate the implications of the incomplete, late or inaccurate data that is currently being provided, and specifically the impact that this is having on the Commission's ability to produce timely and reliable stock assessments. It was indicated that the full provision of all agreed information, including operational level data, is fundamental to good stock assessment. It was also stated that the information in the paper and the tables available on WCPFC's website are useful in assessing compliance with data reporting obligations.

450. Recent positive developments in the provision of data to the Commission were acknowledged. For example, section 2 of ST-WP-01 describes recent developments from a range of CCMs including the Philippines, Indonesia and Vietnam with respect to the provision of vessel numbers. Participants

acknowledged the receipt of unloading data from Japan, the ISSF assistance in obtaining data from ISSF-affiliated fishing, and the announcement by the USA that it had amended its domestic regulations to facilitate the release of operational level data. CCMs thanked the SPC, and in particular P. Williams, for their ongoing work to resolve data gap issues.

451. In relation to data gaps identified in section 3.3 of ST-WP-01, ACAP noted that it has seabird data that may assist WCPFC with implementing the ecosystem approach to fisheries, and that such data could be provided under the MOU between itself and WCPFC.

Recommendation

452. SC6 recommended that SC6-ST-WP-01 be forwarded to TCC for its consideration.

b. Species Composition of Purse-Seine Catches

453. T. Lawson (SPC) presented "Update on the estimation of selectivity bias based on paired spill and grab samples collected by observers on purse seiners in the Western and Central Pacific Ocean" (ST-WP-02).

454. At SC5 (in 2009), Tim presented a working paper in which a method for estimating the size selectivity bias of grab samplers using paired spill and grab samples was developed and the bias was estimated from paired samples that were collected during four trips onboard PNG vessels in 2008. In a grab sample, five fish are selected by the observer from each brail. In a spill sample, 300 to 400 fish from every tenth brail are spilt into a bin and all fish in the bin are measured; the spill sample thus avoids any selectivity bias on the part of the observer. In the current paper, size selectivity bias was estimated using an additional 13 trips collected in 2009 and 2010, including 11 trips onboard PNG vessels and two trips on a USA vessel, for a total of 17 trips.

455. Size selectivity bias was estimated for 5 cm and 10 cm length intervals. The probability that a fish is selected by a grab sampler increases with increasing length; however, the estimates are less reliable for fish greater than 54 cm because of the relative lack of data covering larger fish. Size intervals for fish less than 35 cm and greater than 69 cm were combined because statistically significant estimates could not be achieved for separate size intervals in those size ranges, and also because of a relative lack of data.

456. Polynomial splines were also used to examine selectivity bias and indicated that for lengths less than about 75 cm, availability increases almost linearly with length, as when availability is estimated for each length interval individually. For lengths greater than about 80–90 cm, availability decreases. This suggests that grab sampler's under-select very large fish as well as very small fish; however, it should be noted that these results are based on a relatively small sample of large fish.

457. Estimates of the selectivity bias were used to correct grab samples taken from 27,999 sets from 1995 to 2009. The corrected grab samples were in turn used to adjust purse-seine catch data used in MFCL assessments. When MFCL data are adjusted, the proportion of skipjack drops from 77.2% to 68.4%, compared with unadjusted MFCL data, while the proportions of yellowfin and bigeye increase from 20.9% to 26.5% and 1.9% to 5.2%, respectively.

458. The collection and analysis of paired spill and grab samples is funded under the Commission's Project 60; a review of the project and plans for future work were also presented. Paired samples may take place onboard a Korean purse seiner in August 2010 and negotiations are underway to collect paired samples onboard another USA vessel and a Chinese Taipei vessel. It would be useful to collect paired

samples for vessels for which cannery receipts together with port samples of landing categories can also be obtained, so that the species compositions determined from each type of data can be compared.

Discussion

459. The figures within ST-WP-02 were discussed. A query was raised regarding Figure 7 in ST-WP-02 (species compositions for unadjusted and adjusted catch data used in MFCL analyses, 1972–2009, 20°S–20°N and 120°E–150°W) and clarification requested on the discrepancies between the proportion of skipjack and bigeye in Figure 7 compared with Figure 2 (estimates of purse-seine species composition determined from paired spill and grab samples collected by observers during seven trips in 2008–2009). The presenter indicated the proportion of bigeye in grab samples is generally greater than in spill samples; however, it was noted that the proportion of bigeye determined from the adjusted MFCL data was greater than from the unadjusted data. It was explained that the proportion of i) skipjack and (ii) yellowfin and bigeye combined, in the unadjusted data, were determined primarily from logsheet data and not grab samples; grab samples (not corrected for selectivity bias) are used only to determine the proportions of yellowfin and bigeye in the combined catch of yellowfin and bigeye. In contrast, the species composition of the adjusted data is determined entirely from grab samples that have been corrected for selectivity bias using spill samples, with no reference to logsheets. If MFCL data were adjusted entirely with grab samples that had not been corrected for selectivity bias, the proportion of bigeye would have increased even more.

460. The ability to reliably estimate catch composition was noted to be a critically important issue. It was observed that the negative impact on stock assessments of uncertainty in catch composition data had been previously discussed, and urgently needs to be addressed.

461. CCMs thanked SPC for the additional paired sampling undertaken since SC5, and for the updated paper. It was noted that the results of the larger sample size are broadly consistent with the data presented in 2009, and that this was encouraging. It was observed that this type of work needs to be increased significantly and resourced appropriately, and that insufficient information is available for SC to make a decision on how historic purse seine catch data should be corrected.

462. Participants observed that the methods used to correct the historic catch logsheet data are complex and poorly understood by most CCMs. It was requested that better information on the methods used to correct historic catch logsheet data be made available to Participants (including a flow diagram – Attachment I).

463. It was observed that the data presented by SPC in ST-WP-02 significantly assists in resolving issues regarding species composition. However, the difficulties inherent in using such limited data sets as the basis for significant fisheries management decisions were also noted. It was suggested that the information be expanded, with data collected from i) vessels flagged to all major CCMs; and ii) vessels fishing throughout the range of the fishery with an emphasis on covering all set types. It was also stated that the results of the paired sampling should be verified against other data such as unload monitoring, port sampling and cannery receipts. The importance was noted of ensuring that members understand not only the differences between the sampling methods, but also how they relate to actual catch composition.

464. FFA members stated they saw an urgent need for the paired sampling to be stepped up and supplemented with other data, and that this was a requirement of all Commission members.

(i) ST-WP-04 (Accuracy of species identification of yellowfin and bigeye in three canneries of Kingdom of Thailand)

465. H. Okamoto (Japan) introduced ST-WP-04 and reported on species identification of yellowfin and bigeye in three canneries in the Kingdom of Thailand. In the Convention Area and Indian Ocean, the catch of four tuna species (skipjack, yellowfin, bigeye and albacore) was over 3,400 thousand metric tonnes in 2008; of this approximately 750 thousand tonnes (22%) was landed in the Kingdom of Thailand. In April 2010 the accuracy of the yellowfin and bigeye identifications made by three canneries in the Kingdom of Thailand was investigated. In these canneries yellowfin and bigeye were sorted into five market categories according to their sizes (<1.4 kg, 1.4–1.8 kg, 1.8–3.4 kg, 3.4–9.0 kg and >9.0 kg) for each species. The study conducted species identification for 2,572 individuals from 25 market categories (only excluding the largest category of >9.0 kg), measured body lengths, weighed up to 20 individuals for each category, and then calculated the mixture rates of species (% of $\frac{bigeye\ (or\ yellowfin)}{bigeye+yellowfin}$) by market category and cannery (and in some cases by individual fishing vessels). For the smallest categories the mixture rates were found to be relatively high (12.6% on average by weight, but ranging from 0.0% to 21.7%) and to vary between factories. The mixture rates for the larger three categories were much lower (2.8% on average, and ranging from 0.0% to 6.8%). The estimated accuracy of the market reports generated by the canneries (corrected catch/market report) ranged from 98.7% to 113.3% for bigeye, and from 98.0% to 105.1% for yellowfin. The market reports from the three Thai canneries investigated seem to be reliable, although the accuracy is lower when there are more fish of the smallest category.

Discussion

466. The accuracy of species identification by the Thai canneries was noted, and Japan informed SC6 that it has established a data collection scheme with the Thai government. Members were encouraged to collect cannery and other landing data for their purse-seine vessels.

467. Research into species identification using canneries was discussed. One CCM noted its interest in seeing more sampling of this sort and for the research to continue (in particular with regard to the identification of small fish). SPC noted that the 6,000 tags that have been returned from Thai canneries could potentially be used to verify the accuracy of cannery identifications.

(ii) ST-WP-05 (Comparison of length frequency and species composition using observer and port sampling data) and ST-WP-07 (Size and species composition of the PNG purse seine catch)

468. T. Usu (PNG) presented two working papers: "A descriptive analysis of the size and species composition of the Papua New Guinea purse seine catch" (ST-WP-07) and "A preliminary comparison of length-frequency and species composition using observer and port sampling data" (ST-WP-05), and reported on size and species composition using observer and port sampling data.

469. Independent port sampling was conducted on catches landed or transhipped by purse–seine vessels and carriers in PNG from May 2009 to April 2010. The size of sampling reflected approximately 20% of the catch for the respective vessels sampled. The species composition was dominated by skipjack (71.3%), yellowfin (24.3%) and bigeye (1.7%), with other species making up the remaining 2.7%. Percentages of skipjack increased from the last quarter of 2009 through to 2010, from 52.7%–70.5% (low) to 71.3%–78.6% (high); while yellowfin decreased from 23.3%–42% (high) to 17.8%–24.6% (low). Interannual trends in length frequencies were observed for all the major tuna species (skipjack, yellowfin and bigeye) with a shifting of the modal and mean lengths indicating progressive changes in fish sizes. More rigorous analysis is needed to compare these results with previous studies and interannual variations

for management purposes. Other species were mainly made up of bullet tuna (62%), frigate tuna (22%), mackerel scad (7%), triggerfish (4%), rainbow runner (2%) and black triggerfish (1%); while the rest were below 1% composition. These non-target species should be the priority in future analysis.

470. PNG's National Fisheries Authority has been carrying out an independent port sampling study. Unlike other port sampling, the study protocol comprises sampling of all fish from wells stratified into three layers (top, middle and bottom). This is the first attempt to compare results of this port sampling with the results from other data sets. Eight vessels were initially sampled by observers using the grab-sampling technique and subsequently by port samplers. The results showed that port samplers were reporting a higher proportion of skipjack. Observer grab-sampling indicated higher compositions of large skipjack and yellowfin than port sampling; however there were no significant difference in the mean lengths for all species. Future work should involve analysis of other averages, higher and lower tails of the length distribution, and comparisons with more data sets and in particular observer spill-sampling data.

Discussion

471. Participants thanked the presenter for the working papers describing their port sampling programme, and noted similar studies carried out in the past by the USA and Japan. The results of the spill and grab sample research were broadly consistent with results obtained previously using smaller samples, but the need to undertake further research before drawing conclusions regarding the accuracy of spill sampling was stressed. CCMs were urged to make a commitment to increase species composition sampling, especially spill sampling, which was noted to be the most accurate of the alternatives.

472. There was a discussion of the pre-sorting of fish aboard fishing vessels, and how this can bias port sampling data. The presenter explained that PNG uses the port sampling data they collect in estimating bycatch and analyzing and managing the impact of FADs on small bigeye and yellowfin. The similarities in the results of the PNG port sampling and the spill sampling being undertaken by SPC were noted.

Recommendations

473. SC6 recommended that:

i) the current work (Project 60) on paired spill/grab experimental sampling should have continued funding and be extended to include fleets, areas and set types where no representative sampling has taken place. Where possible, the results of the paired sampling should be verified against cannery, unloading and port sampling data. A standard spill sampling methodology should be documented once the trials are complete;
ii) CCMs collect species and size composition data in cooperation with factories and canneries where catch is landed;
iii) a flow diagram, illustrating how sampling biases can affect species composition data, should be made available to participants. This should document the method used to correct historic logsheet data; and
iv) a follow-up workshop on species composition issues to the workshop held in Sete, France in June 2009 should be held, in collaboration with all relevant RFMOs.

c. Progress report on reconciliation of WCPFC and ISC data holdings

474. WCPFC's Science Manager presented the "Progress report on the reconciliation of WCPFC and ISC data holdings" (ST-WP-03), and noted that:

i) the WCPFC data inventory was provided to the ISC Statistics Working Group and ISC10;

ii) the recently recruited ISC data administrator will work on the recovery of historically missing data with relevant ISC members, and produce a more complete data inventory for review in the ISC Statistics Working Group in July 2011, which then will be provided to WCPFC; and
iii) two proposed options (establishing an memorandum of cooperation on data exchange or convening an annual consultative meeting) for the periodic exchange of data to address data gaps between WCPFC and ISC could be considered at SC6.

Discussion

475. A preliminary comparison table of WCPFC and ISC data holdings was provided to SPC, and a complete analysis of their respective data holdings will be provided to SC7.

476. FFA members noted their disappointment with the apparent continued reluctance of ISC members to share operational-level catch and effort data relevant to the assessment and management of WCPO stocks. Some ISC members noted that they had provided data for the North Pacific to WCPFC, and that SC5 recommended that the WCPFC 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. The advice presented to SC5 (that, in general, ISC does not hold fine scale data, but relies on each member to conduct analyses of its own data and subsequently contribute these analyses to collective stock assessments) was noted. It was commented that the process for reconciling the data held by the respective organisations that was previously agreed by the Commission was important; if followed, it would allow WCPFC to resolve the issue. All CCMs were strongly encouraged to actively participate, and the Secretariat was thanked for developing a draft agreement that would facilitate information sharing within the already agreed rules for data dissemination.

Recommendations

477. SC6:
i. acknowledged the progress made to date, but reiterated the decisions made by the Commission at WCPFC6 on the process of reconciling the different data held by the WCPFC and ISC; and
ii. requested the science services provider to provide specific tables that show provisions of operational level catch and effort data for the North Pacific region from all CCMs.

9.2 Regional Observer Programme

478. WCPFC's ROP Coordinator, K. Staisch, presented a report on the WCPFC ROP. He reported that audit procedures have been developed to meet Commission requirements for a full audit of all national observer programmes for certification prior to June 2012. Commission-approved data fields to be collected by ROP observers for scientific and monitoring purposes are now being collected by a number of national and subregional observer programmes. Commission CMMs are being monitored and have a direct influence on the mandate and duties of the observers when onboard vessels. Debriefing of observers is being upgraded in most Pacific observer landing ports. Monitoring fleets to ensure 100% purse-seine coverage between 20°N and 20°S continues to be an important role for the Secretariat.

479. A survey of Pacific Island national observer programmes in July 2010 indicates that 551 authorized observers are available for ROP trips. Programmes surveyed also indicated that approximately 90 debriefers across all programmes would be required.

480. It was noted by the ROP Coordinator that ROP data collected by national programmes on ROP trips should be available for analysis. However, the WCPFC Secretariat has not been able to receive data

in time from the data provider or the national programmes to be able to provide a report based on the ROP collected data for 2009 or 2010 to date. The ROP Coordinator urged all FFA and SPC members to give the data provider (SPC) permission to send ROP data collected by their observers to the Secretariat.

