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

Scientific Committee
Eighth Regular Session

Busan, Korea
7–15 August 2012

SUMMARY REPORT

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TABLE OF CONTENTS

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 THE MEETING

1. The Eighth Regular Session of the Scientific Committee (SC8) was held in Busan, Republic of Korea from 7–15 August 2012. N. Miyabe chaired the meeting.

REVIEW OF FISHERIES

2. The provisional total Western and Central Pacific Fisheries Commission (WCPFC) Statistical Area tuna catch for 2011 was estimated at 2,244,776 mt, the lowest since 2005 and 300,000 mt less than the record in 2009 (2,544,679 mt) (Fig. 1). This catch represented 79% of the total Pacific Ocean catch of 2,833,020 mt, and 55% of the global tuna catch (the provisional estimate for 2011 is 4,077,814 mt, which is the lowest for 10 years). The 2011 Statistical Area catch of skipjack (1,540,189 mt – 69% of the total catch) was only the fifth highest recorded and around 215,000 mt less than the record catch of 2009 (1,756,628 mt). The Statistical Area yellowfin catch for 2011 (430,506 mt – 19%) was the lowest since 1996 and more than 170,000 mt less than the record catch taken in 2005 (602,892 mt) due to poor catches in the purse-seine fishery. The Statistical Area bigeye catch for 2011 (151,533 mt – 7%) was close to the average for the past decade. The 2011 Statistical Area albacore catch (122,548 mt – 5%) was relatively stable and close to the average for the past decade. The 2011 Statistical Area albacore catch includes catches of North and South Pacific albacore in the Statistical Area, which comprised 81% of the total Pacific Ocean albacore catch of 152,195 mt in 2011. The South Pacific albacore catch in 2011 was 75,258 mt.

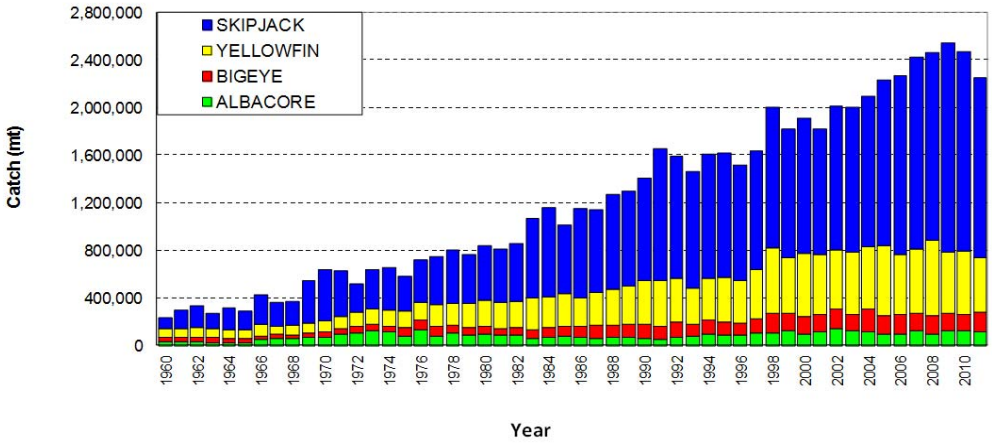


Figure 1: Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCPFC Statistical Area.

3. The provisional 2011 Statistical Area purse-seine catch of 1,688,336 mt was the lowest catch for five years and more than 220,000 mt less than the record attained in 2009 (1,919,424 mt) (Fig. 2). The 2011 Statistical Area pole-and-line catch (164,416 mt) was the lowest annual catch since the mid-1960s and continued the trend in declining catches for three decades. The provisional Statistical Area longline catch (251,298 mt) for 2011 was the fifth highest on record, at around 15,000 mt less than the highest on record attained in 2002 (266,963 mt). The 2011 South Pacific troll albacore catch (3,119 mt) was higher than catches from the past two years, mainly due to higher catches experienced in the New Zealand domestic fishery.

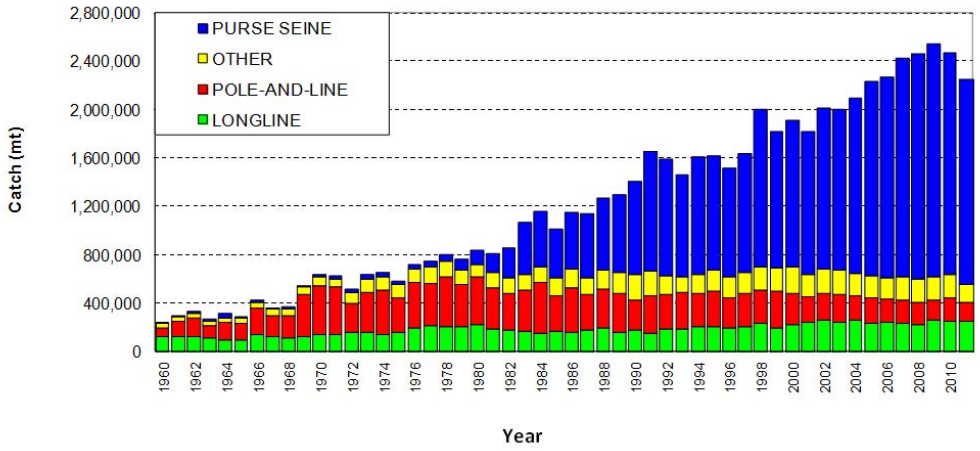


Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the WCPFC Statistical Area, by longline, pole-and-line, purse-seine and other gear types

DATA AND STATISTICS THEME

Data gaps of the Commission

4. SC8 noted the request by the Commission's science services provider for CCMs to review their data provision status on WCPFC's website (http://www.wcpfc.int/statprov), to ensure the provisions of scientific data reflect what they have provided to the Commission, and to acknowledge and plan to resolve any of the gaps highlighted.

5. SC8 recognized the importance of the provision of operational-level catch and effort data for the work of the Commission, with an important example highlighted as a recommendation in an earlier SC8 presentation summarizing the outcomes of the WCPO bigeye tuna assessment peer review (refer to SC8-SA-WP-01).

6. SC8 noted that several CCMs have not provided operational catch and effort data, and none of these CCMs have submitted a Data Improvement Plan, as recommended by WCPFC7.

7. SC8 recommended the following.

   a. CCMs that have not yet provided operational-level catch and effort data, to provide Data Improvement Plans to the Eighth Session of the Technical and Compliance Committee (TCC8). It was also recommended that until operational catch and effort data are provided, these CCMs should provide annual catch estimates by gear types and species for waters of national jurisdiction and high seas areas separately, as per the scientific data provision rules of the Commission.

b. Working paper SC8-ST-WP-01 Rev.1 be forwarded to TCC8 to highlight data gaps that need addressing and for use in the compliance with conservation and management measures (CCMM) process.
c. The Data Gaps Report should include references to relevant WCPFC conservation and management measures (CMMs) to clarify the data obligations of CCMs particularly in regards to chartered vessels.
d. WCPFC9 adopt and include the recommended length size class intervals in Section 5 of "Scientific Data to be provided to the Commission", as follows:
   - Skipjack tuna – 1cm
   - Albacore tuna – 1cm
   - Yellowfin tuna – ideally 1cm, but not more than 2 cm
   - Bigeye tuna – ideally 1cm, but not more than 2 cm
   - Billfish – ideally 1cm, but not more than 5 cm
e. WCPFC9 adopt and include the following text into Sections 1 and 5 of "Scientific data to be provided to the Commission":
   "The statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data. Where feasible, this shall also be applied to all historical data."
f. WCPFC9 adopt and include the following text into Sections 3, 4 and 5 of "Scientific Data to be provided to the Commission":
   "Information on operational changes in the fishery that are not an attribute in the data provided is to be listed and reported with the data provision."

Species composition of purse-seine catches

8. SC8 recommended the following.
   a. Meeting paper SC8-WCPFC8-08, "Plan for the improvement of the availability and use of Purse-seine catch composition data", be referred to TCC8 for consideration, and to consider the broader application of spill sampling across the ROP.
   b. Future papers relating to the availability of purse-seine catch composition data should indicate the level of improvement in the accuracy of logsheet reporting of purse-seine species composition by fleet.
   c. CCMs identified in Table 1 of meeting paper SC8-WCPFC8-08 should collaborate with SPC and the WCPFC Secretariat to further increase the number of paired sampling trips.
   d. Project 60 be continued through 2013. The study has a target of 50 trips to be sampled, of which 35 trips will be completed by the end of 2012. The Data and Statistics Theme forwarded a 2013 budget request of USD 75,000 based on USD 5,000 per trip for the remaining 15 trips.

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

9. SC8 noted that no significant issues have arisen in the past year, and that the Commission's science services provider continue to carry out informal dialogue with ISC.

Requests from CMM 2008-01

10. SC8 recommended that a) because no reports for "Other Commercial Tuna Fisheries Fishing for Bigeye and Yellowfin Tuna" were received, in accordance with para 39 of CMM 2008-01, the issue be forwarded to TCC8 for consideration; and b) Agenda Item 3.2.1 be removed from future SC agendas, and be addressed in the Data Gaps Report.

Regional Observer Programme

11. SC8 endorsed the report on "Summary of Regional Observer Programme Audits" (SC8-ST-IP-03), and noted that consistent with previous SC advice, observer coverage should be spatially and temporally representative of each fishery operating in the Convention Area.

STOCK ASSESSMENT THEME

WCPO bigeye tuna

Peer review of 2011 bigeye tuna stock assessment

12. Key Panel recommendations called for:
    a. conducting a Pacific-wide assessment to test the assumption that a WCPO-only assessment is appropriate;
    b. addressing the uncertainty related to the tagging data for eastern Australia and the early catch per unit effort (CPUE) data from the Japanese longline fisheries as a priority in the next assessment; and
    c. removing Japanese "training vessel" length-frequency data from the assessment until these data are better understood.

Finally, the Panel found no definite basis to select between estimating B_{MSY} based on the entire sequence of recruitment and spawning biomass estimates versus more recent values, and recommended consideration of harvest strategies based on fishing mortality as these should be robust to this uncertainty.

13. CCMs agreed that all of the terms of reference (TOR) were addressed by the Panel, and the responses and recommendations were reasonable. There were 26 general recommendations and 12 recommendations specific to MULTIFAN-CL (MFCL, Attachment F). Budget implications were estimated at USD 160,000 annually to the science services provider to address the general recommendations and USD 40,000 to complete the MFCL recommendations.