481. The ROP Coordinator reported on recent events, where murder charges were made against crew members of a purse-seine vessel, following the death of an observer while on duty. The safety and health of observers who are onboard vessels collecting often sensitive data have become a major concern to all programmes.

482. The ROP Coordinator noted that a more comprehensive report on data management costs, cross endorsement and other issues would be available for the TCC6 meeting.

Discussion

483. Concern was expressed regarding the safety of observers onboard fishing vessels. The ROP Coordinator and some CCMs noted that that ensuring safety was not the responsibility of the ROP, but rather of flag states. It was also highlighted that the issue should be treated seriously, but that the programme's large size meant some issues of this type were likely to occur over time.

484. The ROP Coordinator noted that national vessels within their own waters are not included in the ROP data.

485. CCMs who are members of PNA expressed their support for the report and commented on the 100% coverage on purse-seine vessels. They expressed their anticipation that 100% coverage will result in much better scientific data and the effective implementation of CMMs.

486. CCMs expressed their strong support for the ROP and their appreciation to those involved in setting it up. ST-WP-06 highlights some initial problems with the ROP, and in particular with regard to the absence of long-term arrangements for ROP data management. It was noted that at WCPFC6, the Commission decided that ROP data management should be carried out by SPC for one year. The longer-term option for ROP data management was still to be determined. It was noted that the role of the SC is to emphasize the importance of timely provision of observer data to support scientific analyses and verification of catch and effort data, and that many of the issues with the ROP are beyond the scope of SC, and should be considered by TCC.

487. SPC clarified that they were only partially funded to carry out ROP data entry. SPC also noted a new joint SPC and FFA initiative funded by the New Zealand Aid Programme, which aims at building capacity in national observer programmes, but does not cover data processing. SPC also stated that it believes the ROP data it holds remains the property of national observer programmes, and that it is not SPC's role to determine who this data should be released to.

488. The matter of cross-endorsement of WCPFC/IATTC observers was noted as being an issue of interest to FFA members. The WCPFC Secretariat has prepared a draft IATTC-WCPFC agreement on cross-endorsement, which is attached to ST-WP-06. It was noted that the late availability of this paper hampered review of the draft agreement. It was requested that any further work by the WCPFC Secretariat to progress this agreement be deferred until TCC6 has reviewed the draft proposal.

489. Japan commented on the efforts it has made toward achieving 5% observer coverage on longline vessels, and noted the difficulties encountered in acquiring observers. It stated that some countries have been unable to provide Japan with observers when these were requested.

490. It was highlighted that at EB-IP-05, the comparability of data on seabirds and IATTC data collection forms were discussed. It was suggested that bycatch data should also be collected on sea turtles, marine mammals, and sharks. It was highlighted that the IATTC data collection form is still in draft form and will be discussed at IATTC's December 2010 meeting. Concern was expressed that the ROP was in the process of being initiated, and that changes in the required data fields could confuse the situation. It was noted that Kobe II proposed a technical working group, including representatives from all tuna RFMOs, which would deal with issues of observer programmes. Participants decided that a draft recommendation on ROP collection of bycatch data should be transferred to the ecosystem and bycatch theme.

Recommendations

491. SC6:

i) noted the ROP matters raised in ST-WP-01 and ST-WP-06, and emphasised the importance of the timely provision of observer data to support the verification of catch and effort data and for undertaking the evaluation of fishing activities for stock assessment and bycatch mitigation purposes;
ii) encouraged the Commission to finalize the outstanding matters relating to ROP data management and ROP data provision as a matter of priority; and
iii) noted the lack of adequate funding support provided for data compilation and analysis in the current Commission budget and requested that this be addressed at WCPFC7.

9.3 West Pacific East Asia Oceanic Fisheries Management Project

492. SC6 agreed that because nearly all of the participants had attended the earlier meeting of the WPEAOFMP Steering Committee, there was no need for a further presentation or discussion on this agenda item. A record of the WPEAOFMP Steering Committee meeting is available as GP-WP-03.

Recommendations

493. SC6:

i) noted the WPEAOFMP Steering Committee report;
ii) noted the excellent progress achieved by the WPEAOFMP over the past 12 months; and
iii) indicated its continuing support for this project.

9.4 Tagging initiatives

494. SC6 agreed that because nearly all of the participants had attended the earlier meeting of the PTTP Steering Committee there was no need for a further presentation or discussion on this agenda item. A record of the PTTP Steering Committee meeting is available as GP-WP-05.

Recommendations

495. SC6:

i) noted the good progress achieved by PTTP over the past 12 months;
ii) endorsed PTTP's 2010–2011 work plan;
iii) noted and endorsed the tagging programmes underway or planned in Hawaii, the EPO, and the coastal and offshore areas off Japan, Korea, Indonesia, the Philippines and PNG; and
iv) encouraged the science services provider to undertake further analyses to integrate PTTP data into future stock assessments as soon as possible.

AGENDA ITEM 10 — COOPERATION WITH OTHER ORGANIZATIONS

10.1 Review of existing MOU and relations with other organizations

496. SC's Chair introduced a discussion of the existing MOUs between WCPFC and other organizations. He noted that:

i. WCPFC6 approved the memorandum of cooperation (MOC) on the "Exchange and Release of Data" with IATTC developed by the WCPFC Secretariat on the basis of Appendix 4 of WCPFC's Rules of Procedures for the Protection of, Access to, and Dissemination of Data compiled by the Commission; it was signed on 11 December 2009.
ii. An MOC with the North Pacific Anadromous Fisheries Commission (NPAFC) was sent to the WCPFC Chair for signature.

497. CCMs, on behalf of FFA members, provided comments on two of the current MOUs between WCPFC to other organizations. Regarding the MOU between WCPFC and SPC, they expressed satisfaction with the decision of the Commission at WCPFC6 in approving the three-year MOU. It was suggested that a longer-term budgetary commitment by the Commission would assist the organization with improved resource planning, and that this might be considered as a future as part of the MOU with SPC. Regarding the MOU between WCPFC and ISC, FFA members reaffirmed their position consistent with the Convention that SC is the primary provider of scientific advice to the Commission, for all stocks in the Convention Area under the competence of the WCPFC. Consistent with this, they indicated their desire that SC should be able to directly request advice from ISC on North Pacific stocks, particularly those species that are not northern stocks, and requested that ISC present full presentations, stock assessments and advice to SC. CCMs that are members of the ISC were urged to make data used in ISC stock assessments available to SPC-OFP for use in stock assessments.

498. The WCPFC Science Manager clarified that the Commission has a three-year contract with SPC that includes key elements over that three-year period; direction on specific activities and funds are provided on a yearly basis.

Recommendation

499. SC6 noted that the MOU with ISC will be reviewed at WCPFC7.

AGENDA ITEM 11 — CONSIDERATION OF THE SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

11.1 Special Requirements Fund

500. The WCPFC Science Manager noted that the balance of the Special Requirements Fund was approximately USD 160,000. He noted that members interested in applying for the Special Requirements Fund should refer to the guidelines on the website.

501. A statement was made on behalf of FFA members, including the 15 members that are small island developing states. It was noted that the inclusion of this item (Consideration of the Special Requirements of Developing States, pursuant to Part 8 of the Convention) is required by the WCPFC Rules of Procedure: specifically, Rule 2. At WCPFC6 the WCPFC Chair noted the suggestion by FFA members for a special agenda item for developed CCMs to report annually on initiatives to implement Article 30 of the Convention. FFA members proposed that during SC6, in addition to interventions from

Pacific Island countries, developed CCMs provide reports on implementation of Article 30, specifically in relation to the activities and work programme of SC.

502. The USA noted that it is making contributions that, although not directed to the special requirements funds, will support capacity building for Pacific Island members. Approximately USD 350,000 will be used for a number of projects, with a focus on a variety of activities, including observer support. The USA funded a recent ROP debriefing workshop in Cairns, Australia, and has supported attendance by Pacific Islanders at other meetings. All these activities support the work of the Commission, and assist with capacity building for Pacific Island members.

503. The Chair thanked the USA for its support on these matters, and specifically for support provided for the observer programme.

504. It was noted that that the current balance of the Special Requirements Fund is just over USD 163,000. Members of the SC expressed their appreciation for the support provided through the Special Requirements Fund, and acknowledged the contributions made by the USA and FSM. Members also welcomed the recent pledge of 30,000 to the Special Requirements Fund that Australia announced during the July Forum Joint Ministerial Meeting on MCS in Canberra, Australia.

505. Eleven projects were approved for the JTF in 2010, and most relate to database capacity building activities in Pacific Island countries and territories. Two of the 2010 projects were delivered through SPC, and provided support to regional activities of observer programme training standards and fisheries database development in Pacific Island countries. The JTF has also provided co-financing support to the WPEAOFMP in Indonesia, the Philippines and Vietnam, and to projects in individual Pacific Island countries. FFA members expressed their appreciation to Japan for financing science and database capacity building activities under the JTF since 2007. Pacific Island countries noted they would appreciate continuing assistance for fisheries database development and support. FFA members encouraged developed CCMs who did not contribute to the Special Requirements Fund, or otherwise contribute to capacity building activities in Pacific Island countries in the areas of science and data collection, to consider providing in-kind contributions to the Special Requirements Fund.

506. FFA members noted the value of the stock assessment workshops and national database training and support provided by SPC, noting that these workshops make a major contribution to the technical and scientific understanding of Pacific Island countries and territories, as well as database management. They stressed that, in addition to short-term training, members felt it was important to create opportunities for higher-level, longer-term academic training in the areas of stock assessment and science to ensure Pacific Islanders can fully participate in WCPFC scientific work. CCMs noted that the scope of the Special Requirements Fund and other capacity building funds could accommodate such training, but that the balance of these funds is insufficient. FFA members urged developed CCMs to consider supporting opportunities for long-term academic training in the areas of stock assessment and scientific analyses for Pacific Islanders, noting recommendation 23 from the Kobe workshop on Best Practices on the Provision of Scientific Advice calling for assistance funds covering various forms of capacity building, including training of technicians and scientists, scholarships and fellowships.

507. The Secretariat thanked CCMs for their expressions of appreciation to Japan and the USA for the support provided to them. It also noted that several indirect contributions to the work of the Commission by Australia, EU, France, Korea, New Zealand, PNG, Chinese Taipei, and others.

508. FSM, Nauru, Niue, Samoa and the Solomon Islands all expressed, on behalf of their governments, their appreciation for the JTF for funding the 2010 tuna data workshop and the SPC tuna stock assessment training workshop. These CCMs also expressed their appreciation for the assistance

received, many delivered with support from SPC under individual country project proposals which have been instrumental in capacity building and the development and enhancement of their science and database storage programmes and data collection protocols.

AGENDA ITEM 12 — FUTURE WORK PROGRAMME AND BUDGET

12.1 Strategic Research Plan of the Scientific Committee

509. The Strategic Research Plan (SRP) for 2007–2011 was reviewed in the margins of SC6 by an informal small group. D. Wilson presented the modifications proposed by the informal small group, and highlighted the current requirement in the SRP for an independent review every five years. It was noted that if an independent review were to be undertaken in 2011, terms of reference would need to be developed by SC. A discussion focused on whether a peer review of the SRP was required, and what would be gained by holding such a review at present. A decision was reached to modify the existing SRP to make external peer review optional. SC6 adopted modifications to the SRP (Attachment J). A new draft SRP for 2012–2016 will be developed at SC7 for consideration by the Commission.

Recommendation

510. SC6 recommended that the revised SRP for 2007–2011 be noted by the Commission, adding that the SRP was modified by SC6 so that there is no requirement for a mandatory external peer review every five years.

12.2 Review of the Scientific Committee work programme

511. SC6 noted that Project 39 and Project 56 were completed or will be completed in 2010.

12.3 Progress of 2010 work programme, 2011 work programme and budget, and 2012-2013 provisional work programme and indicative budget.

512. The WCPFC Science Manager presented a progress report on 2010 work programme activities.

- The continuation of Project 14 was supported with allocated funds of USD 25,000 used in the co-financing of the project.
- The report for Phase 1 of Project 35 will be submitted to the WCPFC7. The Phase 1 report and a proposal for Phase 2 will be considered at SC7.
- The second year progress report of Project 39 was presented and the contract for the third year will be finalized in late August. The budget for the final year's contract 2010–2011 was endorsed by WCPFC6.
- USD 10,000 was used to support the Review Workshop of the PTTP in February 2010.
- Project 56 funding was terminated in 2010, however, work relating to the project will continue and be reported to SC7.
- Tasks 1 and 4 under Project 57 will be put out to tender. Tasks 2 and 3 will be carried out by SPC. An allocation of USD 20,000 will be halved between SPC and the successful tender.
- The second year project report and progress report for Project 60 have been provided to SC6 by SPC.

513. SC6 noted that four projects were ongoing, with additional work items identified during SC6 for inclusion in the proposed 2011 work programme and budget. Project 60 was extended for additional work in 2011.

514. SC6 identified several high priority projects and recommended funding in 2011. These projects include:

- Collation of South Pacific striped marlin data for a planned stock assessment in 2012 (USD 30,000).
- Work on seabirds to continue the ERA analysis of areas of high seabird interactions (USD 10,000). This project is contingent on the Secretariat's advice arising from SPC's advice on seabirds.

515. SC6 agreed that the budget allocation for scientific services (SPC) for 2011 would be USD 720,000, including data services, stock assessments and the shark research programme. An additional USD 40,000 was proposed for SPC to complete the aforementioned projects on South Pacific striped marlin (30,000) and seabirds (10,000). SC6 recommended completion of four assessments, (three full and one updated) for SC7; therefore an additional allocation of USD 100,000 will be required for SPC. SC6 recommended a total budget for SPC of USD 860,000.

516. Unobligated budget will be used for the following additional high-priority projects via a tender process:

- Project 18: Determination of appropriate sample sizes for length-frequency sampling strategies
- Project 19: Identification and description of operational characteristics of the major WCPO fleets and identification of important technical parameters for data collection
- Project 31: Improve existing and explore alternative models for standardization of fishing catch and effort for construction of stock assessment indices
- Project 36: Study on age and growth of target tuna species
- Project 37: Analysis of FAD impacts on trophic dynamics
- Project 61: North Pacific striped marlin mitigation methods
- Management Objectives Workshop: noting that additional budgetary resources may be required if any preparatory consultancy work or independent international expert[s] are required to support the workshop (Project 58).

Recommendations

517. SC6 recommended that:

i. Project 35 (Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology) be allocated USD 31,000 for 2011.
ii. Project 60 (the collection and evaluation of purse-seine species composition data) be funded for 2011 with an allocation of USD 60,000.
iii. An additional USD 30,000 was proposed for SPC to complete the project on South Pacific striped marlin (identified in para. 514).
iv. An additional USD 10,000 was proposed for SPC to complete the project on seabirds (identified in para. 514).
v. An amount of USD 100,000 for scientific services to provide additional support to complete the three full assessments and one updated assessment. The undertaking of one of the full assessments is dependent on the completion of the yellowfin stock assessment peer review before WCPFC7. The SC budget submitted to WCPFC7 may be revised if the peer review is not completed by WCPFC7.
vi. Funding (USD 90,000) allocated for the Management Objectives Workshop, postponed from 2010 and to be held in 2011, be approved by the Commission to be reprogrammed in to the Commission's 2011 Part 1 budget.