Indicator analysis

14. SC8 noted that fishery indicators provide information on trends in the fishery for years when a stock assessment is not conducted. SC8 recommended that future versions of SC8-SA-WP-02 should present explanatory detail for the figures and a brief interpretation of the trends.

Progress report on Project 35 (Refinement of Bigeye Parameters Pacific-wide)

15. SC8 noted the progress of Project 35 and recommended its continuation in 2013.

Provision of scientific information

16. SC8 noted that no stock assessment was conducted and there is no new information to inform stock status for WCPO bigeye in 2012; therefore, the stock status and trends, and management advice and implications from SC7 are still current.

WCPO yellowfin tuna

Review of research and information

17. SC8 noted Korea's (CPUE) analysis as a preliminary analysis, and encouraged expansion of the work because it appears to be a useful approach and may provide an index of yellowfin tuna abundance in the future.

Provision of scientific information

18. SC8 noted that no stock assessment was conducted and there is no new information to inform stock status for WCPO yellowfin in 2012; therefore, the stock status and trends, and management advice and implications from SC7 are still current.

WCPO skipjack tuna

Provision of scientific information

19. SC8 noted that no stock assessment was conducted and there is no new information to inform stock status for WCPO skipjack in 2012; therefore, the stock status and trends, and management advice and implications from SC7 are still current.

South Pacific albacore

Status and trends

20. The 2012 assessment results are generally similar to, but more optimistic than those of the 2009 and 2011 assessments (Table ALB1).

21. Time trends in estimated recruitment, biomass, fishing mortality and fishery impacts are shown for the reference case model in Figures ALB1−4.

22. Key conclusions, based on the median of the grid, are that overfishing is not occurring and the stock is not in an overfished state (Fig. ALB5). Spawning potential depletion levels ($SB_{curr}/SB_{curr_{F=0}}$) of albacore were moderate at ~37%. However, SC8 noted that depletion levels of the exploitable biomass is estimated to be between 10% and 60%, depending on the fishery, having increased sharply in recent years.

Table ALB1: Management parameters estimated from the 2012 base case (determined as the median from the structural uncertainty grid), the 2011 base case model, and the 2009 assessment, for comparison. Note that the definitions for current change through time.

Management quantity	2012 base case (grid median)	2011 base case	2009 base case	2009 median
$C_{current}$	78,664	54,520	66,869	65,801
C_{latest}	89,790	56,275		
MSY	99,085	85,130	97,610	81,580
$C_{current}/MSY$	0.79	0.64	0.69	0.80
C_{latest}/MSY	0.90	0.66		
F_{mult}	4.81	3.86		
$F_{current}/F_{MSY}$	0.21	0.26	0.25	0.29
SB_0	442,350	400,700	460,400	406,600
SB_{MSY}/SB_0	0.23	0.26	0.26	0.24
$SB_{current}/SB_0$	0.59	0.59	0.59	0.60
SB_{latest}/SB_0	0.56	0.47		
$SB_{current}/SB_{MSY}$	2.56	2.25	2.28	2.44
SB_{latest}/SB_{MSY}	2.38	1.82		
$SB_{curr}/SB_{curr_{F=0}}$	0.63	0.63	0.68	0.64
$SB_{latest}/SB_{latest_{F=0}}$	0.58	0.6		

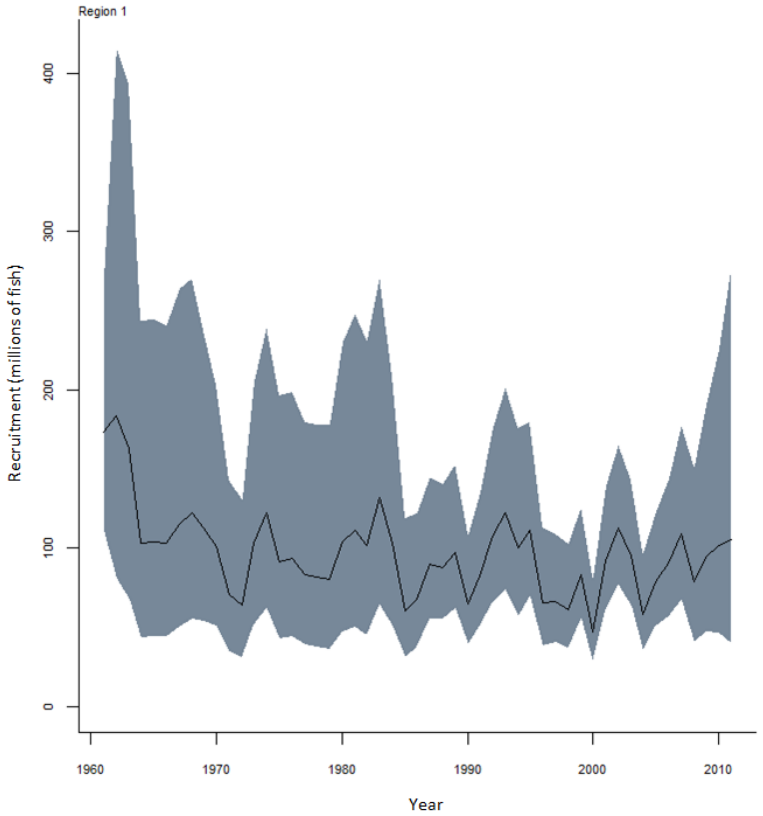


Figure ALB1: Annual recruitment (number of fish) estimates from the reference case model. Grey area represents parameter uncertainty estimated from the Hessian matrix.

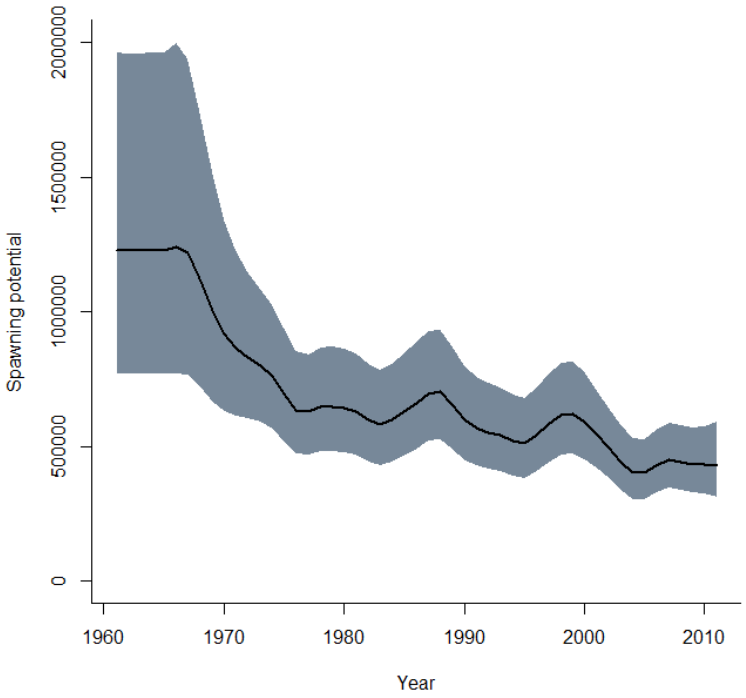


Figure ALB2: Annual estimates of spawning potential from the reference case model. Grey area represents parameter uncertainty estimated from the Hessian matrix.

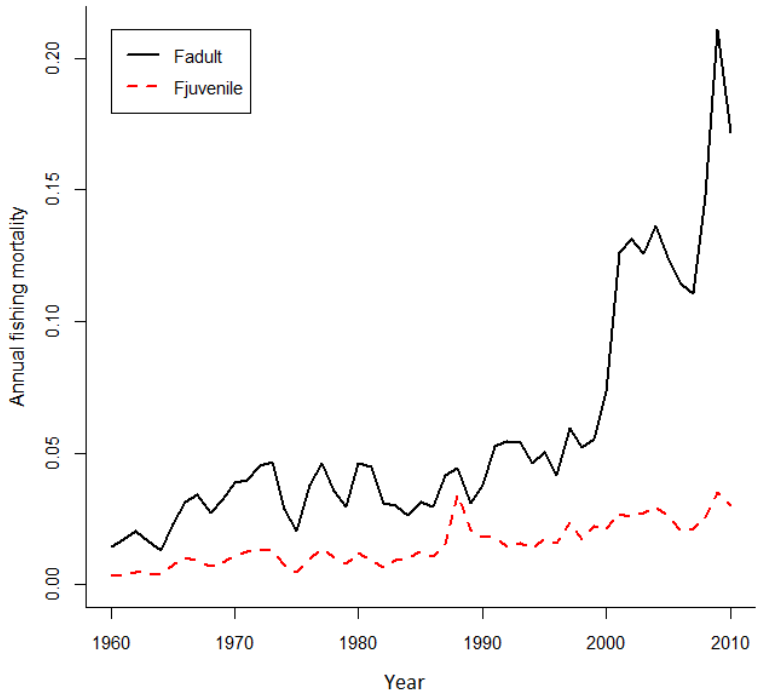


Figure ALB3: Annual estimates of fishing mortality for juvenile and adult South Pacific albacore from the reference case model.

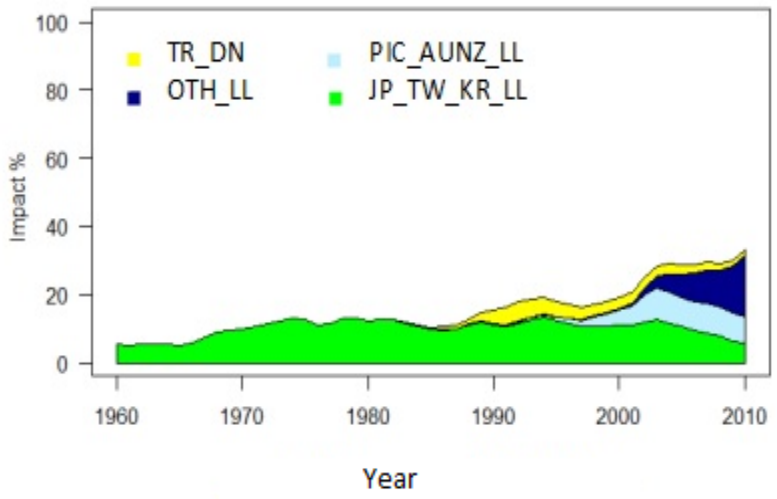


Figure ALB4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) attributed to various fishery groups (TR_DN = troll and driftnet fisheries; OTH_LL = "Other" longline fisheries; PIC_AUNZ_LL = Pacific Island, Australian and New Zealand longline fisheries; JP_TW_KR_LL = Japanese, Korean and Chinese Taipei distant-water longline fisheries).

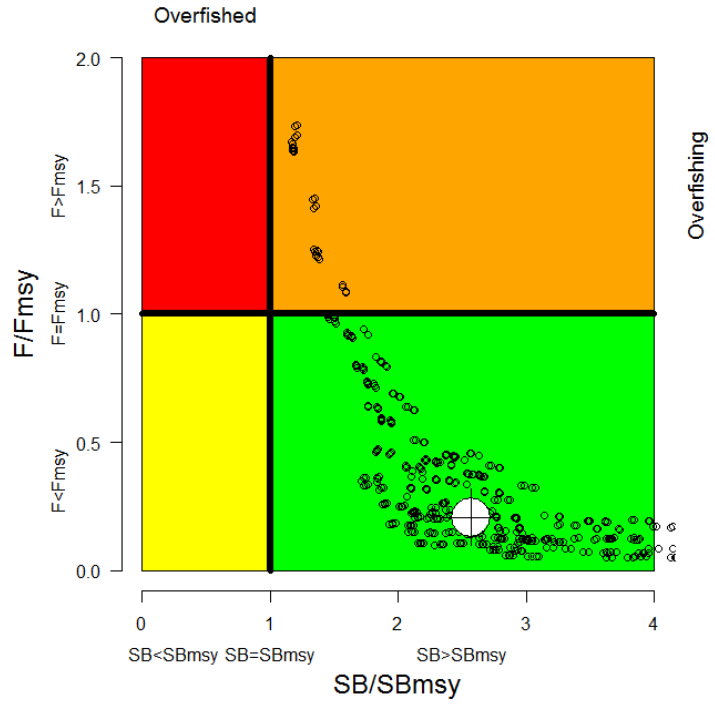


Figure ALB5: $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for 540 model runs in the uncertainty grid (black hollow circles) and the median (large white circle). Note that some grid model runs extend as far as 7 for $SB_{current}/SB_{MSY}$.

Management advice and implications

23. The South Pacific albacore stock is currently not overfished and overfishing is not occurring. Current biomass is sufficient to support current levels of catch. However, for several years, SC has noted

that any increases in catch or effort are likely to lead to declines in catch rates in some regions, especially for longline catches of adult albacore, with associated impacts on vessel profitability. SC8 further noted that vessel activity must be managed, as per the requirements of CMM 2010-05.

24. Given the recent expansion of the fishery and recent declines in exploitable biomass available to longline fisheries, and given the importance of maintaining catch rates, SC8 recommended that longline fishing mortality be reduced if the Commission wishes to maintain economically viable catch rates.

Recommendations

25. SC8 requested that the science services provider conduct deterministic projections for South Pacific albacore to be presented to WCPFC9. Projections would be based on scalars of the 2010/2011 [final year] catches as used in the assessment. Specifically, longline scalars of 0.7 to 1.5 in 0.1 increments and scalars of 1, 2, 5 for the surface troll fishery are proposed. Outputs should be similar to those commonly reported for projections, plus information on predicted changes in vulnerable biomass. In making this request it is noted that the management advice was based on the median of the uncertainty grid and some consideration will be required of the technical approaches to be used to undertake these projections.

26. SC8 recognized the potential for analysis of trade data to reduce the uncertainty in reported catch.

South Pacific swordfish

Review of research and information

27. SC8 recommended that, if possible, the sex-specific growth and other biological parameters should be incorporated prior to undertaking the next stock assessment. SC8 recommended that SPC conduct the South Pacific swordfish stock research under the proposed work plan as follows:

a. finalize the development of the method of sex-specific stock assessment;
b. stock assessment conducted through collaboration from EU and the results presented at SC9; and
c. the science services provider will present an update on its analysis of South Pacific swordfish as a component of their stock status report to WCPFC9.

Status and trends

28. SC8 noted that no stock assessment was conducted for South Pacific swordfish for SC8. Therefore, the stock status description from SC5 is still current.

Management advice and implications

29. SC8 noted that no stock assessment was conducted for South Pacific swordfish in 2012. Therefore, the management recommendations from SC5 are still current, and SC8 recommended that the provision of management advice to the Commission be deferred to SC9.

Southwest Pacific striped marlin

Status and trends

30. SC selected the reference case model from the assessment to characterize stock status and selected several key sensitivity runs to characterize uncertainty in trends in abundance and stock status

(Figs. MLS1-MLS5 and Tables MLS1 and MLS 2). It was noted that the use of the reference case and key sensitivities selected by SC8 (see Table MLS1) leads to slightly different conclusions in terms of stock status compared with that based on the uncertainty grid used in the assessment. The reference case and five of the six other key sensitivity runs estimated $F_{current}/F_{MSY}$ to be less than one indicating that overfishing is unlikely to be occurring. However, when considering $SB_{current}/SB_{MSY}$, the reference case and four of the six other key sensitivity runs are estimated to be less than one, indicating evidence that the stock may be overfished.

Table MLS1: Estimates of management quantities for selected stock assessment models from the 2012 Ref.case model and the six plausible key model runs. For the purpose of this assessment, "current" is the average over the period 2007–2010 and "latest" is 2011.

	Ref.case	**sel_JP_AU_3log**	**CP_JP2_AU_2_3**	**h=0.65**	**h=0.95**	**Growth_est**	**Sz_data_wt**
$C_{current}$	1758	1753	1785	1759	1759	1707	1764
C_{latest}	1522	1523	1512	1522	1522	1476	1521
MSY	2081	2017	2256	1914	2276	2182	2179
$C_{current}/MSY$	0.85	0.87	0.79	0.92	0.77	0.78	0.81
C_{latest}/MSY	0.73	0.76	0.67	0.80	0.67	0.68	0.70
F_{mult}	1.24	1.10	1.39	0.83	1.98	1.79	1.42
$F_{current}/F_{MSY}$	0.81	0.91	0.72	1.21	0.51	0.56	0.71
SB_0	15,130	14,530	16,590	16,790	14,220	15,360	16,000
SB_{MSY}/SB_0	0.27	0.27	0.27	0.32	0.22	0.28	0.26
$SB_{current}/SB_0$	0.24	0.22	0.25	0.21	0.25	0.31	0.25
SB_{latest}/SB_0	0.24	0.23	0.25	0.22	0.26	0.32	0.26
$SB_{current}/SB_{MSY}$	0.87	0.81	0.92	0.67	1.14	1.11	0.95
SB_{latest}/SB_{MSY}	0.90	0.84	0.92	0.70	1.19	1.14	1.00
$SB_{curr}/SB_{curr_{F=0}}$	0.34	0.32	0.37	0.34	0.34	0.44	0.37
$SB_{latest}/SB_{latest_{F=0}}$	0.37	0.34	0.39	0.37	0.37	0.46	0.40
Steepness (h)	0.80	0.80	0.80	0.65	0.95	0.80	0.80

Table MLS2: Comparison of southwest Pacific Ocean striped marlin reference points from the 2012 reference case model and the range of the seven models in Table MLS1; the 2006 base case model (steepness estimated as 0.51).

Management quantity	2012 assessment Ref.case (uncertainty)	2006 assessment Base case
Most recent catch	1,758 mt (2011)	1,412 mt (2004)
MSY	2081 t (1914–2276)	2610 t
$F_{current}/F_{MSY}$	0.81 (0.51–1.21)	1.25
$B_{current}/B_{MSY}$	0.83 (0.70–0.99)	0.70
$SB_{current}/SB_{MSY}$	0.87 (0.67–1.14)	0.68
$Y_{Fcurrent}$/MSY	0.99 (0.93–1.00)	0.99
$B_{current}/B_{current,\ F=0}$	0.46 (0.44–0.53)	0.53
$SB_{current}/SB_{current,\ F=0}$	0.34 (0.32–0.44)	NA

NA = not available

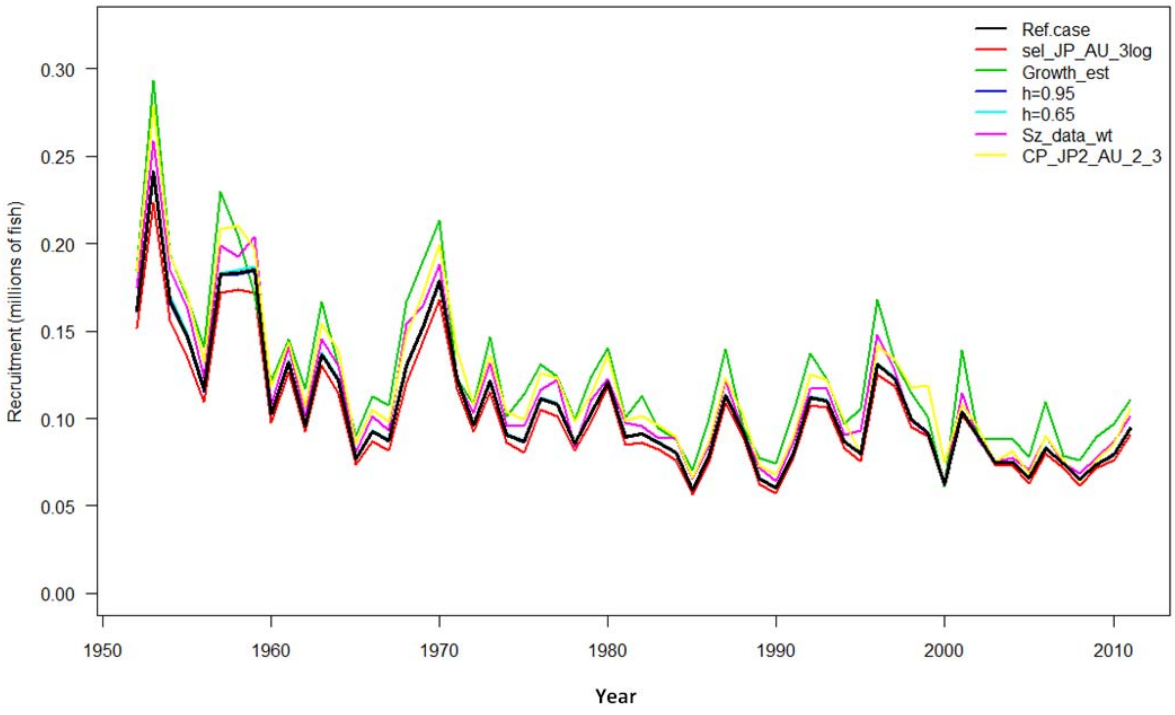


Figure MLS1: Estimated annual recruitment (millions of fish) for southwest Pacific Ocean striped marlin obtained from the Ref.case model (black line) and the six plausible key model runs.