Table 1. List of Scientific Committee work programme titles and budget for 2010, and indicative budget for 2012–2013, 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 / Project with priority	2011		2012		2013	
	Core	Other	Core	Other	Core	Other
Project 14. (Priority = High) West Pacific East Asia Project	25,000		25,000		25,000	
Project 35. (Priority = High) Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology	31,000		62,000		75,000	
Project 42. (Priority = High) Pacific-wide tagging project	10,000	2,500,000	10,000		10,000	
Project 57. (Priority = High) Identifying Provisional Limit Reference Points for the key target species in the WCPFC	20,000		20,000			
Project 60. (Priority = High) Collection and evaluation of purse-seine species composition data	60,000					
Striped marlin (priority = high)	30,000					
Seabirds (priority = high)	10,000					
SUB-TOTAL	186,000		117,000		110,000	
UNOBLIGATED BUDGET	60,000		110,000		121,000	
SPC-OFP BUDGET	720,000		792,000		871,200	
SPC-OFP Stock assessments	100,000[a]					
GRAND TOTAL	1,066,000		1,019,000		1,102,200	

[a] Relates to the additional costs of a third full stock assessment, noting that costs of two full stock assessments and one updated assessment is currently included in the SPC-OFP budget figure.

AGENDA ITEM 13 — ADMINISTRATIVE MATTERS

13.1 Rules of procedure

518. The Chair opened a discussion on proposals to alter the rules of procedure. None were proposed.

13.2 Peer review of stock assessments

519. A discussion was held on the need for peer review of stock assessments, and of a peer review of the bigeye assessment in particular. The peer review process for the 2010 WCPO bigeye assessment had been approved by SC5 (WCPFC6 Report para. 67). Reviewers could include CCMs or other RFMOs. WCPFC7 would adopt the peer review process and endorse the budgets. Once a peer reviewer is selected, they would examine the bigeye tuna 2010 assessment, and submit a report to the April Stock Assessment Preparatory Workshop (SAPW). The peer review report will be finalized after the 2011 bigeye assessment is prepared (June–July 2011), and then submitted to SC7, which would submit comments to WCPFC8. The WCPFC Science Manager noted the budget implications.

520. The USA noted that it had provided support for a peer review of the 2009 yellowfin tuna assessment, which would be provided to SC7. The USA further noted that it might also be able to support the 2010 bigeye assessment, and would be able to advise on this at WCPFC7. A query was raised whether there would be value in reviewing an ISC assessment model, which is quite different from that used by SPC. The ISC Chair clarified that its initial stock assessment review was examining procedures and functions, and that a second review would examine the actual stock assessment results.

521. CCMs noted their support for undertaking peer reviews of WCPFC stock assessments, while noting that there were a range of options for undertaking peer reviews, some of which would have budgetary implications. FFA members noted that the independent review of science structure and function had recommended the parallel review of a northern stock with the WCPO stock, and proposed that it was important that the same process of peer review for bigeye and yellowfin be undertaken for a northern stock during 2011. They suggested North Pacific albacore might be a suitable candidate for peer review.

Recommendations

522. SC6 recommended that:

i) the Commission allocate a budget to carry out the bigeye stock assessment peer review, if required;

ii) the Northern Committee consider allocating funds for peer review of a northern stock assessment. SC6 further noted that North Pacific albacore is a possible candidate for review of the stock assessment scheduled to be completed in 2011.

523. SC6 further noted that:

i) the USA is currently funding the review of the 2009 yellowfin tuna stock assessment. The SC thanked the USA for this initiative.

ii) the SC would undertake a consultation with IATTC for information with respect to the external review process for the stock assessments in the WCPFC, based upon the recently completed external review of the IATTC bigeye stock assessment; and

iii) the USA will investigate the possibility of providing financial support for the peer review of the 2010 bigeye stock assessment. This will be confirmed at WCPFC7.

13.3 Future operation of the Scientific Committee

a. Review of the structure and functions of the Scientific Committee meetings

524. R. Campbell reviewed the proposal for streamlining the structure of SC. He noted that SC5 considered several topics relating to improving the efficiency and effectiveness of the future SC operations, and that it was generally agreed that the revised structure incorporating themes (used for SC6) had proven more efficient than the former structure that included separate working groups. He then outlined options for further streamlining of the SC meeting, based on the review that was done for SC5.

Discussion

525. Several CCMs recommended ways in which the structure of the meetings could be further streamlined. Various proposals were discussed, most of which included scheduling meetings of the Biology, Methods and Fishing Technology themes on a biennial or triennial basis, with issues essential to the work of the SC incorporated in the Stock Assessment, Management Issues or other themes as appropriate. It was suggested that issues relevant to stock assessment could be raised at the annual SAPW meetings convened by SPC. The utility of the national reports presented at SC meetings was also discussed, and suggestions made to hold steering group meetings (e.g. for PTTP and WPEAOFMP) during an evening or weekend session. A proposal was put forward to expand the Management theme to include a discussion of economic issues, and strong support expressed for the importance of the Fishing Technology theme. Consideration was given to whether expanded SAPW meetings would be held under the auspices of the WCPFC or SPC, with funding provided for attendance by Pacific Island countries.

Recommendation

526. Following a discussion of the new meeting structure adopted at SC6, and after considering options for further improving the efficiency and effectiveness of the future operation of the SC, SC6 recommended that the Commission adopt the following structure for the meeting of SC7:

i) The meeting will meet over nine days (one day less than SC6). It is desirable that the days over which the meeting is to be held minimize the time required for attendees to fly to and from the meeting (i.e. avoid the need to fly on weekends).
ii) Together with the other usual non-theme agenda items (i.e. Agenda Items 1, 2, 10–15 at SC6) the meeting will include the following themes (duration in parentheses):
    a. Data and Statistics theme (3 sessions)
    b. Stock Assessment theme (10 sessions)
    c. Ecosystems and Bycatch theme (4 sessions)
    d. Management Issues theme (2 sessions)
iii) The Biology, Methods, and Fishing Technology themes are to be included in an expanded SC, which is to be held less frequently, as deemed necessary. To allow for the inclusion of these three additional themes, the duration of these SC meetings will be expanded by one or two days, as specified by the preceding SC. Convenors for these three themes will be identified at the SC meeting held the year before the expanded SC meeting. Scientists who would like to present their work during each theme are requested to contact the relevant convenor who will then decide on whether this work should be presented and discussed.
iv) Issues relating to Biology, Methods and Fishing Technology that are of relevance to the stock assessments to be undertaken that year, and which are to be considered by the SAPW, are to be included in this workshop. Because SPC is the convenor of SAPW, those scientists who would like to present their work to SAPW are requested to contact SPC who will then decide on whether this work should be presented and discussed.

v) Issues of significance in relation to stock assessment outcomes and/or the evaluation of CMMs, and which would have been covered by the Methods, Biology and Fishing Technology themes, are to be included in the Stock Assessment theme. These issues should be identified by SAPW and the convenor of the Stock Assessment theme in consultation with the SC Chair and Vice-Chair. To help facilitate the inclusion of such presentations the duration of the Stock Assessment theme has been expanded by one session.
vi) In recent years, special sessions relating to presentations and discussions of large projects of interest to SC (such as the session on the WPEAOFMP held during SC6) have been held on Saturday afternoons. This practice will continue. In the event that a second special session is required (as for PTTP during SC6) then this is to be held as an evening session on a suitably specified day.
vii) Sunday will continue to be a non-meeting day.

527. SC7 will review the performance of the above structure, and if required, recommend revisions to be applied to the future SC meetings.

b. Selection of officers

528. N. Miyabe was nominated by SC6 and recommended to the Commission to continue his service as SC Chair.

529. P. Dalzell was nominated by SC to continue his service as convener of the Ecosystem and Bycatch theme, with A. Batibasaga serving as co-convener; R. Campbell was nominated to serve as convener of the Management Issues theme; and P. Maru and V. Marsh were nominated as co-conveners for the Data and Statistics theme. The convener(s) for the Stock Assessment theme will be decided intersessionally.

c. Outstanding issues from the Independent Review

530. SC6 reviewed the paper GN-IP-03 "Issues to be addressed from the Independent Review of the Commission's Transitional Science Structure and Functions", which outlines outstanding issues to be addressed by SC. SC6's responses to the paper are in Attachment K.

531. In relation to this agenda item, GN-WP-04 "Stock Assessment Preparatory Workshop: Revised Terms of Reference" was considered. This paper is included as Attachment L for the Commission's consideration.

13.4 Next Meeting*

532. SC6 welcomed Palau's offer to host SC7, to be held in Koror, Palau, which is provisionally scheduled for 9–17 August 2011.

AGENDA ITEM 14 — OTHER MATTERS

533. No other matters were raised by SC6.

AGENDA ITEM 15 — ADOPTION OF THE REPORT OF THE SIXTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

534. SC6 adopted the Summary Report for the Sixth Regular Session of the Scientific Committee. 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 16 — CLOSE OF MEETING

535. The SC Chair thanked all participants for their contributions to the meeting, and in particular noted the efforts of theme conveners.

536. K. Sisior, the representative from Palau, expressed her country's pleasure at being able to host SC7, and extended a welcome to all participants in 2011.

537. WCPFC's Science Manager (Interim Executive Director) thanked all participants for making the meeting a success, and thanked the Government of Tonga for its financial and logistical support for the meeting. He acknowledged the efforts made by the staff of the Tonga Department of Fisheries, and several tokens of appreciation were presented to meeting participants.

538. S. Vailala, Head of Tonga's Department of Fisheries, thanked the Secretariat and expressed appreciation to all staff and participants who contributed to the meeting outcomes. Tokens of appreciation were presented to the SC Chair, SC Vice-Chair, and the Interim Executive Director.

539. A. Mobiha, the representative of PNG, spoke on behalf of all participants in thanking participants and theme conveners for their hard work. He also paid tribute to the welcome extended by the Government of Tonga, and for the efforts made by both the staff of the Tonga Department of Fisheries and of the WCPFC Secretariat.

540. The meeting closed at 19:10 on Thursday, 19 August 2010.

Attachment A

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

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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
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

OPENING STATEMENT
SC Chair

Deputy Prime Minister Dr Viliami Ta'u Tangi,
Minister for Agriculture, Food, Forest and Fisheries His Siren Highness (HSH) Prince Tu'ipelehake,
Head of Fisheries Dr Sione Vailala Matoto,
Distinguished officials representing the government and people of Tonga,
Representatives of Members, Cooperating Non-Members and Participating Territories of WCPFC,
Observers, and Ladies and Gentlemen:

On behalf of the Scientific Committee, I am honoured to present short opening remarks at the start of our sixth regular session of the Commission's Scientific Committee. As usual, this Committee will review Pacific tuna fisheries, stock assessment of bigeye and skipjack tuna, the effectiveness of bigeye and yellowfin measure, bycatch mitigation measures, special requirements of small island developing States and territories, and scientific research programmes.

WCPO tuna fisheries produced an annual catch of 2.5 million mt of skipjack, yellowfin, bigeye and albacore in 2009, which is the highest annual catch recorded. Among them, 77% of the catches were made by purse seine fishery, and skipjack catch is still increasing linearly, reaching 1.8 million mt in 2009. Because of high level of overfishing activities for bigeye stock, the Commission adopted a conservation and management measure for bigeye and yellowfin tuna in 2008. This measure requests 30% reduction of fishing mortality from the level of 2001-2004. However, it was pointed out that there were many exemptions from that measure and the Commission requested SC to evaluate the measure and re-assess bigeye tuna stock status. So this year, stock assessment of bigeye and skipjack tuna and evaluation of the bigeye measure will be highlighted.

Recommendations from the Independent Review of the Commission's transitional science structure and functions were provided by MRAG. One of the important issues was the re-structuring of the SC meetings. MRAG recommended dissolving some working group meetings so that more time can be allocated to stock assessment issues. In response to this recommendation, SC6 will attempt to implement a new structure including "Theme session". Though the contents are similar to those of Specialist Working Groups, but the whole committee meeting became a plenary and no production of independent working group reports. As you can see here, the Scientific Committee is definitely experiencing a transitional period.

This year so-called Kobe II process was implemented by the tRFMOs. In Barcelona, "Joint Tuna RFMOs Meeting of experts to share best practices on the provision of scientific advice" and "International

Workshop on improvement, harmonization and compatibility of monitoring, control and surveillance measures" were convened. Then, "Joint International Workshop on tuna RFMO management issues relating to by-catch and to call on RFMOs to avoid duplication of work on this issue", and "International Workshop on management of tuna fisheries" were held in Brisbane.

These Joint Tuna RFMO meeting produced a number of recommendations, and SC6 will consider scientific aspect of these outcomes and then provide recommendations to the Commission.

There will be many other issues but those I've mentioned above will be some of key issues for this year's session. I hope that the sixth session of the SC meeting in Tonga produces successful and fruitful outcomes. Thank you.

Attachment C

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

OPENNING ADDRESS AND WELCOME
by Dr VILIAMI TANGI, ACTING PRIME MINISTER and MINISTER FOR HEALTH

His Serene Highness, Prince Tu'ipelehake, Honourable Minister for Agriculture & Food, Forestry and Fisheries.
Excellencies and representatives of diplomatic communities
Members of Parliament
Interim Executive Director of the Western and Central Pacific Fisheries Commission, Dr. SungKwon Soh and staff of the WCPFC,
Chairman of the WCPFC Science Committee meeting,
Distinguished delegates representing Members and Cooperating Non-Members of the WCPFC,
FFA staff, SPC-OFP staff and Observers,
Members of the media,
Representatives of the Tuna Industry,
Ladies and Gentlemen.

On behalf of the Government of Tonga, I am deeply honoured to welcome you all to the Friendly Islands of Tonga. I am thankful, to the Almighty's Grace and safe deliverance of you all to the Sixth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. My salute to the organizers, to the sponsors, to the institutions and the national governments for all the concerted efforts contributed to your presence here at the Fa'onelua Convention Center this morning.
This meeting is about the science, scientific data and science base recommendations which will guide the oversight management of Tuna fishing in the Western and Central Pacific Ocean. Tonga is in full support of endeavors by coastal states to realize their development aspiration and associated benefits but also equitable distribution and share opportunities in this fishery. Therefore, there is a great need for us all to cement broader cooperation within the Commission and with our fisheries multilateral and bilateral partners in order to strongly adhere to the science base recommendations from this Scientific Committee.

The agenda for this meeting is ambitious as befits the tasks ahead of the Commission. I am aware that you, the scientists from the member countries and from the Commission's scientific consultants, who have worked tirelessly over the past year. Specifically, to enhance our understanding of these fisheries and fish stocks in order to make available the best scientific information, critical for conserving and managing these highly migratory species. Now is the time to bring all this information together to provide pragmatic advice to the Commission. I am proposing to you all to work in a spirit of consensus, which will be the basis for success for this meeting.