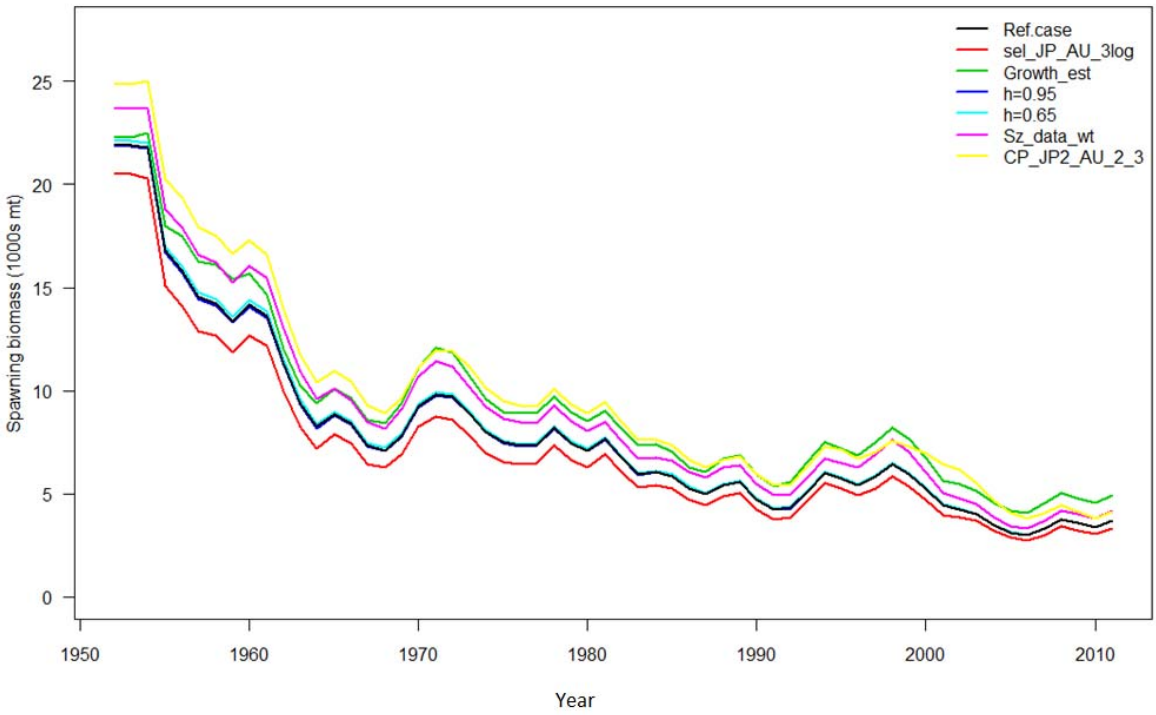


Figure MLS2: Estimated average annual average spawning potential for the southwest Pacific Ocean striped marlin obtained from the Ref.case model (black line) and the six plausible key model runs.

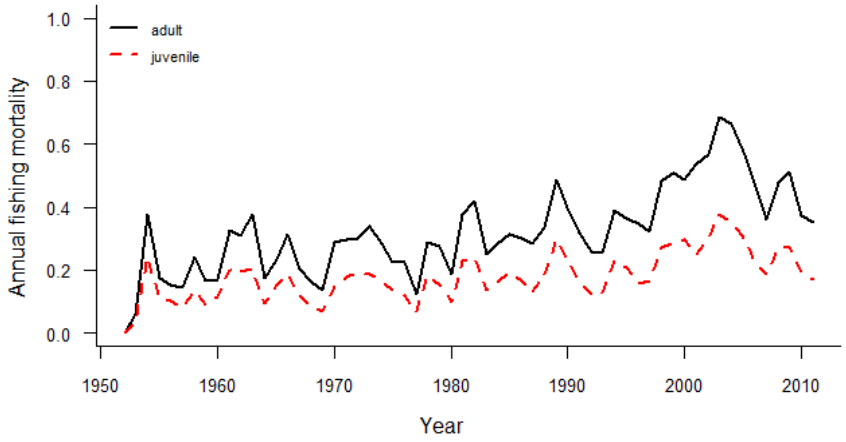


Figure MLS3: Estimated annual average juvenile and adult fishing mortality for the southwest Pacific Ocean striped marlin obtained from the Ref.case model.

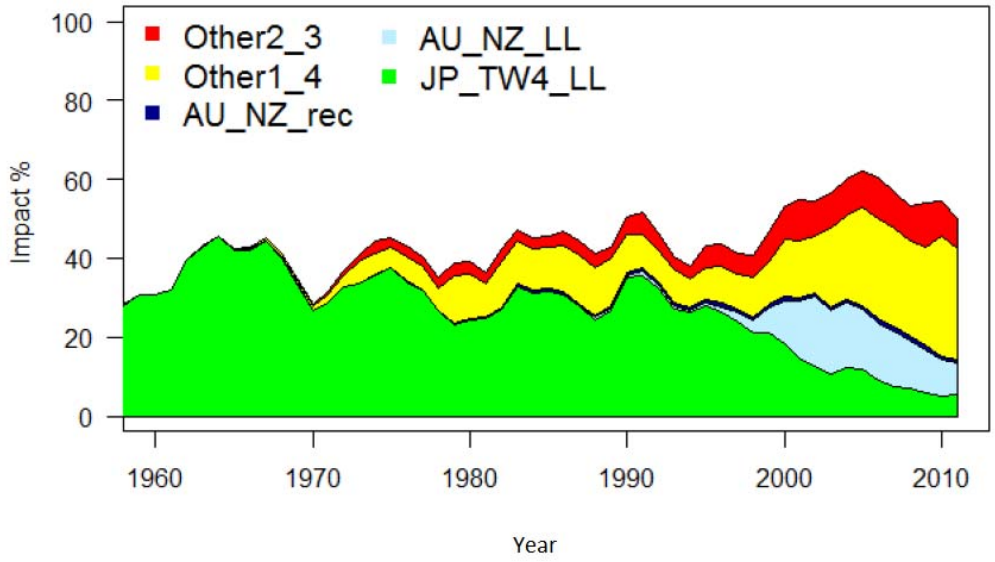


Figure MLS4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) for the southwest Pacific Ocean striped marlin attributed to various fishery groups (Ref.case model). JP_TW4+LL = Japanese longline fisheries in sub-areas 1 to 4 and Taiwanese longline fishery in sub-area 4; AU_NZ_LL = Australian and New Zealand longline fisheries; AU_NZ_rec = Australian and New Zealand recreational fisheries; Other1_4 = all longline fisheries in sub-areas 1 and 4 excluding Taiwanese in sub-area 4 and excluding Japanese; Other2_3 = all longline fisheries in sub-areas 2 and 3 excluding Japanese, Australian and New Zealand.

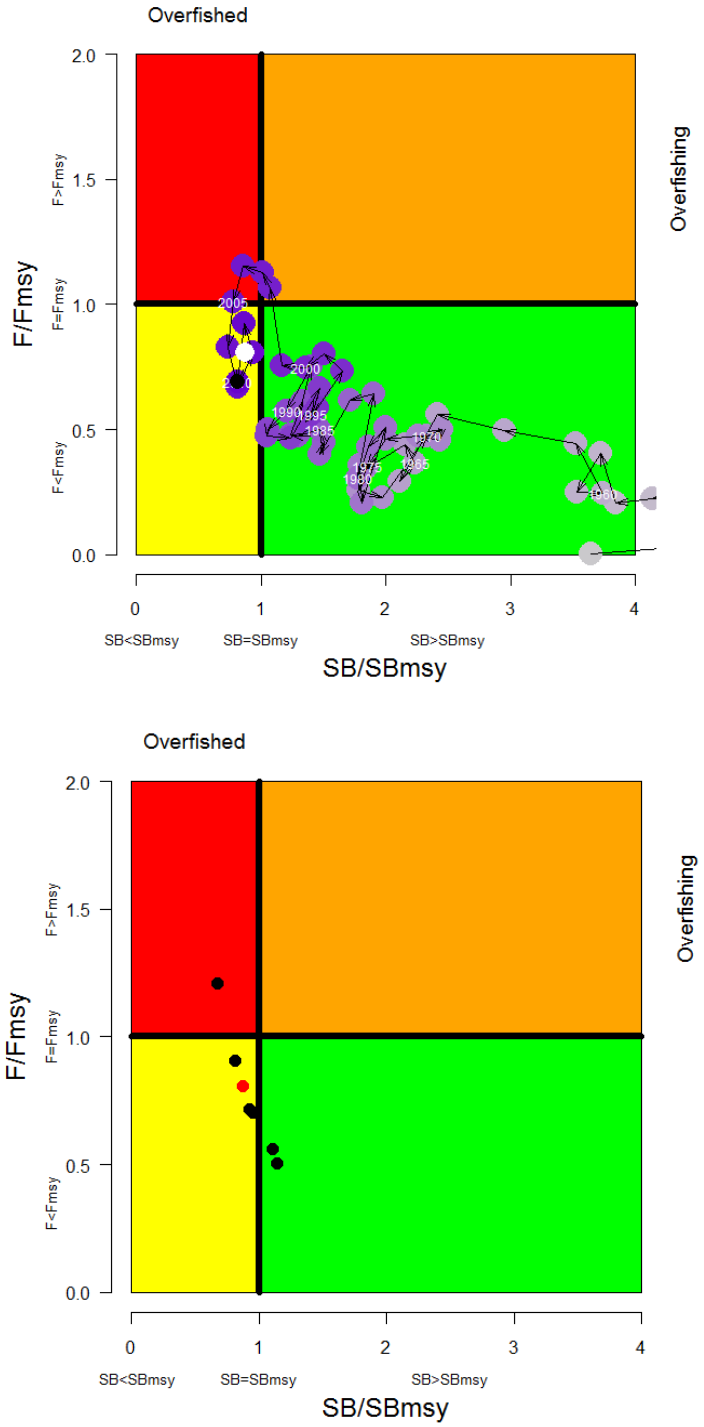


Figure MLS5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the Ref.case (top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the Ref.case (red circle) and the six plausible key model runs. See Table MLS1 to determine individual model runs.

Management advice and implications

31. The southwest Pacific striped marlin assessment results indicate that the stock is fully exploited, is not experiencing overfishing, but may be overfished. SC8 noted that recent catches are close to MSY, and that recent fishing mortality is slightly below F_{MSY}, and that recent spawning biomass is slightly below SB_{MSY}. The recent catch increase is driven in part by increases in catch in the northern area of the stock area that is not subject to the current CMM for this stock.

32. SC8 recommended measures to reduce the overall catch of this stock, through the expansion of the geographical scope of CMM 2006-04, in order to cover the distribution range of the stock.

33. In designing such a measure to implement this recommendation from SC8, the Commission may need to consider the historic trends in the fishery, including catch declines in the traditional central and southern areas and the recent catch increases in the northern areas.

34. SC8 recognized that striped marlin is often caught as a non-target species. SC8, therefore, recommended that data analysis be conducted to identify areas of high catch concentration that could be subject to targeted management.

North Pacific striped marlin

35. Noting the delay in the western and central North Pacific striped marlin assessment, and the associated lack of timely submission of assessment documents, SC8 recommended that the Commission consider tasking the science services provider with conducting the next assessment, unless ISC can demonstrate that it will prevent such delays in the future and that the ISC Chair cooperates for more timely submission of stock assessment analyses and reports.

Status and trends

36. The western and central North Pacific striped marlin stock is overfished and experiencing overfishing. The current (2010) spawning biomass is 65% below SB_{MSY}=2,713 mt and the current fishing mortality (2007–2009) exceeds F_{MSY}=0.61 by 24% (Fig. WCNPSTR4). Reducing fishing mortality would likely increase spawning stock biomass and may improve the chances of higher recruitment.

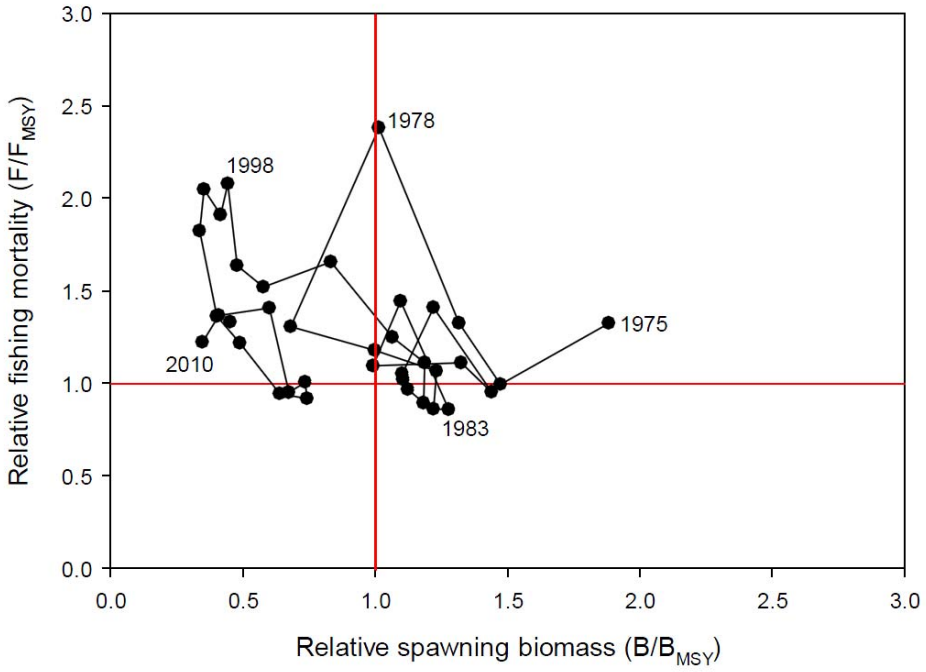


Figure WCNPSTR4: Kobe plot of the trends in estimates of relative fishing mortality and relative spawning biomass of western and central North Pacific striped marlin (*Kajikia audax*) during 1975–2010.

Management advice and implications

37. SC8 noted ISC's conservation advice for the Commission's consideration as follows.

Noting that the last year of the model was 2010 and F_{2012} is likely to be different to $F_{current}$, current fishing mortality (average 2007–2009) is estimated to be 24% above F_{MSY}. Fishing at F_{MSY} would lead to an estimated spawning biomass increase of roughly 45–72% by 2017. Seven additional harvest scenarios were also modeled using either resampled recruitment estimates from 1994–2008, or randomly generated deviations around the assumed spawner-recruit relationship. Included in the alternative harvest scenarios were: constant catch at 2,500 mt, which represents 80% of average catches during 2007–2009; constant catch at 3,600 mt, which represents catch levels prescribed in CMM 2010-01; fishing at the current F (average 2007–2009); and fishing at the average F (2001–2003).

- Fishing at a constant catch of 2,500 mt was estimated to increase spawning biomass by 133–223% by 2017.
- Fishing at a constant catch of 3,600 mt was estimated to increase spawning biomass by 48–120% by 2017.
- In comparison, fishing at the current (2007–2009) fishing mortality rate was estimated to increase spawning biomass by 14–29% by 2017, and fishing at the average 2001–2003 fishing mortality rate would lead to a spawning biomass decrease of 2% under recent recruitment to an increase of 6% under the stock-recruitment curve assumption by 2017.

38. SC8 recommended that ISC conduct an additional set of projections of western and central North Pacific striped marlin based on the 2012 stock assessment results. Projections should be based on resampling only recruitment from the most recent five-year period (2004–2008). Recruitment during that period is below the average of the 1994–2008, and may represent a different and more pessimistic

recruitment regime than assumed in the current projections. The eight harvest scenarios examined in the 2012 stock assessment should be evaluated with this more pessimistic assumption, and an additional run using this recruitment scenario and constant catch at the 2011 level should also be included. Probabilities of stock recovery as well as trajectories of spawning biomass and catch should be documented and presented to WCPFC9.

39. Given the current pessimistic status of the stock, SC8 recommended that the Commission strengthen the existing CMM to ensure the recovery of North Pacific striped marlin, based on information provided by ISC.

North Pacific albacore tuna

Status and trends

40. SC8 noted that no stock assessment was conducted for North Pacific albacore in 2012. Therefore, the stock status description and management recommendations from SC7 are still current.

Management advice and implications

41. SC8 noted that no stock assessment and management advice had been provided since SC7. Therefore, the advice from SC7 should be maintained, pending a new assessment or other new information.

Pacific bluefin tuna

Status and trends

42. SC8 noted that no stock assessment was conducted for Pacific bluefin tuna in 2012. Therefore, the stock status description and management recommendations from SC7 are still current.

Management advice and implications

43. SC8 noted that no stock assessment and management advice had been provided since SC7.

44. SC8 noted the following conservation advice from ISC:

> Until a new stock assessment result becomes available, ISC12 agreed to carry over the previous conservation advice, albeit with the precautionary note that the uncertainty in the stock status has increased through the passage of time and stock biomass may have declined since the last stock assessment. The advice on Pacific bluefin stock status from ISC11 is: "Given the conclusions of the July 2010 PBFWG workshop (ISC/10/ANNEX/07), the current (2004–2006) level of F relative to potential biological reference points, 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."

North Pacific swordfish

Status and trends

45. SC8 noted that no stock assessment was conducted for North Pacific swordfish in 2012. Therefore, the stock status description and management recommendations from SC6 are still current.

Management advice and implications

46. SC8 noted that no stock assessment and management advice had been provided since SC6. Therefore, the advice from SC6 should be maintained, pending a new assessment or other new information.

Oceanic whitetip shark

Status and trends

47. Spawning biomass, total biomass and recruitment have all exhibited a declining trend since 1995 (the first year of the assessment) (Fig. OCS1). Current spawning biomass is low and is estimated to be at 15% of SB_{MSY}.

48. Fishing mortality from the non-target longline fishery has been on an increasing trend since 1995, while fishing mortality from the targeted longline fishery and purse-seine fisheries has varied without any trend (Fig. OCS 2). Current fishing mortality is high and is estimated to be more than six times greater than F_{MSY}.

49. The key conclusions are that overfishing is occurring and the stock is in an overfished state relative to MSY-based reference points ($SB_{current}/SB_{MSY}$ = 0.153 [range: 0.082–0.409]) and depletion-based reference points ($SB_{current}/SB_0$ = 0.065 [range: 0.034–0.173]) (Tables OCS1 and OCS2). This conclusion is robust to uncertainties in key model assumptions (Figs. OCS 3 and OC4).

Table OCS 1: Estimates of management quantities for the reference case and sensitivity runs.

Management Quantity	Units	Reference	Catch_2	Catch_3	CPUE_2	Nat_M_1	Nat_M_3	Steep_1	Steep_3	Init_F_1	Init_F_3_	Samp.Sz_2	SigmaR_2
C_{Latest}	t	1,802	3,160	6,321	1,451	2,534	1,468	1,984	1,630	1,820	1,779	1,803	1,785
$C_{Current}$	t per annum	2,001	3,707	7,414	1,891	2,822	1,625	2,195	1,811	2,028	1,967	2,004	2,010
$\widetilde{Y}_{F_{MSY}}$	t per annum	2,700	1,645	3,290	2,606	3,596	2,244	2,279	3,000	2,380	3,318	2,697	2,734
$\widetilde{B}_0$	t	110,447	67,513	135,032	106,461	230,313	70,350	122,226	99,683	97,390	135,715	110,327	111,860
$\widetilde{B}_{MSY}$	t	46,780	28,593	57,188	45,102	99,195	29,001	54,400	39,828	41,249	57,483	46,729	47,377
$B_{current}$	t	7,295	11,212	22,426	4,493	11,436	5,647	8,896	5,917	7,543	7,006	7,327	7,405
$S\widetilde{B}_0$		3,537	2,162	4,324	3,409	6,380	2,330	3,914	3,192	3,119	4,346	3,533	3,582
$S\widetilde{B}_{MSY}$		1,498	916	1,831	1,444	2,748	960	1,742	1,275	1,321	1,841	1,496	1,517
$SB_{current}$		229	347	694	137	366	156	288	177	237	220	231	230
$B_{current} / \widetilde{B}_0$		0.066	0.166	0.166	0.042	0.050	0.080	0.073	0.059	0.077	0.052	0.066	0.066
$B_{current} / \widetilde{B}_{MSY}$		0.156	0.392	0.392	0.100	0.115	0.195	0.164	0.149	0.183	0.122	0.157	0.156
$SB_{current} / S\widetilde{B}_0$		0.065	0.161	0.161	0.040	0.057	0.067	0.074	0.055	0.076	0.051	0.065	0.064
$SB_{current} / S\widetilde{B}_{MSY}$		0.153	0.379	0.379	0.095	0.133	0.163	0.165	0.139	0.179	0.120	0.154	0.152
$SB_{Current} / SB_{1995}$		0.139	0.342	0.342	0.086	0.161	0.127	0.158	0.119	0.121	0.181	0.141	0.140
$\widetilde{B}_{MSY} / \widetilde{B}_0$		0.424	0.424	0.424	0.424	0.431	0.412	0.445	0.400	0.424	0.424	0.424	0.424
$S\widetilde{B}_{MSY} / S\widetilde{B}_0$		0.424	0.424	0.424	0.424	0.431	0.412	0.445	0.400	0.424	0.424	0.424	0.424
$F_{current}$		0.469	0.662	0.655	0.861	0.479	0.202	0.535	0.459	0.356	0.249	0.243	0.464
F_{msy}		0.070	0.071	0.071	0.070	0.047	0.091	0.051	0.092	0.070	0.070	0.070	0.070
$F_{current} / \widetilde{F}_{MSY}$		6.694	9.298	9.197	12.324	10.287	2.229	10.560	4.992	5.080	3.556	3.469	6.616