During your deliberation in the next two weeks, major issues relating to the conservation and management of tuna stocks in the Western and Central Pacific Ocean will be discussed. An area which

covers the EEZs of the Pacific Island nations, including Tonga, 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 considerations are necessary to implement our fishery today, most importantly, our role as parties to this Commission. With the growing global demand for fish, the economic benefits derive from fishery, impacts on climate change affecting fishery, increases in population growth and so forth are some of the key drivers to consider on the management of our fishery to ensure sustainability of the tuna stocks.
Tuna fishing in Tonga started in the late 70s and the beginning of 80s and we started to see significant improvement towards the late 90s and early part of 2000. Since then, the catch and fishing activities of Tuna fishery in Tonga had been declining towards the middle of 2000 and further decline to present day while the total Tuna catch in Western and Central Pacific Ocean increase to some high records in the last couple of years. Tonga may not be situated in the hot spot for Tuna but we do understand this is a highly migratory species. Therefore, there is a great need for good cooperation among coastal states and distant water fishing nations, in order to ensure equitable share of benefits from this important fisheries resources during our lifetimes. Lastly, it is our join responsibilities to ensure that the future generations are also able to enjoy the benefits as well.
Finally, although we like to think of Tonga as paradise, but be warned, Tonga is located on the South Pacific Cyclone Belt and also on the edge of the Tonga deep trench of the Australian plate. Fortunately, this is not the cyclone season but be reminded that we are always subject to the occasional natural calamity. Therefore, climate change is an important factor that I wish to remind everyone to be included in resources assessments and projections.

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 the culture and hospitality of Tonga. We sincerely hope that you would enjoy your stay here in Nuku'alofa. Having said so, I now have the pleasure on behalf of the Government of the Kingdom of Tonga to declare the Sixth Scientific Committee Meeting of the Western and Central Pacific Fisheries Commission open.
Thank you all.

Attachment D

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

AGENDA

WCPFC-SC6-2009/02

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 (WCPO) fisheries*
2.2 Overview of Eastern Pacific Ocean (EPO) fisheries
2.3 Annual Report (Part 1) from Members, Cooperating Non-Members, and Participating Territories (CCMs)
2.4 Reports from regional fisheries bodies and other organizations

AGENDA ITEM 3 FISH BIOLOGY THEME

3.1 Biological parameters*

AGENDA ITEM 4 FISHING TECHNOLOGY THEME

4.1 Small tuna on floating objects (STFO)*

AGENDA ITEM 5 METHODS THEME*

AGENDA ITEM 6 STOCK ASSESSMENT THEME

6.1 WCPO bigeye tuna
  a. Stock status and trends*
  b. Management Advice and Implications*
6.2 WCPO yellowfin tuna
  a. Stock status and trends*
  b. Management Advice and Implications*
6.3 Requests from CMM-2008-01
  a. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries*
  b. Review of CMM-2008-01*

6.4 WCPO skipjack tuna
   a. Stock status and trends*
   b. Management Advice and Implications*
6.5 South Pacific albacore
   a Stock status and trends*
   b. Management Advice and Implications*
6.6 South Pacific swordfish
   a. Stock status and trends*
   b. Management Advice and Implications*
   c. Requests from CMM-2009-03*
6.7 Southwest Pacific striped marlin
   a. Stock status and trends*
   b. Management Advice and Implications*
6.8 North Pacific striped marlin
   a. Stock status and trends*
   b. Management Advice and Implications*
6.9 Northern stocks
6.9.1 North Pacific albacore (CMM-2005-03)
   a. Stock status and trends*
   b. Management Advice and Implications*
6.9.2 Pacific bluefin tuna (CMM-2009-07)
   a. Stock status and trends*
   b. Management Advice and Implications*
6.9.3 North Pacific swordfish
   a. Stock status and trends*
   b. Management Advice and Implications*

AGENDA ITEM 7 MANAGEMENT ISSUES THEME*

AGENDA ITEM 8 ECOSYSTEM AND BYCATCH MITIGATION THEME

8.1 Fisheries impacts (Ecological Risk Assessment)
   a. Seabirds*
   b. Sharks*
   c. Sea turtles*

AGENDA ITEM 9 DATA AND STATISTICS THEME

9.1 Data gaps
   a. Data gaps and progress towards addressing gaps
   b. Species composition of purse-seine catches
   c. Data issues with the ISC
9.2 Regional Observer Programme (ROP)
9.3 West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP)
9.4 Tagging initiatives (PTTP)

AGENDA ITEM 10 COOPERATION WITH OTHER ORGANISATIONS

10.1 The status of cooperation and relations

AGENDA ITEM 11 CONSIDERATION OF THE SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

11.1 Special Requirements Fund
   a. Review of 2009/2010 activities
   b. Advice and recommendations to the Commission*

AGENDA ITEM 12 FUTURE WORK PROGRAM AND BUDGET

12.1 Strategic Research Plan of the Scientific Committee
12.2 Review of the Scientific Committee Work Programme
12.3 Progress of 2010 Work Programme, 2011 Work Programme and budget, and 2012-2013 provisional Work Programme and indicative budget*

AGENDA ITEM 13 ADMINISTRATIVE MATTERS

13.1 Rules of Procedure
13.2 Peer review of stock assessments*
13.3 Future operation of the Scientific Committee
   a. Review of the Structure and Functions of the Scientific Committee Meetings

13.4 Next meeting*

AGENDA ITEM 14 OTHER MATTERS

AGENDA ITEM 15 ADOPTION OF THE REPORT OF THE SIXTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

15.1 Adoption of the Summary Report and Executive Summary of the Sixth Regular Session of the Scientific Committee

AGENDA ITEM 16 CLOSE OF MEETING

Attachment E

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

THEME SESSION AGENDA

WCPFC-SC6-2010 /08
Rev. 4
5th August 2010

FISH BIOLOGY

1. Selection of rapporteurs

2. Review of new biological information and study on tunas in the WCPO

BI-WP-02 H. Ashida, T. Tanabe, K. Satoh, A. Fukui, S. Tanaka, N. Suzuki. Reproductive biology of male skipjack tuna *Katsuwonus pelamis (Linnaeus)* in the tropical Western and Central Pacific Ocean

3. Review of biological research projects under the convention

BI-WP-03 S. Nicol[1], K. Sisior[2], S. Retalmai[3], J. Farley[4]. Bigeye tuna age and reproductive biology – progress report.

BI-WP-01 J.Farley [1], A.Williams [2]. South Pacific Albacore age and reproductive biology – progress report.

4. Recommendation on research needs and projects

FISHING TECHNOLOGY

1. Selection of rapporteurs
2. Review of agenda
3. Review of information and related studies

3.1. Acoustic discrimination

a) FT WP-01: Application of broadband dolphin mimetic sonar for discriminating target fish species. H. Okamoto *et al*

Supporting documents (noted, not presented)

– *FT-IP-04: Technical options for the utilization of underwater video to characterize species, size composition and spatial distribution of tunas and bycatch species aggregating around floating objects. D. Itano.*

3.2. Behavioral studies of tuna on FADs

Supporting documents (noted, not presented)

– *FT-IP-01: Vertical Behavior and the Observation of FAD Effects on Tropical Tuna in the Warm-Pool of the Western Pacific Ocean. Leroy et al.*
– *FT-IP-04: Telemetry study on juvenile yellowfin tuna Thunnus albacares around a payao in the Philippines. R. Babaran et al.*

3.3. FAD and gear modifications to improve selectivity

a) FT WP-03: Analysis of the Catch Rate of Juvenile Bigeye Depending On the Depth of the Purse-seine Net Used by the Tropical Fleet. A. Delgado de Molina *et al. (noted, not presented)*

3.4. Technical solutions to bycatch mitigation

a) FT WP-02: Study on the methods to reduce the bycatch of juvenile bigeye tuna by purse seine operation on FADs in the western and central Pacific Ocean. S. Hasegawa *et al.*

b) FT WP-04: International Seafood Sustainability Foundation initiatives to develop and test bycatch mitigation options for tropical purse seine fisheries. V. Restrepo.

Supporting documents (not presented)

– *FT-IP-02: ISSF Meeting on mitigation of by-catches in the Tuna Purse seine Floating Object fisheries: Sukarrieta, Spain 24-27 November 2009. ISSF.*
– *FT-IP-03: Purse seine by-catch mitigation techniques. AZTI-Tecnalia.*

4. Work plan and future research

5. Recommendations from the SC and advice to the Commission

METHODS

1. Selection of rapporteurs

2. Adoption of agenda

The meeting will review the draft agenda and make changes as required.

3. Changes in MULTIFAN-CL

The meeting shall review the recent changes made to MULTIFAN-CL used for undertaking the principal stocks assessments in the WCPO.

ME-WP-01: Update of recent developments in MULTIFAN-CL and related software for stock assessment: N. Davies et al.

4. Developments in CPUE Analyses

The meeting shall review recent developments in the methods used to standardize catch-rates and development annual indices of stock abundance.

ME-WP-02 Application of the Tweedie distribution to zero-catch data in CPUE analysis: H. Shono

ME-WP-03 Confidence interval estimation of CPUE year trend in delta-type two step models: H. Shono

5. Future Research

6. Other Issues

7. Adoption of Report

STOCK ASSESSMENT

I. Selection of rapporteurs
II. Adoption of agenda
III. Adoption of structure of Stock Assessment Theme report
IV. Agenda item – 6. Stock Assessments

6.1 WCPO bigeye tuna

SA-WP-01	Background information for the 2010 bigeye assessment – S. Harley et al.
SA-WP-02	Analysis of Japanese longline operational catch and effort for bigeye – S. Hoyle et al.
SA-WP-03	CPUE standardization for bigeye and yellowfin tuna in the western and central Pacific Ocean – S. Hoyle
SA-WP-04	Stock assessment of bigeye tuna in the western and central Pacific Ocean – S. Harley et al.

6.2 WCPO yellowfin tuna
6.3 Requests from CMM-2008-01

SA-WP-05	Further analysis of CMM 2008-01

6.4 WCPO skipjack tuna

SA-WP-07	Recent status of Japanese skipjack fishery in the vicinity of Japan − K. Uosaki et al
SA-WP-09	Standardized CPUE for a skipjack caught by Japanese offshore pole and line fishery in the northern region of western and central Pacific Ocean – H. Kiyofuji et al.
SA-WP-08	A standardized CPUE analysis of the Japanese distant-water skipjack pole-and-line fishery in the western and central Pacific Ocean (WCPO), 1972-2009 − Adam Langley et al.
SA-WP-10	Stock assessment of skipjack tuna in the western and central Pacific Ocean – S. Hoyle et al.

6.5 South Pacific albacore
6.6 South Pacific swordfish
6.7 Southwest Pacific striped marlin
6.8 North Pacific striped marlin
6.9 Northern stocks
6.9.1 North Pacific albacore (CMM-2005-03)
6.9.2 Pacific bluefin tuna (CMM-2009-07)
6.9.3 North Pacific swordfish

Information Papers
SA–IP–01 – Report from the pre-assessment workshop in April 2010 – S. Harley and S. Hoyle

SA–IP–02 – Changes to the data available for stock assessment – P. Williams

V. Research and planning coordination
VI. Advice to the Commission
VII. Adoption of Report

MANAGEMENT ISSUES

1. Confirmation of convener and selection of rapporteurs
2. Adoption of agenda
The meeting will review the draft agenda and make changes as required.

3. Terms of Reference
The Convener will introduce the draft TOR of the Management Issues Theme and the Committee will refine the TOR. The TOR will open for any modification as necessary.

4. Consideration of Management Issues

(a) Limiting catches of Juvenile Bigeye

In considering potential management measures to address overfishing of bigeye tuna there has been interest in determining the spatial distribution of juvenile BET within the WCPO and the effectiveness of FAD closures. In order to further address these issues the SC with review and discuss the following two papers:

MI-WP-03 Charaterization of purse seine fishing activities during the 2009 FAD closure.
P. Williams and S. Harley.

ST-IP-02 Preliminary analysis of the spatial distribution of juvenile bigeye tuna catches from equatorial WCPO purse seine fisheries.
S. Harley and T. Lawson.

(b) Identification of Limit Reference Points (LRP) for the key target species in the WCPO

The Special Workshop on Reference Points held at SC5 made a number of recommendations to further progress this issue. The SC will review the outputs of this work, and following up the recommendation from SC5, make a recommendation to WCPFC7 on appropriate provisional Limit-Reference-Points, both types and associated values, for the key target species in the WCPFC.

MI-WP-01 Stochastic and deterministic projections: A framework to evaluate the potential impacts of limit reference points, including multi species considerations.
N. Davies and S.J. Harley.

5. Workshop on Management Objectives

At the Special Workshop on Reference Points held at SC5 it was recommended that the Commission hold a workshop on Management Objective. The purpose of the workshop was to: i) assist managers identify the information required to guide management decisions, and how these can be quantified, ii) provide guidance on identifying stock specific limit and target reference points; and iii) provide advice on how uncertainty in the estimation of performance indicators can be incorporated into management decisions. The 2010 budget approved at WCPFC6 included US$90,000 to support a Management Objectives Workshop.

The SC will consider the provision of scientific assistance to the preparation and convening of the Commission's workshop on Management Objectives that is scheduled for 2011. Issues to consider include timing, venue, lead agency and drafting of an agenda.

6. Review of Kobe II Workshop outcomes

The SC will also review the outputs of the Kobe II 'Workshop on the Provision of Scientific Advice' and 'Workshop on Tuna Management'

GN-WP-06 Joint tuna RFMOs workshops in 2010: Reports and recommendations.

7. Adoption of Report

ECOSYSTEM AND BYCATCH

1. Selection of rapporteurs
3. Adoption of agenda
4. Ecosystem effects of fishing

a. SEAPODYM applications in WCPO – progress report
b. Kobe II Workshop on Bycatch.

5. Sharks

a. A Proposal for a Research Plan to Determine the Status of the Key Shark Species.
b. Addition of porbeagle and hammerhead sharks to list of key species under CMM-009-04 (Conservation And Management Of Sharks)
c. Update of CMM-2009-04

6. Seabirds

a. Experimental comparison among four types tori-line designs in the western North Pacific
b. Options for differential management and monitoring of seabird bycatch.
c. Review of seabird bycatch mitigation measures for pelagic longline fishing
d. Experimental determinations of factors affecting the sink rates of baited hooks to minimize seabird mortality in pelagic longline fisheries.
e. Effect of line shooter and mainline tension on the sink rates of pelagic longlines and implications for seabird interactions.
g. Progress report on the development and testing of the underwater bait setter for pelagic longline fisheries.
h. Seabird spatial ecological risk assessment
i. Update of CMM-2007-04 (Conservation and management measure to mitigate the impact of fishing for highly migratory fish stocks on seabirds)

7. Sea Turtles

a. Review of CMM-2008-03 (Conservation and management of sea turtles)

8. Other Species

a. Evaluation of longline mitigation to reduce catches of North Pacific striped marlin in the Hawaii-based tuna fishery
b. Outcome on marine mammals from of Kobe II Bycatch Meeting
c. WCPFC Bycatch Mitigation Information System (BMIS)
d. Non-target secies interactions with the tuna fisheries of the Western and Central Pacific Ocean.