Table OSC2: Estimates of management quantities for the reference, median, 5th, and 95th quantiles of the uncertainty grid.

Management Quantity	Units	Reference	Grid Median	Grid 5%	Grid 95%
C_{Latest}	t	1,802	2,218	1,295	6,962
$C_{Current}$	t per annum	2,001	2,703	1,593	8,131
$\widetilde{Y}_{F_{MSY}}$	t per annum	2,700	2,713	1,484	4,831
$\widetilde{B}_0$	t	110,447	111,973	56,366	309,263
$\widetilde{B}_{MSY}$	t	46,780	47,300	22,321	133,204
$B_{current}$	t	7,295	8,672	3,864	26,001
$S\widetilde{B}_0$		3,537	3,554	1,848	8,566
$S\widetilde{B}_{MSY}$		1,498	1,505	739	3,690
$SB_{current}$		229	280	112	820
$B_{current} / \widetilde{B}_0$		0.066	0.073	0.034	0.192
$B_{current} / \widetilde{B}_{MSY}$		0.156	0.175	0.079	0.454
$SB_{current} / S\widetilde{B}_0$		0.065	0.069	0.034	0.173
$SB_{current} / S\widetilde{B}_{MSY}$		0.153	0.166	0.082	0.409
$SB_{Current} / SB_{1995}$		0.139	0.181	0.087	0.458
$\widetilde{B}_{MSY} / \widetilde{B}_0$		0.424	0.424	0.399	0.449
$S\widetilde{B}_{MSY} / S\widetilde{B}_0$		0.424	0.424	0.399	0.449
$F_{current}$		0.469	0.461	0.243	0.909
F_{msy}		0.070	0.070	0.035	0.093
$F_{current} / \widetilde{F}_{MSY}$		6.694	6.940	3.001	20.026

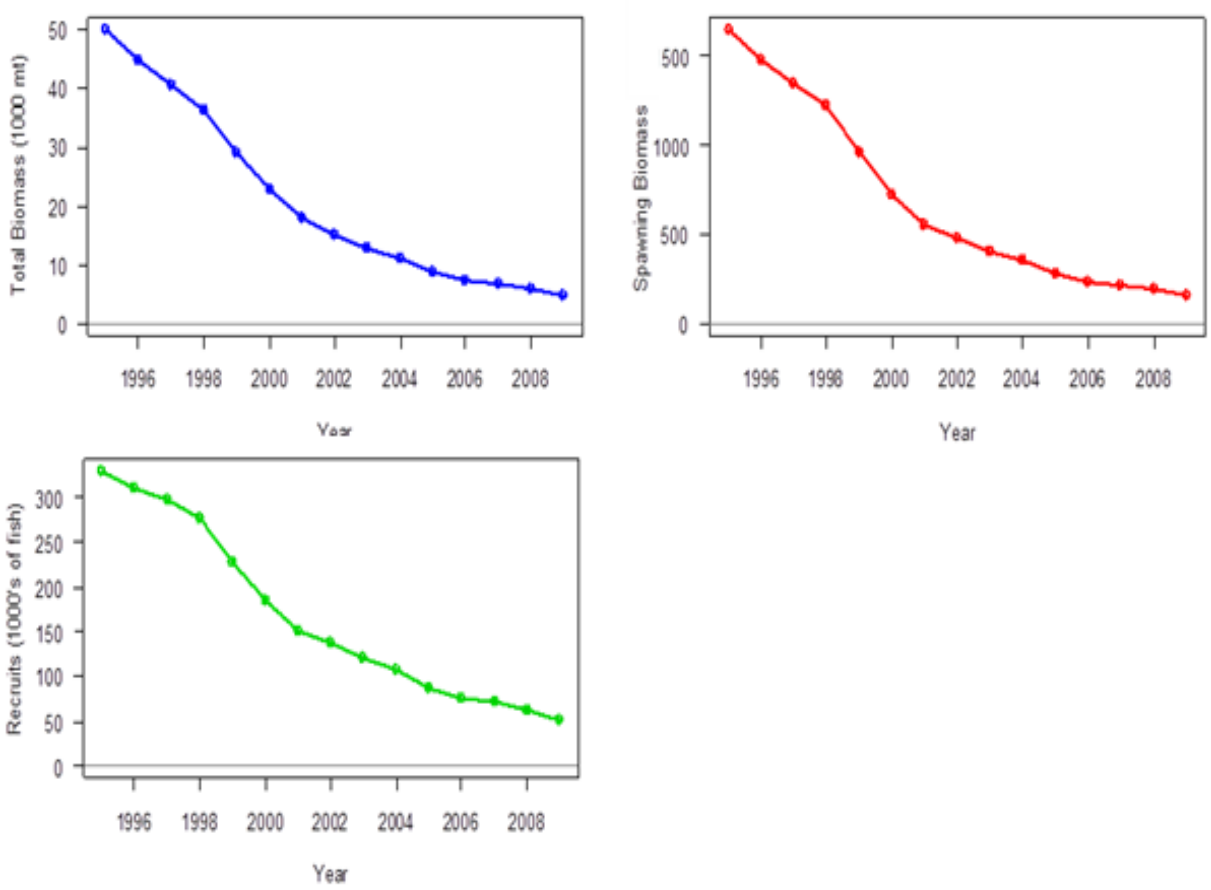


Figure OCS 1: Estimated total biomass (top left, 1000 mt), estimated spawning biomass (top right) and estimated annual recruitment (1000s of fish) in the WCPO for the reference case.

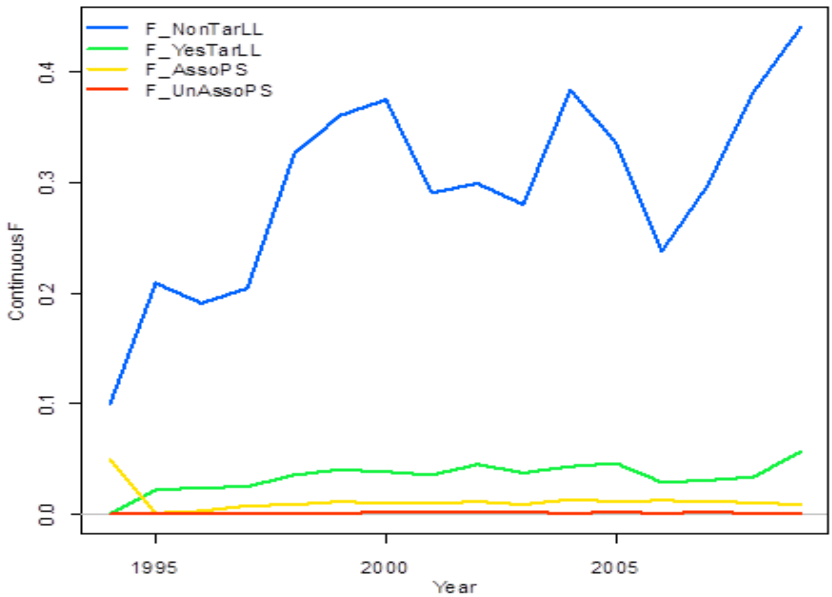


Figure OCS 2: Estimated fishing mortality by fleet for the reference case over the model period.

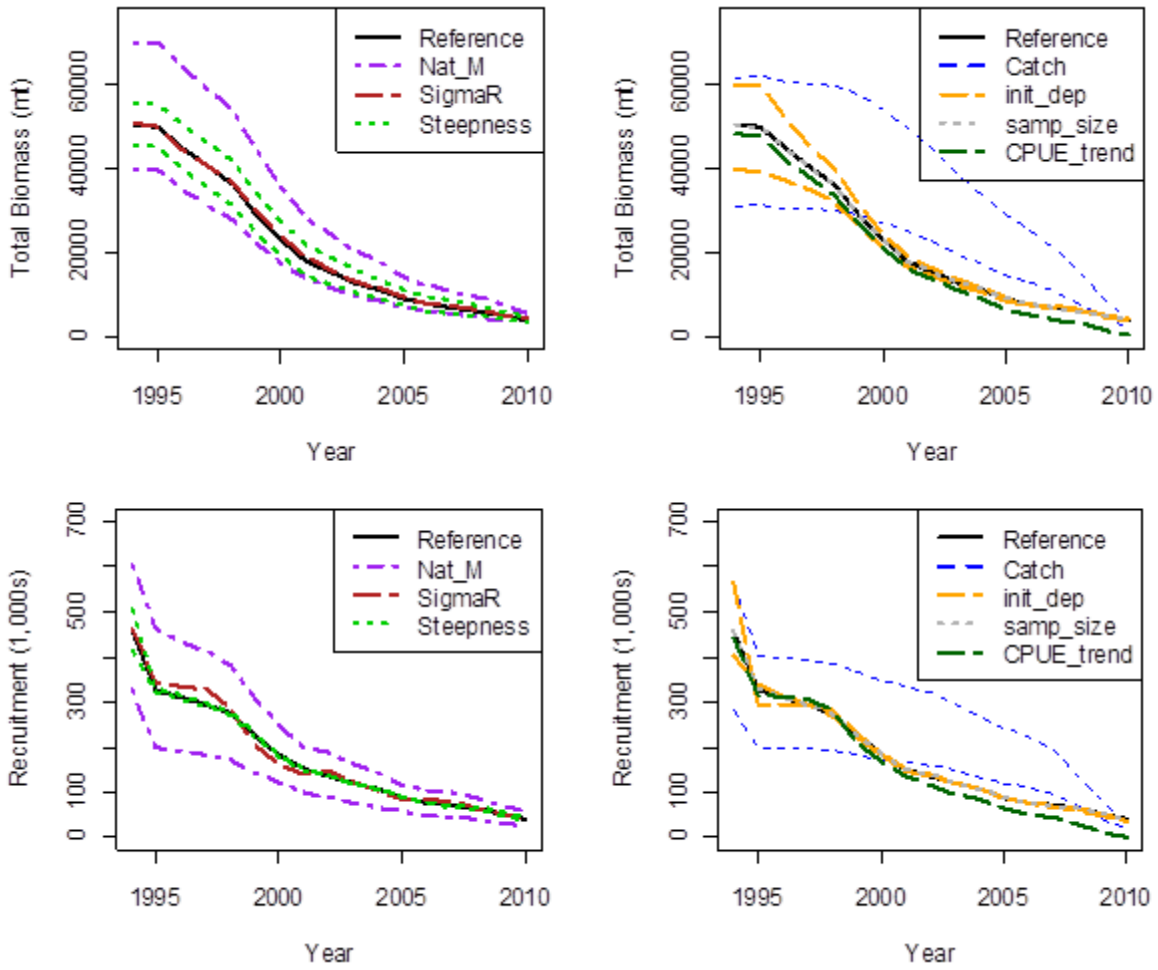


Figure OCS 3: Sensitivity analysis effects on total biomass (top) and recruitment (bottom) of alternate variable levels on the reference case. Figures on the left show the effects of natural mortality, SigmaR (the s.d. on the recruitment devs.), and the steepness. Figures on the right show the effects of changing the catch inputs, initial depletion, sample size down weighting, and CPUE inputs.

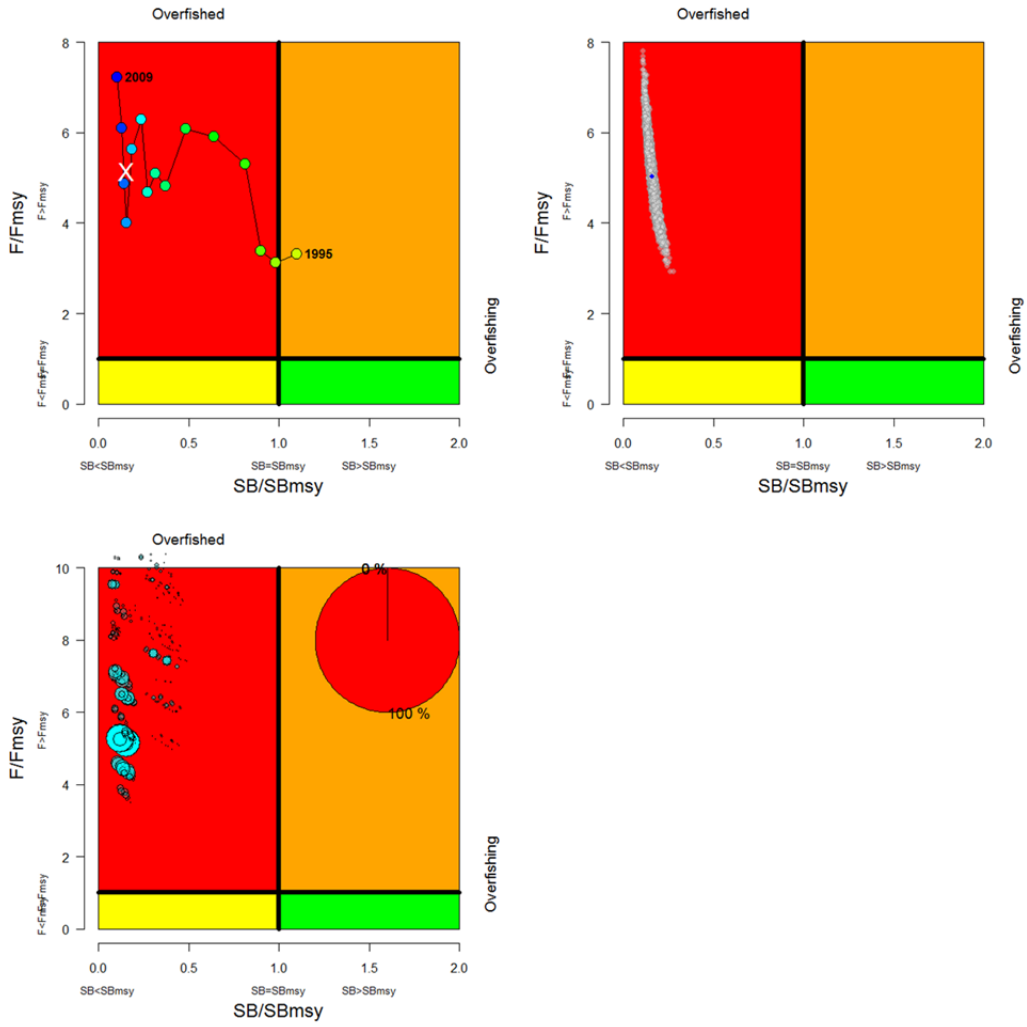


Figure OCS 4: Kobe plots indicating annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points. These present the reference model for the period 1995–2009 (top left panel), the statistical uncertainty based on the Markov chain Monte Carlo (MCMC) analysis for the current (average of 2005–2008) status (top right panel, blue dot indicates current estimates), and based on the current (average of 2005–2008) estimates for all 648 models in the grid (bottom panel). In the bottom panel, the size of the blue circles is proportional to the weight (plausibility) of the model run. The pie chart in the top right summarizes the proportion of model weight in each quadrant. Note that the y-axes range differ in the bottom plot.

Management advice and implications

50. Despite the data limitations going into the assessment, and the wide range of uncertainties considered, all of the accepted model runs indicate that the WCPO oceanic whitetip shark stock is currently overfished and overfishing is occurring relative to commonly used MSY-based reference points and depletion-based reference points. Management measures to reduce fishing mortality and to rebuild spawning biomass have been agreed to under CMM 2011-04, but mitigation to avoid capture is recommended.

51. Given the bycatch nature of most fishery impacts, mitigation measures provide the best opportunity to improve the status of the WCPO oceanic whitetip shark stock.

52. Reference points for non-target species, including oceanic whitetip sharks, should be developed as envisaged under Articles 5 and 10 of the WCPF Convention.

Silky shark

Status and trends

53. The 2012 silky shark assessment was the first assessment completed for this species. There is conflict among the different CPUE series and this conflict carries through the assessment to indicate very different management implications. The longline bycatch series suggests significant declines in abundance (and overfishing), while models incorporating the purse-seine CPUE series resulted in unrealistically high biomass estimates, with no sustainability concerns.

54. It might be expected that the CPUE series developed on longline bycatch would be more reflective of changes in abundance than the target longline CPUE series, which is extremely spatially limited, or the purse-seine CPUE series, which has no clear measure of fishing effort. SC8 considered that the incorporation of additional existing observer data could lead to significantly different conclusions from the assessment, and therefore additional work is required. Therefore, SC8 concluded that it was not possible to determine estimates of stock status and yields.

55. SC8 noted the findings of WCPFC-SC7-2011/EB-WP-03 which state:

> "Although silky sharks have been shown to have declining catch rate trends in past studies in the Pacific, no strong trends were found in recent (2011) WCPO analyses. Nevertheless, declining size trends in two datasets, declining catch rates in these two datasets for the most recent years of the time series, and increasing removals all indicate a need for close, ongoing monitoring of indicators. Further research may allow better definition of trends and a clearer depiction of stock status."

Refining standardized CPUE and the assessment

56. There is large structural uncertainty in the silky shark assessment, which needs to be addressed in future assessments; however, the 2012 silky shark assessment represents the best available information. Conflicting trends in standardized longline (declines after 2004) and purse-seine (increases in most of the time series) fisheries require further investigation. The model fit to the highly influential bycatch longline series is poor. Particular investigation should be made on the divergence between standardized and nominal CPUE after 2004, which occurs when vessel effects are incorporated into the standardization process.

Management advice and implications

57. Noting SC8's concerns over the data conflict and potential biases in the silky shark assessment, it is not possible to provide management advice based on the assessment at this time. However, noting that some basic fishery indicators (e.g. mean lengths and some CPUE series) are showing declines in recent years, SC8 recommended no increase in fishing mortality on silky sharks.

58. Further, recognizing that the major fishery impacts relate to non-target fisheries, SC8 recommended that the Commission consider mitigation measures to reduce the impact of these non-target fisheries as a precautionary measure. SC8 also recommended that the silky shark assessment be updated to incorporate all potentially important data series.

59. Reference points for non-target species, including silky sharks, should be developed as envisaged under Articles 5 and 10 of the WCPF Convention.

MANAGEMENT ISSUES THEME

Limit reference points

60. SC8 noted the hierarchical approach to identifying the key limit reference points (LRPs) for key target species in the WCPFC recommended by SC7 and adopted by the Commission at WCPFC8.

61. SC8 recommended, noting the current level of research and the uncertainties in our knowledge on steepness, particularly on the level where recruitment overfishing may start, that LRPs for bigeye, yellowfin and South Pacific albacore be set at Level 2 with regard to the biomass-based LRP of $20\%SB_{recent,F=0}$, with deferral of a recommendation on the value of X% in the Level 2 fishing mortality-based LRP of $F_{x\%SPR}$ to SC9 (note that SPR refers to the spawning-potential-per-recruit and $SB_{recent,F=0}$ refers to the estimated average spawning biomass over a recent period in the absence of fishing). The LRP for skipjack was recommended to be set at Level 3, $20\%SB_{recent,F=0}$.