9. Future research plan
10. Detailed operational research plan for 2010/11 with budget
11. Work programme for 2010-2012 with indicative budget
12. Other matters
13. Adoption of Report

DATA AND STATISTICS

1. **Selection of rapporteurs**
2. **Adoption of agenda**
3. **Data gaps and progress towards addressing gaps**
4. **Species composition of purse-seine catches**
5. **Data issues with the ISC**
6. **Regional Observer Programme (ROP)**
7. **Other matters**
8. **Adoption of Report**

Attachment F

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

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*)
AV	average recruitment over the period 1998-2007 in the bigeye stock assessment
$B_{current}$	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-theme	Fish Biology theme 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
CN	China
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-theme	Ecosystems and Bycatch Mitigation theme 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	Food and Agriculture Organization of the United Nations
$F_{current}$	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
$F_{SSB\text{-}ATHL}$	fishing mortality that maintains spawning stock biomass (SSB) above the average level of its ten historically lowest points (ATHL)
FT-theme	Fishing Technology theme 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
ID	Indonesia
IOTC	Indian Ocean Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISSF	International Sustainable Seafood Foundation
IUCN	International Union for the Conservation of Nature
JTF	Japan Trust Fund
LL	longline
LL-ALL	all longline catch
LRP	limit reference point
m	meters
ME-theme	Methods theme group
MFCL	MULTIFAN-CL (a stock assessment modeling approach)
MH	Marshall Islands
MIMRA	Marshall Islands Marine Resources Authority
MOU	memorandum of understanding
MRAG	Marine Resource Assessment Group
MSE	management strategy evaluation
MSY or *MSY*	maximum sustainable yield
mt	metric tonnes
NFRDI	National Fisheries Research and Development Institute (Korea, Philippines)

NPAFC	North Pacific Anadromous Fisheries Commission
OS	Off shore
PFRP	Pelagic Fisheries Research Program (Hawaii, USA)
PH	Philippines
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
SA-theme	Stock Assessment theme group
SB or *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-theme	Data and Statistics theme group
TCC	Technical and Compliance Committee of the WCPFC
TW	Taiwan (Chinese Taipei)

Attachment G

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

LIST OF DOCUMENTS

WCPFC-SC6-2010/07 (Rev.6)
19 Aug 2010

MEETING INFORMATION

WCPFC-SC6-2010/01	Meeting notice and information
WCPFC-SC6-2010/02	Provisional agenda
WCPFC-SC6-2010/03	Provisional annotated agenda
WCPFC-SC6-2010/04	Indicative schedule
WCPFC-SC6-2010/05	Registration form
WCPFC-SC6-2010/06	Guidelines in submitting meeting papers
WCPFC-SC6-2010/07	List of documents. Rev. 6
WCPFC-SC6-2010/08	Provisional agenda for Theme Sessions. Rev.4
WCPFC-SC6-2010/09	Provisional agenda for head of delegation (HOD) meeting
WCPFC-SC6-2010/10	Provisional agenda and schedule of the Steering Committee [PTTP] Meeting
WCPFC-SC6-2010/11	Provisional agenda and schedule of the Steering Committee [WPEA] Meeting

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 – 2009. SPC and FFA**
GN-WP-2	**IATTC. Summary of the fishery and assessments of the major stocks of tuna exploited in the eastern Pacific Ocean.**
GN-WP-3	**Steering Committee [WPEA]. Report of the WPEA Steering Committee[12].**
GN-WP-4	**Stock Assessment Preparatory Workshop: Revised Terms of Reference**
GN-WP-5	**Steering Committee [PTTP]. Report of the PTTP Steering Committee[1].** Refer to GN-IP-15.
GN-WP-6	**Secretariat. Joint tuna RFMOs workshops in 2010: Reports and recommendations.**
GN-WP-7	**Draft work programme of the Scientific Committee for 2008-2010**

Information Papers

GN-IP-1	Secretariat. **Intersessional activities of the Scientific Committee**
GN-IP-2	Secretariat**. Progress report on the reconciliation of WCPFC and ISC data holdings** moved to ST-WP-03

[12] Will be available during SC6

GN-IP-3	Secretariat. **Issues to be addressed from Independent Review of Commission's Transitional Science Structure and Functions.**
GN-IP-4	S. Nicol *et al.* **Pacific Tuna Tagging Project progress report and work plan for 2010.**
GN-IP-5	S. Nicol *et al.* **PTTP work plan 2010-2011** Incorporated in GN-IP-04
GN-IP-6	A.Williams and S.Nicol. **South Pacific albacore tagging –progress report**
GN-IP-7	Secretariat. **Structure and future operations of the SC Meeting.**
GN-IP-8	ISC. **Report of the 10th meeting of the International Scientific Committee for tuna and tuna-like species in the North Pacific Ocean.**
GN-IP-9	**Strategic Research Plan 2007-2011.**
GN-IP-10	Secretariat. **Progress report on the West Pacific East Asia Fisheries Project. Rev.1**
GN-IP-11	Secretariat. **Western Pacific East Asia Fisheries Management Project Fund. Statement of income and expenditure and changes in the fund balance for the 2010 year as at 11 August 2010.**
GN-IP-12	**West Pacific East Asia Oceanic Fisheries Management Project. Department of Capture Fisheries and Resources Protection. Vietnam – First six month progress report.**
GN-IP-13	**Philippines WPEA progress report summary**
GN-IP-14	**First year work plan. Indonesia WPEA progress report, 2010.**
GN-IP-15	**PTTP report**

FISH BIOLOGY THEME

BI THEME Working Papers	
BI-WP-01	J.Farley, A.Williams, C.Davies, S.Nicol. **Regional study of South Pacific Albacore population biology: Year 2 – biological sampling and analysis.**
BI-WP-02	H. Ashida, T. Tanabe, N. Suzuki. **Assessment of male skipjack tuna spawning activity in the tropical Western and Central Pacific Ocean. Rev. 1**
BI-WP-03	S. Nicol et al. **Bigeye tuna age, growth and reproductive biology (Project 35) – progress report. Rev.1**
NO BI Information Papers	

ECOSYSTEM AND BYCATCH MITIGATION THEME

EB THEME Working Papers	
EB-WP-01	S.Clarke *et al.* **A research plan to determine the status of the key shark species.**
EB-WP-02	N.Sato et al. **Experimental Comparison among four types tori-line designs in the western north Pacific.**
EB-WP-03	K.Bigelow and B.Mourato. **Evaluation of longline mitigation to reduce catches of North Pacific striped marlin in the Hawaii-based tuna fishery.**
EB-WP-04	ACAP. **Review of seabird bycatch mitigation measures for pelagic longline fishing operations.**
EB-WP-05	ACAP. **Options for differential management and monitoring of seabird bycatch.**
EB-WP-06	G.Robertson *et al.* **Experimental determinations of factors affecting the sink rates of baited hooks to minimize seabird mortality in pelagic longline fisheries.**
EB-WP-07	G.Robertson *et al.* **Effect of line shooter and mainline tension on the sink rates of pelagic longlines and implications for seabird interactions.**
EB THEME Information Papers	
EB-IP-01	D.Filippi, S.Waugh, S. Nicol. **Revised spatial risk indicators for seabird interactions with longline fisheries in the western and central Pacific.**
EB-IP-02	P.Lehodey *et al.* **Project 62: SEAPODYM applications in WCPO - progress report. Rev.1**
EB-IP-03	Pacific Islands Regional Plan of Action for Sharks

EB-IP-04	Secretariat. **Seabird bycatch mitigation**
EB-IP-05	**Report on the Kobe II Workshop on Bycatch**
EB-IP-06	L.Fitzsimmons. **WCPFC Bycatch Information System (BMIS)**
EB-IP-07	G.Robertson and P.Ashworth. **Progress report on the development and testing of the underwater bait setter for pelagic longline fisheries.**
EB-IP-08	SPC-OFP. **Non-target species interactions with the tuna fisheries of the western and central Pacific Ocean**
EB-IP-09	E.F.Melvin, T.J.Guy and L.B.Read. **Shrink and defend: A comparison of two streamer line designs in the 2009 South Africa tuna fishery.**
EB-IP-10	V. Allain. **Trophic structure of the pelagic ecosystems of the western and central Pacific Ocean**
EB-IP-11	Z.G. Kim et al. **Summary report of the Korean tuna fishery observer program for the WCPFC Convention Area in 2009. Rev.1**

FISHING TECHNOLOGY THEME

	FT THEME Working Papers
FT-WP-01	H.Okamoto et al. **Application of broadband dolphin mimetic sonar for discriminating target fish species.**
FT-WP-02	S. Hasegawa et al. **Study on the methods to reduce the bycatch of juvenile bigeye tuna by purse seine operation on FADs in the western and central Pacific Ocean.**
FT-WP-03	A. Delgado de Molina et al. **Analysis of the catch rate of juvenile bigeye depending on the depth of the purse-seine net used by the tropical fleet.**
FT-WP-04	V. Restrpo. **International seafood sustainability foundation initiatives to develop and test bycatch mitigation options for tropical purse seine fisheries.**
	FT THEME Information Papers
FT-IP-01	B. Leroy et al. **Vertical behavior and the Observation of FAD effects on tropical tuna in the warm-pool of the western Pacific Ocean.**
FT-IP-02	International Seafood Sustainability Foundation. **ISSF meeting on mitigation of by-catches in the tuna purse seine floating object fisheries: Sukarrieta, Spain 24-27 November 2009.**
FT-IP-03	AZTI-Tecnalia. **Purse seine by-catch mitigation techniques.**
FT-IP-04	D.G. Itano. **Technical options for the utilization of underwater video to characterize species, size composition and spatial distribution of tuna and bycatch species.**
FT-IP-05	R. Babaran et al. **Telemetry study on juvenile yellowfin *Thunnus albacores* around a payao in the Phillipines.**
FT-IP-06	B. Kumasi, T. Usu, L. Baje, L. Kumoru. **Preliminary analysis of length frequency for FAD associated catch in the archipelagic waters of Papua New Guinea from port sampling data.**

MANAGEMENT ISSUES THEME

	MI THEME Working Papers
MI-WP-01	N. Davies, S.J. Harley. **Stochastic and deterministic projections: A framework to evaluate the potential impacts of limit reference points, including multi-species considerations.**
MI-WP-02	R. Campbell. **Identifying possible limit reference points for the key target species in the WCPFC.** Moved to MI-IP-01
MI-WP-03	P.Williams and S.Harley. **Characterization of purse seine fishing activities during the 2009 FAD closure.**
	MI THEME Information Papers
MI-WP-01	R. Campbell. **Identifying possible limit reference points for the key target species in**

	the WCPFC.

METHODS THEME

ME THEME Working Papers	
ME-WP-01	N.Davies *et al.* **Update of recent developments in MULTIFAN-CL and related software for stock assessment.**
ME-WP-02	H. Shono. **Application of the Tweedie distribution to zero-catch data in CPUE analysis.**
ME-WP-03	H. Shono. **Confidence interval estimation of CPUE year trend in delta-type two-step model.**
No ME THEME Information Papers	

DATA AND STATISTICS THEME

ST Theme Working Papers	
ST-WP-01	P.Williams. **Scientific data available to the Western and Central Pacific Fisheries Commission. Rev. 3.**
ST-WP-02	T.Lawson. **An update on the species composition of purse-seine catches determined from paired spill and grab samples collected by observers.**
ST-WP-03	Secretariat. **Progress report on the reconciliation of WCPFC and ISC data holdings**
ST-WP-04	K.Satoh et al. **Accuracy of species identification of yellowfin and bigeye in three canneries of Kingdom of Thailand**
ST-WP-05	L. Baje, T. Usu, B. Kumasi, L. Kumoru. **A preliminary comparison of length frequency and species composition using observer and port sampling data.**
ST-WP-06	Secretariat. **Regional Observer Programme**
ST-WP-07	T. Usu, L. Baje, B. Kumasi, L. Kumoru. **A descriptive analysis of the size and species composition of the Papua New Guinea purse seine catch.**
ST Theme Information Papers	
ST-IP-01	P.Williams. **Estimates of annual catches in the WCPFC Statistical Area.**
ST-IP-02	S.J. Harley and T. Lawson. **Preliminary analysis of the spatial distribution of juvenile bigeye tuna catches from equatorial WCPO purse seine fisheries**
ST-IP-03	S.Harley and P.Williams. **Further analysis of the set-time issue** Withdrawn
ST-IP-04	T. Lawson. **Effect of unit of effort on analyses of observer coverage rates**

STOCK ASSESSMENT THEME

SA Theme Working Papers	
SA-WP-01	S.Harley *et al*. **Background information for the 2010 bigeye assessment.**
SA-WP-02	S.Hoyle *et al*. **Analysis of Japanese longline operational catch and effort for bigeye tuna in the WCPO.**
SA-WP-03	S.Hoyle. **CPUE Standardization for bigeye and yellowfin tuna in the western and central Pacific Ocean.**
SA-WP-04	S.Harley *et al*. **Stock assessment of bigeye tuna in the western and central Pacific Ocean.**
SA-WP-05	J.Hampton, S.J. Harley. **Further analysis of CMM 2008-01.**
SA-WP-06	P.Williams and S.Harley. **Characterization of purse seine fishing activities during the 2009 FAD closure. Rev.1.** Moved to MI-WP-03
SA-WP-07	K. Uosaki et al. **Recent status of Japanese skipjack fishery in the vicinity of Japan.**
SA-WP-08	A.Langley *et al.* **A standardized CPUE analysis of the Japanese distant-water skipjack pole-and-line fishery in the western and central Pacific Ocean (WCPO), 1972-2009.**

SA-WP-09	H. Kiyofuji et al. **Stardardized CPUE for skipjack caught by Japanese offshore pole and line fishery in the northern region of western and central Pacific Ocean.**
SA-WP-10	S.Hoyle *et al.* **Stock assessment of skipjack tuna in the western and central Pacific Ocean.**
SA Theme Information Papers	
SA-IP-01	S.Harley and S.Hoyle. **Report from the pre-assessment workshop in April 2010.**
SA-IP-02	P.Williams. **Changes to the data available for stock assessment.**

ANNUAL REPORT – PART 1

Symbol	CCMs
AR-CCM-01	**Australia** Rev.1
AR-CCM-02	**Canada**
AR-CCM-03	**China**
AR-CCM-04	**Cook Islands**
AR-CCM-05	**European Union**
AR-CCM-06	**Federated States of Micronesia**
AR-CCM-07	**Fiji**
AR-CCM-08	**French Polynesia**
AR-CCM-09	**Japan** Rev.1
AR-CCM-10	**Kiribati**
AR-CCM-11	**Korea** Rev.1
AR-CCM-12	**Marshall Islands**
AR-CCM-13	**Nauru**
AR-CCM-14	**New Caledonia**
AR-CCM-15	**New Zealand**
AR-CCM-18	**Papua New Guinea**
AR-CCM-19	**Philippines**
AR-CCM-20	**Samoa**
AR-CCM-21	**Solomon Islands**
AR-CCM-22	**Chinese Taipei**
AR-CCM-23	**Tokelau**
AR-CCM-24	**Tonga**
AR-CCM-25	**Tuvalu**
AR-CCM-26	**United States of America**
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AR-CNM-29	**Belize**
AR-CNM-31	**El Salvador**
AR-CNM-32	**Indonesia**
AR-CNM-35	**Vietnam**

NGO and Others

SC6-Greenpeace	**Urgent cuts and area closures needed to preserve tuna stocks and protect biodiversity.** Rev.1

KOROR DECLARATION

COMMITTING PARTIES TO THE NAURU AGREEMENT TO JOINT EFFORTS TO INCREASE THE ECONOMIC VALUE AND DERIVE GREATER BENEFITS FROM THE TUNA RESOURCE

Leaders from the Federated States of Micronesia, Republic of Kiribati, Republic of the Marshall Islands, Republic of Nauru, Republic of Palau, Independent State of Papua New Guinea, Solomon Islands and Tuvalu met in Koror, Palau, on 25 February, 2010.

LEADERS,

Taking into account the Nauru Agreement concerning cooperation in the Management of Fisheries of Common Interest and the First, Second, and Third Implementing Arrangements setting forth additional measures to implement the Nauru Agreement;

Noting the Federated States of Micronesia Arrangement for Regional Access and the Palau Arrangement for the Management of the Western and Central Pacific Purse Seine Fishery;

Recalling the *Bikenibeu Declaration on Securing Greater Value from their Common Fisheries Wealth* adopted by Fisheries Ministers done at Tarawa on 22 October 2009 calling for the adoption of additional conservation and management measures;

Reaffirming support for the PNA Office established in Majuro, Marshall Islands, on 1 January 2010;

Reiterating the commercial aspirations of the Parties through the PNA Office;

Acknowledging the importance of regional co-operation as underlined in the Vava'u Declaration and reaffirming the Parties' support for co-operative regional fisheries management through the Pacific Forum Leaders Summit, Pacific Islands Forum Fisheries Agency, Secretariat of the Pacific Community, and the Western and Central Pacific Fisheries Commission;

Mindful of the healthy state of skipjack tuna and its ability to support further sustainable growth and development of the fishery;

Expressing concern about the state of bigeye and yellowfin tuna and the increasing growth of capacity and effort in the region;

Desiring to maximize economic gains from the tuna fisheries through the adoption of effective conservation and management measures and exertion of greater control of the fisheries for the Pacific Islands;

Noting that for many of the Parties, the tuna resource represents the primary source of achieving greater economic self-sufficiency;

Further noting that the prospects of enhancing economic growth for many of the Parties depend to a large degree on the sustainability of their common tuna resource;

Recognizing that economic gains may be maximized through the development of additional arrangements that control output and limit effort to create scarcity and increase the value of the tuna resources;

HAVE AGREED:

1. To effectively conserve and restore highly migratory stocks while maximizing economic returns and explore suitable arrangements for the Parties to control output and limit effort;

2. To promote the greater commercial utilization of the tuna resources for the benefit of the Parties, and towards this end, the "Vessel Day Scheme" as adopted for purse seine vessels is hereby confirmed;

3. To close off additional high seas areas between 10^0N and 20^0S and 170^0E and 140^0W in the Western and Central Pacific by prohibiting purse seine vessels licensed by the Parties from operating in such waters;

4. To initiate management practices that will enhance commercial and economic opportunities for the Parties through optimum utilization of the tuna fishery; and

5. To proceed with the full assessment for certification of the skipjack fishery to increase the value of the tuna resource.

Done at Koror, Republic of Palau, this 25th day of February 2010

His Excellency Emanuel Mori
President
Federated States of Micronesia

His Excellency Anote Tong
President
Republic of Kiribati

His Excellency Marcus Stephen
President
Republic of Nauru

His Excellency Johnson Toribiong
President
Republic of Palau

Honorable Dr. Derek Sikua
Prime Minister
Solomon Islands

Honorable Apisai Ielemia
Prime Minister
Tuvalu

Honorable Mattlan Zackhras
Minister for Resources & Development
Republic of the Marshall Islands

Honorable Ben Semri
Minister for Fisheries
Independent State of Papua New Guinea

Attachment I

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

Flowchart of the use of logsheets, annual catch estimates and sampling data

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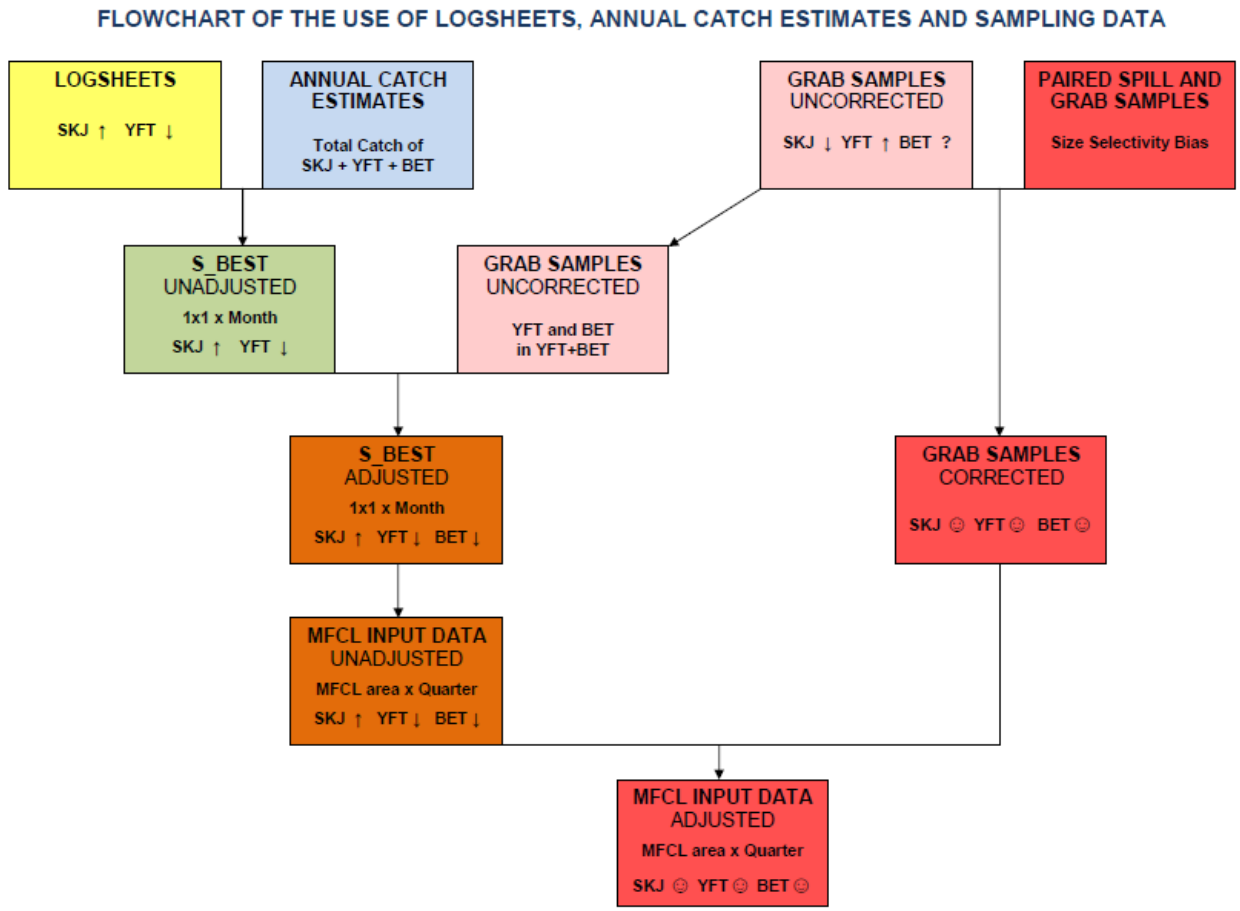

Attachment J

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

STRATEGIC RESEARCH PLAN 2007–2011
Revised at SC6

INTRODUCTION

The Convention and the Commission

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC) was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention). The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.

The Commission is tasked with developing and adopting specific measures to promote these objectives, as detailed in Articles 5 and 6 of the Convention. Fundamental duties of the Commission necessary to promote conservation, sustainability and optimal utilization that are supported by science-based information include:

- assessing the impact of fishing on marine resources and the western and central Pacific Ocean (WCPO) ecosystem;
- protecting biodiversity and promoting ecosystem based approaches to management;
- minimizing waste, pollution and impacts on both target and non-target or associated or dependent species (NTADs);
- preventing or eliminating overfishing and excess fishing capacity;
- promoting the collection, compilation and dissemination of complete and accurate fisheries data and information from national and international research programmes.

To implement and enforce these goals, the Commission is required to utilize the best scientific evidence available. This evidence must be incorporated into a fishery management regime consistent with the principles of the precautionary approach and in consideration of target species, NTADs, environmental factors and habitats of special concern.

The Scientific Committee

Article 11 of the Convention establishes a Scientific Committee, the functions of which are described in Article 12. They include reviewing the results of research, analysis and status assessments of target stocks or NTADs in the Convention Area and to assist development and assess information resulting from a regional observer programme.[13]

The Convention requires that the Scientific Committee recommend a research plan to the Commission[14]. The Strategic Research Plan[15] described here has been prepared in response to this requirement. The Plan will be complemented by rolling work plans, reviewed and amended annually as appropriate by the Scientific Committee.

This Strategic Research Plan is intended to serve an initial period of five years from 2007. As there will be an ongoing need for an adaptive research plan to support the Scientific Committee's objective of providing the best available scientific advice, the Plan will be periodically reviewed to ensure it remains responsive to the Commission's needs.

RESEARCH PRIORITIES

The Commission has four overall research and data collection priorities:

- Monitoring of fishing activities through the collection, compilation and validation of data from the fishery
- Monitoring and assessment of stocks
- Monitoring and assessment of the ecosystem
- Evaluation of existing CMMs and potential management options

Monitoring of fishing activities through the collection, compilation and verification of data from the fishery

Data from the fishery are required to monitor catch and effort, and are an essential input to stock assessment. Increases in data quality and coverage will enable more accurate estimates of catches and are key to reducing uncertainty in stock assessments. Data are also required for tracking fleet dynamics and monitoring changes in the fisheries. A critical role of the Scientific Committee is to promote the collection and compilation of all necessary data and to assist in increasing data accuracy and coverage. Research activities include:

- estimating total fishing effort which includes incremental increases in effective effort, catches and related mortalities of target and non-target species, stratified, as appropriate, by area, time, species or stock, size, sex and other characteristics;

[13] Including work undertaken by scientific experts engaged by the Commission under Article 13, and for the observer programme, in conjunction with the Technical and Compliance Committee.
[14] Article 12(2)(a).
[15] for the period 2006 to 2011

- monitoring the accuracy and coverage of operational-level catch and effort data, aggregated catch and effort data, and size composition data compiled by the Commission, and developing programmes to improve accuracy and coverage and to address data gaps that are identified;

- developing programmes for the collection and compilation of related fisheries data, such as gear and vessel attributes, and other information, that can be used to standardize fishing effort and estimate fishing capacity and changes in effective fishing effort;

- rescuing historical fisheries data and related metadata useful for stock assessment and effort standardization;

- developing draft standards for the collection of operational catch and effort data, port sampling data, observer data and other types of data, as required, including minimum standards for data collection forms;

- developing sampling designs, including sampling protocols, for the collection of these data through observer and port sampling programmes; and

- developing programmes to assist Members and Cooperating Non-members in meeting data-related Convention obligations.

Monitoring and assessment of stocks

Stock assessment and modeling are the primary scientific tools used to estimate the condition of fish stocks and to evaluate the efficacy of conservation measures. Structural uncertainty in stock assessment derives, in part, from inaccurate or incomplete data from the fishery, mistaken assumptions about underlying biological processes, and an incomplete understanding of fishing gear and vessels operations. Addressing uncertainties in stock assessment is a useful guide to assigning priorities to components of the scientific programme.

Stock assessment and modeling
Research activities directly supporting stock assessments include:

- Routine application of existing methods;

- Characterisation of statistical and structural uncertainty in stock assessments;

- Improvement of existing methods and development of new methods;

- Identification and refinement of biological reference points for use in stock status determination;

- Use of simulation models to evaluate the sensitivity of stock assessment tools to violation of specific assumptions about biological processes (e. g. the dependency of natural mortality on age); and

- Improvement of data inputs to stock assessment models, in particular analyses to standardize fishing effort or catch-per-unit-effort to provide reliable indices of abundance.

Biological studies

Understanding of key biological processes and the identification and definition of regional variability in these processes in an area as large as the WCPO is required to underpin stock assessments of target species and selected NTADs. Enhanced understanding of these processes will reduce "structural" uncertainty and possible bias in stock assessments. Required studies include:

- age and growth of pre- and post-recruit segments of the population;
- reproductive parameters and capacity;
- length, weight and sex composition in response to environmental and anthropogenic factors;
- characterisation of stock structure;
- movement and migration;
- behavior and habitat utilisation;
- recruitment variability and the environmental influences thereon; and
- tagging studies.

Tagging is an important tool for biological and behavioral studies of fish and has special importance in the assessment highly migratory fish stocks (HMS). Stock assessments for other types of fish (e. g. small pelagic and demersal species), benefit greatly from "fishery independent" survey data, which provide information on population size independent of data from the commercial fishery. Such survey data can potentially reduce the bias and uncertainty in the stock assessments. Unfortunately, routine scientific survey methods are not applicable to HMS because of the large geographical scales and resultant costs. Tagging studies on all scales are the closest approximation to fishery independent data currently available to support WCPFC management activities. Tagging studies provide information on rates and direction of movement, mortality, habitat utilization, aggregation and vulnerability, all of which are directly used in the stock assessments. Tagging activities include:

- mass tagging with conventional tags to determine large-scale population movement and mortality rates;
- specialized deployment of data storage tags, both conventional archival tags and pop-up satellite tags, to better define horizontal and vertical habitat preferences;
- deployment of other types of electronic tags to determines small-scale movements or residence times in relation to natural features and floating objects, such as seamounts and fish aggregating devices; and
- implementation of comprehensive tag recovery procedures, and studies (e.g. tag seeding) to estimate the rates of reporting of recaptured tags.

Monitoring and assessment of the ecosystem

The ecosystem approach to fisheries requires managers to consider more than the impact of the fishery on single target stocks. Additional considerations include assessing the impact of environmental variability on target stocks, and assessing the impact of the fishery on other species including prey, competitors, species caught in association with the target species (NTAD or non-target, associated and dependent species), and on habitat. Research activities include:

- undertaking regular ecological risk assessments (using Productivity-Susceptibility Analysis or other approaches), to identify priorities for enhanced monitoring, biological research, stock assessment and management intervention;

- establishing ecosystem indicators to monitor the effects of fishing, other anthropogenic effects and natural variability on ecosystem structure, function and biodiversity;

- identifying habitats of special concern, and the fishery impacts, other anthropogenic impacts and the effects of environmental variability thereon;

- estimating maximum aggregate yield of all species that can be safely removed from the ecosystem without disrupting ecosystem structure and function;

- identifying oceanographic features, processes and fishing practices that influence the distribution and abundance of fish stocks and their vulnerability to fishing gear;

- investigating trophic relationships (food webs, aggregation, maturity, spawning, ecological modeling, predator/prey relationships, depredation, etc.);

- synthesising data and ideas across disciplines into ecosystem-based models; and

- conducting bycatch mitigation research including technical options to minimise bycatch and discards.

Evaluation of existing CMMs and potential management options

The impacts of existing CMMs and potential management measures on target stocks, NTADs and the ecosystem as a whole (including socioeconomic impacts) should be considered by the Commission where possible before the implementation of such measures. In particular, insights into the robustness and effectiveness of management measures in achieving the objectives of the Commission, and the associated trade-offs across these objectives, under uncertainty in our current understanding of population and ecosystem dynamics can be obtained from computer simulations. Such simulations may range in complexity from simple projections or equilibrium yield analyses incorporated into single species stock assessment models to complex multi-species management strategy evaluation (MSE) models, in which the stock, fleet and ecosystem dynamics, fishing impacts, data collection, stock assessment, management response and management implementation are modeled as a single integrated system. The research required to develop an MSE framework for the WCPO convention area includes:

- Development of an appropriately structured multi-species operational model that incorporates, inter alia, the effects of oceanographic variability;

- Development of behavioral models of fleet dynamics, including bio-economic models which integrate resource and fleet dynamics;

- Quantification of management objectives and the development of biological, social and economic performance indicators against which the achievement of management objectives can be assessed;

- Development of candidate feedback decision-rules for updating management measures in response to assessment outcomes;

- Characterisation of uncertainty in the evaluation of management measures;

- Development of computer software, or adaptation of existing software, to integrate the above models with modules simulating data generation, assessment, management response and implementation.

IMPLEMENTATION AND REVIEW

Monitoring the implementation of this Strategic Research Plan will be the responsibility of the Chair of the Scientific Committee in collaboration with the Executive Director. Members of the Commission, including Cooperating Non-members, participating territories, observers, scientific experts and the Secretariat will share responsibility for implementation of the Plan. Opportunities to take responsibility for activities supporting implementation of components of the Plan will be considered at each meeting of the Scientific Committee.

At each regular session of the Scientific Committee each Theme (including Statistics, Fishing Technology, Methods, Biology, Stock Assessment and Ecosystems and Bycatch) will review the elements of the Plan relevant to their respective terms of reference and will develop operational work programmes consistent with the Plan. Coordination of the review and work programme development will rest with the Chair of the Scientific Committee in consultation with convenors of the Theme Groups, the manager of the Scientific Services Provider and the Executive Director.

Opportunities to involve individuals and institutions from developing countries and territories should be a strong feature of the implementation of the Plan. Promoting such involvement should be aimed at both utilising available expertise from developing countries and territories, and at providing important opportunities for building scientific and technical capacity within those countries and territories.

Full implementation of the Strategic Research Plan will likely be beyond the means of the Commission's core budget. Extra-budgetary funds from voluntary contributions of Members and other sources will be required and actively sought by the Commission. Nevertheless, adoption of the Plan by the Scientific Committee and subsequent strong support from the Commission is a prerequisite to securing the necessary extra-budgetary funds.

An independent external review of the Plan may periodically be requested by the SC. The Scientific Committee will be responsible for preparing the terms of reference for the review. The Scientific Committee will present the report of the review to the next regular session of the Commission.

RELATIONS WITH OTHER ORGANIZATIONS

Article 22 of the Convention provides that the Commission will consult, cooperate and collaborate with other relevant organizations, particularly those with related objectives and which can contribute to the attainment of the objective of the Convention. In relation to this Plan, relationships with the following institutions are of particular significance.

Technical and Compliance Committee

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Technical and Compliance Committee is consulted on any element of the Plan directly relevant to the functions of the Technical and Compliance Committee.

The Executive Director will provide the Technical and Compliance Committee with copies of reports of the Scientific Committee relating to implementation and review of the Plan.

This commitment will be reflected in the memorandum of understanding (MOU) developed between the Scientific Committee and the Technical and Compliance Committee.

International Committee for Scientific Research on Tuna and Tuna-like Species in the North Pacific

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the International Committee for Scientific Research on Tuna and Tuna-like Species in the North Pacific (ISC) is informed of relevant elements of the Plan that may have a bearing on the research conducted by the ISC.

This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding developed between the Commission and the ISC.

The ISC will be invited to participate in each regular session of the Scientific Committee.

Inter-American Tropical Tuna Commission

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Director of the Inter-American Tropical Tuna Commission (IATTC) is informed of any element of the Plan directly relevant to the functions of IATTC.

This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding between the Commission and the IATTC. The MOU provides for collaboration with respect to the collection and sharing of data and information, subject to data sharing protocols of each organization, the development and implementation of joint research initiatives and the harmonization of conservation and management measures.

The IATTC will be invited to participate in each regular session of the Scientific Committee.

Secretariat of the Pacific Community – Oceanic Fisheries Programme

As the provider of scientific services, provided for under Article 14 of the Convention, the Secretariat of the Pacific Community – Oceanic Fisheries Programme (SPC-OFP), will have a pivotal role in the Scientific Committee's monitoring, review and periodic refinement of the Plan.

SPC-OFP is a standing member of the Scientific Committee and, as scientific expert to the Commission has the capacity to report directly to the Commission n science matters.

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that SPC-OFP is consulted a regular intervals between regular sessions of the Scientific Committee on progress with implementation of the Plan. An MOU between the Commission and SPC-OFP reflects these arrangements.

Indian Ocean Tuna Commission

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Director of the Indian Ocean Tuna Commission (IOTC) is informed of any element of the Plan directly relevant to the functions of the IOTC. Strong similarities exist between the fisheries and fishery management concerns and objectives of each regional fisheries management organization (RFMO). Implementation of research plans by both organizations will benefit from open and transparent communication in many areas, including research related to purse seine and longline fisheries, data collection and verification, illegal, unregulated and unreported (IUU) fleets, capacity and vessel registries. The geographic areas of concern to each party overlap in Southeast Asia, further reinforcing the need for collaboration. Tuna tagging programmes are active within both Commission areas, which will test the ability of both organizations to organize a single, coherent tag recovery and reward system in cooperation with coastal states and distant water fishing nations. Due to the fact that frozen tagged tuna will move between ocean basins for processing, some formal link and communication bridge between RFMOs and their research plans would be desirable.

Food and Agriculture Organization

The Commission's Rules of Procedures provide for the participation of FAO in the meetings of the Commission and its subsidiary bodies. In relation to the Scientific Committee and this Research Plan potential areas for collaboration include the Coordinating Working Party on Fishery Statistics (CWP, www.cwpnet.org) and the Fishery Resources Monitoring System (FIRMS) which is part of the FAO Fisheries Global Information System (FIGIS, a network of integrated fisheries information). FIRMS draws together a unified partnership of international organizations, regional fishery bodies and, in the future, national scientific institutes, collaborating within formal agreement to report and share information on fisheries resources. For effective fisheries information management, FIRMS also participates in the development and promotion of agreed standards.

Attachment K

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

Scientific Committee
Sixth Regular Session

Nuku'alofa, Tonga
10–19 August 2010

SC6 Response to outstanding issues from the Independent Review of the Commission's Transitional Science Structure and Functions

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Prepared by the Secretariat

Introduction

1. The paper WCPFC-SC5-2009/GN-WP-08 was considered at SC5 identifying summary issues from the *Final Report on Independent Review of the Commission's Transitional Science Structure and Functions* (WCPFC-SC5-2009/GN-WP-07) produced by Marine Resources Assessment Group (UK). The Scientific Committee's response to the issues raised in the paper was recorded as Attachment Q of the SC5 Summary Report.

2. WCPFC6 endorsed SC5's recommendation on paragraph 404 ("*SC5 recommended that issues from Attachment Q that require further discussion be raised with WCPFC and its subsidiary bodies at subsequent meetings*"). The table below lists the issues for further consideration.

Recommended Item	Response from SC5	Options for review at SC6	SC6 Response
I. Data Custodianship			
5) Incorporation of ISC data into the WCPFC holdings	5) Will be addressed	5) WCPFC data inventory was developed and delivered to ISC10. SC6 will consider results of the ISC10 on issues related with data exchange and data gaps between the two organizations. A draft mechanism for the periodic exchange of data to address gaps in the data for North Pacific stocks will be discussed and refined at ISC10 and SC6 (refer to **WCPFC-SC6-2010/ GN-IP-02**).	5) Addressed under SC6 agenda item 9.1.c

II. Science Structure and Functions			
5.a) Implement periodic external peer review process	5.a) partially addressed and adopted	5. a) WCPFC6 agreed that the 2010 BET assessment should be the target of the peer review exercise. The results of this exercise to be reported to WCPFC no later than WCPFC8 (WCPFC6, para.67). SC6 will further consider and refine Section 10.2 of the SC5 Summary Report including budget implications. SC6 may review a summary table of the Section 10.2 above (**Attachment 1**)	5. a) Addressed under SC6 agenda item 13.2.
6.b) To support robust science within the ISC i. Additional review by the SC and external peer review	6.b) i. Not addressed	6.b) to be discussed at SC6 i. SC6 will further consider the need of external peer review for the ISC's stock assessment with its budget implications if needed.	6. b) Addressed under SC6 agenda item 10.1.
ii. For transparency, promote wider participation in ISC's assessment activities, and sufficient funding	ii. Not addressed	ii. ISC meetings are open to experts from the WCPFC-SC. SC may consider any budget implications related to this participation.	
iii. SC and NC, with funding support, request ISC of validation work on key ISC assessments	iii. Not addressed		
7.b) Specialist working groups and related processes i. Strengthening Stock Assessment Preparatory Workshop (SAPW) by the WCPFC taking ownership of that activity with appropriate funding support	7.b) i. Generally support SAPW, strongly support to remain as an informal meeting, including relevant biological and methodological papers. SPC	7.b) This will be discussed at SC6. The current terms of reference for the SAPW is attached (**WCPFC-SC6-2010/ GN-WP-04**)	7.b) Addressed under SC6 agenda item 13.3.

	will facilitate the workshop.		
ii. Incorporate the BI-SWG and ME-SWG into SAPW	ii. Incorporate relevant biology and methods papers 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	iii. Revisit at SC6		iii. Slight amendment made to the final paragraph of the SAPW TOR, to be further considered by WCPFC7. Attached in SC6 Summary Report as H.
iv. Identify risks and seek solutions to address such risks when SAPW is expanded	iv. Inclusion of presentations within the SC of significant issues as identified in the SAPW		
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	v. Funding considerations		
III. Implementation 8) Implementation of the recommendations a. Develop a work plan for the implementation of these recommendations			No work plan required as all matters have been addressed.

Attachment L

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

Scientific Committee
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Nuku'alofa, Tonga
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Stock Assessment Preparatory Workshop
Revised Terms of Reference

Terms of Reference

On an annual basis, this workshop will be convened between February and April hosted by the SPC-OFP. The terms of reference will be reviewed and refined if necessary at SC6. The current TOR is annexed below:

Draft Terms of Reference

- Revisit the previous assessment and any concerns, suggestions and/or recommendations raised by the Scientific Committee, the Commission, individual CCMs, or any independent reviews of assessments, or.
- Reviews preliminary work relating to the assessment:
    - Proposed updates to biological parameters
    - Data revisions and other important data inputs
    - Proposed changes to structural assumptions in the model
    - Other methodological issues, e.g. characterization of uncertainty
    - Standardized CPUE analysis
    - Incorporation of tagging data or other auxiliary data
- Provides recommendations to the Service Provider on:
    - The suitability of proposed changes
    - a minimum set model runs to be undertaken, in particular the range of key sensitivity analyses
    - Desired model diagnostics
    - Alternative modeling approaches that could be considered

Due to the timing of the meeting, any model runs are based on previous assessment data sets, and therefore no preliminary stock assessment runs are undertaken.

The outcomes of the meeting will be documented and the report of the meeting will be distributed to workshop participants within 10 days of the meeting and revised and provided to WCPFC Scientific Committee members 30 days after the meeting. It will also be submitted to the next Scientific Committee as a Working Paper. Many of the matters discussed to the workshop will be the subject of meeting papers to the Scientific Committee.

The workshop will occur prior to the submission of data and completion of supporting analyses (e.g. CPUE analyses). Therefore in any instances where the stock assessment scientists deem that major changes to either data, biological parameters, of model structure is warranted, and such changes have not previously been reviewed and approved by the SC or discussed at the Pre-assessment Workshop, model runs based on both the previous and new assumption / data should be undertaken and made available to the SC. Further, supporting documentation should be provided to the SC via working papers to allow the SC to determine the merits of any proposed changes.

In instances where many changes are proposed, it is recognized that it may not be possible or feasible to undertake all auxiliary analysis (e.g. inclusion of model diagnostics, evaluation of management options, and likelihood profile analysis) for all potential model runs prior to the SC meeting and that such a requirement will increase the workload for the stock assessment scientists and increase the size of the assessment reports.

The consultation will be convened by the Commission's Scientific Services Provider in Noumea, New Caledonia or elsewhere by prior agreement.

The consultation will be open to participation by all CCMs and to other experts, by invitation. Delegates from CCMs will be expected to fund their participation. Although consistent with normal Commission practice, an allocation to cover the participation of invited delegates from SIDS and participating territories shall be included in the Commission budget. This allocation for SIDS and participating territory participants will be reviewed regularly. Additional support for delegates from SIDS and participating territories may also be sought from the Commission's Special Requirements Fund or other sources, as appropriate.

Attachment M

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

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JOINT TUNA RFMOS WORKSHOPS IN 2010: RESPONSE TO RECOMMENDATIONS

Summary of SC responses to Kobe II Recommendations

There were four Kobe II meetings in 2010, two in Barcelona in May and June on Science and MCS issues with two more in Brisbane in late July to discuss By-Catch and Management Issues. The Secretariat compiled the recommendations from these workshops in GN-WP-06 and they were discussed by a small working group of SC6. Although only some of the MCS and Management issues were not directly within the work scope of SC6, the Committee was requested to provide comments where it was appropriate. The small working group developed the attached matrix for approval by SC6 with inputs from interested parties and all convenors of thematic sessions.

In general, there was general agreement in principle or full agreement, with most of the recommendations, noting that in several cases WCPFC was already working in line with the recommendations and was working with the tuna RFMOs to achieve greater solidarity and cooperation in the management of the tuna and tuna-like stocks consistent with regional parameters and sensitivities. In a few cases, the interpretation of the wording of the recommendation was not consistent amongst all Members so the Chair of the SC has been asked to clarify the intent of the wording and recommendation for further response by SC.

It is recommended that SC forward their responses to the WCPC7 via TCC6 for further additions in the MCS and Management areas for consideration and direction for future work priorities. Finally, the SC6 recommends that the Secretariat continue its work and prepare a progress report for Kobe III.

1. INTRODUCTION

In accordance with the decision of the second joint tuna RFMOs in San Sebastian, the following four workshops were convened in 2010:

a) Meeting of experts to share best practices on the provision of scientific advice (Barcelona, Spain, May 31 to June 2, 2010);
b) International workshop on improvement, harmonization and compatibility of monitoring, control and surveillance measures, including monitoring catches from catching vessels to markets (Barcelona Spain - June 3 to 5, 2010);
c) International workshop on tuna RFMO management of issues relating to bycatch and to call on RFMOs to avoid duplication of work on this issue (Brisbane, Australia, June 23-25, 2010); and
d) International workshop on RFMO management of tuna fisheries (Brisbane, Australia – 29 June to 1 July, 2010).

All workshop reports can be found at http://www.tuna-org.org/meetings2010.htm by following the relevant links. Recommendations produced from workshops a), c) and d) above, are tabled below, with proposed actions for consideration by the Scientific Committee. SC6 (including each theme session) may provide its responses to the recommendations in each cell in the second column below. The populated tables from SC6 will be delivered to TCC6, and all compiled information will be provided to the Commission.

a) Workshop on the provision of scientific advice

Recommendations	Response	Comments
Routine data collected by year: Catch, effort and size data		
1. All members of Tuna-RFMOs are called upon to give a top priority to the provision of data of good quality in a timely manner, according to the existing mandatory data requirements of tuna RFMOs, in order to facilitate the work of tuna RFMOs scientific bodies in the provision of scientific advice based on the most recent information.	Agreed	Implement the rules and procedures for data provision by CCMs and investigate methods to enforce these provisions.
2. Lags in the submission of fishery data should be reduced making a full use of communication technologies (e.g. web based) and efforts should be undertaken that basic data formats are harmonized.	Agreed	
3. Efforts should be undertaken so that basic data used in stock assessment (catch, effort and sizes by flag and time/area strata) provided by members should be made available via the websites of tuna RFMOs or by other means.	Agreed	The release of non-public domain date must be in accordance with WCPFC Rules Posting of data must adhere to rules of the WCPFC
4. Fine scale operational data should be made available in a timely manner to support stock assessment work, and confidentiality concerns should be addressed through RFMOs rules and procedures for access protection and security of data.	Agreed	We support the provision of operational data from all fleets
5. Tuna RFMOs should ensure adequate sampling for catch, effort and size composition across all fleets and especially distant water longliners for which this information is becoming limited.	Agreed	
6. Tuna RFMOs should cooperate to improve the quality of data, in particular for methods to estimate: (1) species and size composition of tunas caught by purse seiners and by artisanal fisheries and (2)	Agreed	

catch and size of farmed tunas.		
7. Tuna RFMOs should use alternative sources of data, notably observer and cannery data, to both validate the information routinely reported by Parties and estimate catches from non-reporting fleets.	Agreed	
Biological data		
8. Regular large scale tagging programs should be developed, along with appropriate reporting systems, to estimate natural mortality growth and movement patterns by sex, and other fundamental parameters for stock assessments.	Agreed	The WCPFC has recently made progress to achieving this, PTTP is a large scale programme recently completed and supported by the Members In lieu of large scale programmes, there is considerable utility in supporting small scale tag release programmes that are integrated with the analyses of other programmes.
9. Archival tagging should be an ongoing activity of tagging programs as it provides additional insights into tuna behavior and vulnerability.	Agreed	WCPFC supports the utilization of all electronic tagging technologies
10. Spatial aspects of assessment should be encouraged within all tuna RFMOs in order to substantiate spatial management measures.	Agreed	
11. The use of high-resolution spatial ecosystem modeling frameworks should be encouraged in all tuna RFMOs since they offer the opportunity to better integrate biological features of tuna stocks and their environment.	Agreed	
Stock assessment		
12. Tuna RFMOs should promote peer reviews of their stock assessment works.	Agreed	
13. Tuna RFMOs should use more than one stock assessment model and avoid the use of assumption-rich models in data-poor situations.	Agreed	WCPFC have utilized more than one model in some instances Where time and resources are available
14. Chairs of Scientific Committees should jointly develop checklists and minimum standards for stock assessments.		Request SC Chair to seek clarification of the text.
Communication by tuna RFMOs		
15. Standardized executive summaries should be developed for consideration by all tuna	Agreed	Develop a draft template for discussion at KOBE III

RFMOs to summarize stock status and management recommendations. These summaries should be discussed and proposed by the chairs of the Scientific Committees at Kobe III.		
16. The application of the Kobe II strategy matrix should be expanded and applied primarily to stocks for which sufficient information is available.	Agreed	See Attachment A for Kobe II strategy matrix Some progress already, the methodology by SPC in Mi-WP-01 is consistent with the Kobe II Matrix Approach
17. Tuna RFMOs should develop mechanisms to deliver timely and adequate information on their scientific outcomes to the public.	Agreed	All Commission scientific work (papers) is posted on the Commission's website.
18. All documents, data and assumptions related to past assessments undertaken by tuna RFMOs should be made available in order to allow evaluation by any interested stakeholder.	Agreed	Currently practiced with papers posted on the Commission website. Release of Non-Public domain data is released in accordance with WCPF Rules and Procedures for access to, protection of and dissemination of WCPFC data.
Enhanced cooperation between tuna RFMOs		
19. Chairs of Scientific Committees should establish an annotated list of common issues that could be addressed jointly by tuna RFMOs and prioritize them for discussion at the Kobe III meeting.	Agreed	"SC6 recommended that the Kobe Science Working Group conduct a review of the treatment of steepness (a key parameter in the relationship between equilibrium recruitment and equilibrium spawning biomass) in tuna stock assessments globally, and recommend a common approach, on a species-by-species basis as necessary." (Correspondence to be directed to the Chair of SC6)
20. Tuna RFMOs should actively cooperate with programs integrating ecosystem and socio-economic approaches such as CLIOTOP to support the conservation of multi-species resources.	Agreed	
Capacity-building		
21. Where determined by a Tuna RFMO, a review of the effectiveness of capacity-building assistance already provided		Not required for WCPFC Members as it is already being addressed through WPEA for

should be undertaken. Reviews of tuna scientific management capacity in developing countries, within the framework of the respective RFMO may also be conducted at their request.		Philippines and Indonesia and Vietnam and for FFA Members it is a lower priority
22. Developed countries should strengthen in a sustained manner their financial and technical support for capacity-building in developing countries, notably small island developing States, on the basis of adequate institutional arrangements in those countries and making full use of local, sub-regional and regional synergies.	Agreed	
23. Tuna RFMOs should have assistance funds that cover various forms of capacity-building (e.g. training of technicians and scientists, scholarships and fellowships, attendance to meetings, institutional building, and development of fisheries).	Agreed	
24. Tuna RFMOs, if necessary, should ensure regular training of technicians for collecting and processing of data for developing states, notably those where tuna is landed.	Agreed	Carried out for SPC member countries, Indonesia, Philippines and Vietnam by SPC-OFP with funding assistance from JTF and WCPFC-SRF i.e. Tuna Data Workshops, TUFMAN software development, training, and tech support.
25. The structural weaknesses in the receiving mechanism for capacity building within a country should be improved by working closely with Tuna RFMOs.	Agreed	

b) Workshop on Bycatch

Participants in the Kobe II Bycatch Workshop support bringing the following recommendations forward to the respective RFMOs as regards bycatch across five taxa (seabirds, sea turtles, finfish, marine mammals, and sharks):

Recommendations	Response	Comments
I. Improving assessment of bycatch within T-RFMOs		
1. RFMOs should assess the impact of fisheries for tuna, tuna like and other species covered by the conventions on bycatch by taxon using the best available data.	Agreed	
2. RFMOs should consider adopting standards for bycatch data collection which, at a minimum, allows the data to contribute to the assessment of bycatch	Agreed	The rules of data to be provided by CCMs to be expanded to include by-catch data reporting.

species population status and evaluation of the effectiveness of bycatch measures. The data should allow the RFMOs to assess the level of interaction of the fisheries with bycatch species.		
3. Encourage the participation of appropriate scientists in relevant T-RFMO working groups to conduct and evaluate bycatch assessments and proposed mitigation strategies; and	Agreed	
4. Implement/enhance observer and port sampling programs with sufficient coverage to quantify/estimate bycatch and require timely reporting to inform mitigation needs and support conservation and management objectives, addressing practical and financial constraints	Agreed	
II. Improving ways to mitigate/reduce bycatch within T-RFMO		
5. RFMO measures should reflect adopted international agreements, tools and guidelines to reduce bycatch, including the relevant provisions of the FAO Code of Conduct, the IPOAs for Seabirds and Sharks, the FAO guidelines on sea turtles, the best practice guidelines for IPOAS for seabirds, and the precautionary approach and ecosystem approaches.	Agreed	
6. For populations of concern including those evaluated as depleted, RFMOs should develop and adopt immediate, effective management measures, for example, prohibition as appropriate on retention of such species where alternative effective sustainability measures are not in place.	Agreed	
7. Evaluate the effectiveness of current bycatch mitigation measures, and their impact on target species catch and management, and identify priorities for action and gaps in implementation, including enforcement of current measures and capacity building needs in developing states	Agreed	
8. Seek binding measures or strengthen existing mitigation measures, including the development of mandatory reporting requirements for bycatch of all five taxa	Agreed	

across all gear types and fishing methods where bycatch is a concern; and		
9. Identify research priorities, including potential pilot projects to further develop and evaluate the effectiveness of current or proposed bycatch mitigation measures, working with fishers, fishing industry, IGOs and NGOs, universities and others as appropriate, and facilitate a full compendium of information regarding mitigation techniques or tools currently in use, e.g. building on the WCPFC Bycatch Mitigation Information System.	Agreed	
10. Due to the conservation status of certain populations and in accordance with priorities in the RFMO areas, expedite action on reducing bycatch of threatened and endangered species.	Agreed	
11. Adopt the following principles as the basis for developing best practice on bycatch avoidance and mitigation measures and on bycatch conservation and management measure. • binding, • clear and direct, • measureable, • science-based, • ecosystem-based, • ecologically efficient (reduces the mortality of bycatch), • practical and safe, • economically efficient, • holistic, • collaboratively developed with industry and stakeholders, and • fully implemented.	Agreed	
III. Improving cooperation and coordination across RFMOs		
12. As a matter of priority, establish a joint T-RFMO technical working group to promote greater cooperation and coordination among RFMOs with the attached Terms of Reference. The RFMOs are encouraged to expedite the formation of the joint working group.	Agreed	WCPFC Secretariat to take a lead role in coordination of the working group between RFMOs. (Discussion on makeup of the group has yet to be held)
13. Actively develop collaborations between relevant fishing industry, IGOs and NGOs, universities and others as	Agreed	

appropriate, and RFMOs to assess the impact of bycatch on the five taxa, study the effectiveness of bycatch mitigation measures, and further the understanding of population dynamics of species of conservation concern; and		
14. Develop the long-term capacity of T-RFMOs to coordinate and cooperate for data collection, assessment of bycatch, outreach, education, and observer training, including establishing a process to share information on current bycatch initiatives and potential capacity building activities.	Agreed	
15. RFMOs are encouraged to report progress to Kobe III on the formation and on progress against the recommendations in part I and II of this workshop report.	Secretariat to prepare report for Kobe III	
IV. Capacity building for developing countries		
16. Acknowledging the additional or new requirements of bycatch mitigation and the need to build further capacity for implementation, in carrying out the recommendations in I, II, and III above, consider capacity building programs for developing countries to assist in their implementation. Establish a list of existing capacity building programs related to bycatch issues (see attached Appendix 2 for example) to avoid duplication where possible and facilitate coordination of new capacity building programs.	Agreed	

c) WS on RFMO Management of tuna fisheries

Key themes

a. The long-term profitability of all tuna fisheries is linked to their sustainability and proper management, and all RFMOs should ensure that all stocks of tunas are maintained at sustainable and optimal levels through science-based measures.

b. Overcapacity is a symptom of broader management problems, and in developing solutions we need to ensure that we deal with both the problem of overcapacity and the longer-term management issues.

c. In some areas a high proportion of the world's tuna resources are harvested from the waters of developing coastal states. For some of these countries and many small island developing states they are their only tradable resource, and developing coastal States seek a better return for access to tuna resources. Providing developing coastal States with the assistance to better manage, utilise and trade and market these resources will increase the economic return. In this context, developed fishing countries

should work with developing coastal States to build industries that provide a better return, including as appropriate reducing and restructuring fleets.

d. Rights in RFMOs and under international law come with associated obligations, and these must be honoured by all member and cooperating non-member countries.

e. Tuna sashimi markets are now world-wide, not just in Japan; e.g. USA, EU, China, Chinese Taipei, and Korea.

f. Fish-aggregating devices (FADs) increase the catches in purse-seine fisheries for skipjack tuna, but FAD fishing for skipjack also captures juvenile bigeye and yellowfin tunas, lowering the longterm catch rates of those species.

g. Rights already exist in most tuna fisheries, e.g. participatory rights in RFMOs, allocations in some RFMOs, and states' rights under international law.

h. Some participants stated that now is not the time to build further purse seiners, unless industry can secure long-term access rights in partnership with developing coastal States.

i. The issues relating to overcapacity and overfishing in tuna RFMOs do not change; hopefully the players now understand that they must act.

Recommendations

Recommendations	Response	Comments
RFMOs should, as a matter of urgency:		
1. Develop publicly available authorised and active vessel[16] lists for all gears. These lists will include small-scale fishing vessels that are capable of catching significant amounts of fish under the competency of tuna RFMOs.	Agreed	
2. Encourage secretariats to continue their work on the global list of tuna vessels, including the assignment of a unique vessel identifier.	Agreed	
3. As appropriate, RFMOs include only vessels on their active vessel[1] register in any scheme for reducing capacity by eliminating vessels.	Agreed	
4. Review existing capacity against the best available scientific advice on sustainable levels of catch and implement measures to address any overcapacity identified.	Agreed	Capacity should be reviewed and attempts made to address overcapacity issues
5. Each tuna RFMO consider implementing where appropriate a freeze on fishing capacity on a fishery by fishery basis. Such a freeze should not constrain the access to, development of, and benefit from sustainable tuna fisheries by developing coastal States.	Agreed	Capacity should be reviewed and attempts made to address overcapacity issues
6. All RFMOs establish strong requirements for the provision of accurate data and information to secretariats so that the status of tuna stocks can be accurately assessed. All RFMO members and cooperating non-	Agreed	SC (SPC) may provide comments on CCM's data provision. The SC may consider a

[16] The definition of "active vessel" is to be determined by individual RFMOs.

members should make a firm commitment to provide these data on a timely basis, and it should be cross-checked with market, landings and processing establishment data under the competency of tuna RFMOs.		plan for the cross-checking of available data.
7. Develop a consistent enforceable regime for sanctions and penalties, to be applied to RFMO members and non-members and their vessels that breach the rules and regulations developed and implemented by RFMOs.	Agreed	Refer to TTC for consideration as appropriate when data agreements have been breached
8. Ensure that the effectiveness of all conservation and management measures is not undermined by exemption or exclusion clauses.	Agreed	
9. Ensure that all conservation and management measures are implemented in a consistent and transparent manner and are achieving their management goals.	Agreed	
10. Review and strengthen their MCS framework to improve the integrity of their management regime and measures.	Agreed	
RFMOs should, in the medium term:		
11. Develop measures of capacity and, in the absence of an agreed capacity definition, adopt the FAO definition "The amount of fish (or fishing effort) that can be produced over a period of time (e.g. a year or a fishing season) by a vessel or a fleet if fully utilised and for a given resource condition."	Agreed	The FAO definition will be used in the interim until the Commission develops its own definition for "capacity".
12. Ensure that all stocks maintained at sustainable and optimal levels through science-based measures.	Agreed	
13. Review and develop management regimes, based *inter alia* on the concept of fishing rights for fisheries under the RFMOs' competence.	Agreed	
14. Consider using right-based management approaches and other approaches as part of a 'tool box' to address the aspirations of developing states, overfishing, overcapacity and allocation.	Agreed	
15. The tuna RFMOs should ensure a constant exchange of information with regard to the capacity of fleets operating within their zones as well as the mechanisms to manage this capacity. Kobe III will provide an opportunity for the tuna RFMOs to provide an update on progress with these issues.	Agreed	Secretariat to report on progress at regular intervals