62. One CCM recommended $F_{20\%SPR}$ as an LRP for Level 2. This CCM stated that $F_{20\%SPR}$ is logically consistent with $20\%SB_{recent,F=0}$ as a means of maintaining a minimal spawning potential. This CCM noted that it is important to have LRPs for both harvest rate and depletion level to conserve spawning potential. Finally, this CCM stated that estimates of $F_{20\%SPR}$ are more robust to biological uncertainties than $20\%SB_{recent,F=0}$ because $F_{20\%SPR}$ does not require an estimate of unfished recruitment.

63. SC8 recommended that the probability of breaching an LRP should be very low.

64. SC8 recommended that the allowable risk of breaching an LRP may be applied on a species-specific basis, for example higher risk for yellowfin and bigeye tunas, but a more precautionary lower risk to skipjack and South Pacific albacore tunas.

65. SC8 noted that a range of risk levels of breaching the LRP were suggested by CCMs, with a majority of CCMs recommending a 10% level and that a lower, more precautionary value could be considered in some cases.

66. SC8 recommended that the Management Objectives Workshop review appropriate values for specifying the level of risk for individual species.

67. SC8 recommended that further work be undertaken by SPC on the identification of:

- the appropriate period for estimating the average recruitment for each species in the LRP $20\%SB_{recent,F=0}$, and
- the appropriate values of X for each species in the LRP $F_{x\%SPRo}$,

and that this work be presented to SC9 for review and for final specification of these LRPs.

68. SC8 recommended that work should continue to move all key WCPFC stocks to Level 1 reference points.

69. SC8 recommended that SPC further develop a common approach to characterization of uncertainty and estimation of risk in relation to LRPs, in order to ensure consistency in the provision of management advice to the Commission, and that this approach be reviewed at SC9.

70. SC8 further recommended that SPC present working paper SC8-MI-WP-01 to the Management Objectives Workshop, which is to be held prior to WCPFC9, for further discussion.

Target reference points and harvest control rules

71. SC8 considered working papers SC8-MI-WP-02 and SC8-MI-WP-03 on target reference points and harvest control rules, and recommended that these papers be presented to the Management Objectives Workshop, which is to be held prior to WCPFC9.

72. SC8 also recommended that in preparing information for the Management Objectives Workshop that SPC take into consideration the following:

- use of LRPs recommended by SC8;
- multi-species implications of target reference points; and
- the role for empirical indicators in the harvest control rules.

Review of CMM 2008-01

73. SC8 recommended that TCC and the Commission note the following conclusions based on analyses presented in working papers SC8-MI-WP-04 and SC8-MI-WP-06, when reviewing the effectiveness of CMM 2008-01 (and its extension under CMM 2011-01) and in the development of a revised CMM for bigeye, yellowfin and skipjack tuna stocks.

a. The limits placed on purse-seine operations have not adequately constrained total purse-seine effort, with total effort in 2011 estimated to be 31% higher compared with effort in 2004 and 46% higher than 2001–2004 levels.
b. The number of days reported with any activity related to a drifting fish aggregation device (FAD) was 16.1% in 2009, 6.8% in 2010 and 8.2% in 2011 during the FAD closure periods. The observed incidence of vessels drifting at night with fish aggregation lights on increased from 2.3% in 2009 to 6.8% in 2010 and was 3.4% in 2011.
c. Despite the FAD closure, the total estimated number of FAD sets made in 2011 was a record high, largely due to a high FAD set ratio outside of the FAD closure period and increased purse-seine effort overall. Nevertheless, several fleets (notably those from Japan, Philippines, New Zealand) have substantially changed their fishing operations, focusing more on unassociated set fishing in 2010 and 2011 than they had in the past but others remain highly dependent on FADs.
d. The catch of bigeye, small yellowfin and small skipjack tunas can be significantly reduced by purse-seine vessels switching from FAD sets to unassociated sets.
e. The total bigeye purse-seine catch during 2011 was the highest on record (77,095 mt) and only the second time that the purse-seine catch had exceeded the longline catch.
f. Available data indicates that the high-seas pocket closure since 1 January 2010 has largely been respected. Since January 2010, effort has been concentrated mainly in EEZs, with no apparent re-distribution of effort to the eastern high seas, although effort in this area could increase with the predicted return of El Niño-Southern Oscillation **(**ENSO)-neutral or El Niño conditions.
g. Closing areas and time entirely to purse-seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation, and will be less profitable to purse-seine operations as a whole.
h. The provisional longline catch of bigeye tuna in 2011 is 24% lower than 2001–2004 levels. However, in the core area of the tropical longline fishery, reduced catches have been paralleled by a decline in nominal CPUE and no apparent reduction in fishing effort, which indicate that the recent catch declines could be more the result of further declines in adult

bigeye tuna abundance than reduced fishing mortality or a shift in target species. The provisional longline catch of yellowfin tuna in 2011 is close to 2001–2004 average levels.

i. Stock projections undertaken using the reference case models for the 2011 assessments for bigeye tuna indicate that the maintenance of bigeye tuna catch and effort levels observed in the fishery in 2009 results in F/F_{MSY} remaining high, with a projected level of 1.40 in 2021. However, for the scenario best approximating the reported catch and effort in the fishery in 2010, F/F_{MSY} declines and is at a projected level of 0.96 in 2021. This is driven by several factors: lower than usual FAD use in 2010, lower longline catches, and a large (30%) reduction in reported catches from the domestic fisheries of Indonesia and the Philippines. For the scenario approximating 2011 fishery conditions, F/F_{MSY} stabilizes at a projected level of 1.29. The difference between 2010 and 2011 fishery outcomes is mainly due to the return to higher levels of FAD-based purse-seine effort in 2011.
j. For scenarios that mimic a total purse-seine closure (i.e. where FAD effort is not transferred to unassociated fishing), there is a small incremental reduction in F/F_{MSY} compared with that achieved by a FAD closure. However, this comes at a cost of substantial reductions in total catch, particularly of skipjack in the purse-seine fishery. This conclusion is robust to the use of base years from 2001 to 2009 to characterize the differences.
k. It is estimated that if the CMM was implemented without exemptions, approximately an additional half of the overfishing that is estimated to occur under the CMM as written could be removed (reduction of bigeye tuna F/F_{MSY} from 1.35 to 1.17).
l. Estimation of individual impacts on bigeye tuna F/F_{MSY} of observed levels of catch or effort for the longline, purse-seine and domestic Philippines and Indonesia fishery groups in 2009 and 2010 against a base of 2004 indicates that the reduction in purse-seine FAD effort in 2010 has the greatest effect in terms of removing overfishing (67.4% of overfishing removed) followed by the reduction in longline catch in 2010 (34.7% of the overfishing removed).

74. Based on the above observations and analyses, and noting that the fishing mortality for bigeye has not been reduced to the level intended under CMM-2008-01, SC8 supported the need for additional or alternative targeted measures to reduce fishing mortality on bigeye. In the development of a revised CMM for bigeye, yellowfin and skipjack tuna stocks, SC8 recommended that the Commission consider:

- strengthening the control of FAD activities;
- building on the apparent success of some fleets in reducing their dependence on FADs to achieve greater control of FAD activity outside the closures, including control of the number of FADs set throughout a year instead of FAD time-closures;
- reducing the total number of FAD sets to levels no greater than those in the fishery in 2010;
- clarifying the definition of limits on purse-seine effort that are applicable in different areas;
- reducing fishing mortality on bigeye tuna from the longline fishery; and
- adopting management measures that apply to all sectors of the fishery.

75. SC8 recommended that the Commission take account of the information in working paper SC8-MI-WP-05, "Mapping the distribution of the conservation burden", in its consideration of new management measures for WCPFC.

76. SC8 recommended that the Management Objectives Workshop consider the issues raised in working paper SC8-MI-WP-05.

ECOSYSTEM AND BYCATCH MITIGATION THEME

Ecosystem effects of fishing

77. SC8 reiterated the need to improve knowledge on the influence of environmental effects on tuna fisheries in order to reduce the uncertainty in short, medium and longer term projections of tuna abundance. SC8 recognized that the outcomes of the project proposed in EB-WP-01 and its supportive linkages with the ongoing development of SEAPODYM will complement the SC's work programme. SC8 recognized that this project will not require direct contributions in funds or manpower from the Commission, and endorses the development and implementation of the project if external funding can be secured.

78. SC8 noted the progress of the Kobe Technical Working Group for bycatch, and provides the following advice: a) the participation of the WCPFC Secretariat (or its delegate) in the harmonization of longline observer data is desirable; b) encourages development of the Bycatch Mitigation Information System into a tuna regional fisheries management organization (RFMO)-wide resource; and c) submission of the Agreement on the Conservation of Albatrosses and Petrels (ACAP) harmonized seabird identification guide to the WCPFC Secretariat to coordinate its review.

6.2 Sharks

79. SC8 noted the progress made in support of the Shark Research Plan while also noting that meaningful progress in some areas remains hindered by data availability and quality.

80. SC8 recommended that the Commission assist in providing or identifying funds to distribute existing shark identification guides, and promote the development of species identification guides harmonized, where appropriate, with other RFMOs in order to improve data reporting.

81. SC8, through the Commission, encouraged CCMs to adopt and promote the recording of data by their longline fleets on harmonized and sufficiently detailed longline logsheets that include key shark species.

82. SC8 recommended that the science services provider conduct a study on the spatial and temporal distribution of whale sharks in the WCPO based on observer data and other data sources as appropriate.

83. SC8 supported the finding of the science services provider that whale shark meets the basic criteria for consideration as a key shark species, and recommended that the whale shark (*Rhincodon typus*) be defined as a key shark species of WCPFC.

84. SC8 considered, discussed and adopted guidelines for the safe release of encircled animals specific to whale shark (Attachment G).

6.3 Seabirds

85. Following the review of papers presented, the SC determined that currently, there is no single mitigation measure that can reliably prevent the incidental mortality of seabirds in most pelagic longline fisheries.

86. SC8 recognized the advice from ACAP that the following seabird bycatch mitigation measures are the most effective: weighted branchlines, night setting and bird scaring lines.

87. SC8 recommended that a combination of techniques should be used, especially weighted branchlines, bird scaring lines, and night setting, which have proven most effective for reducing seabird bycatch of the seabird fauna prevalent in a particular region of concern. Other factors such as safety, practicality and the characteristics of the fishery should also be recognized.

88. SC8 recognized that different longline fleets have obtained lower interaction rates with different mitigation methods. SC8 also noted that a combination of longline deployment techniques and other gear attributes used in the Hawaii-based longline fisheries effectively reduce incidental seabird capture.

89. SC8 reiterated advice that a spatial management approach be employed for seabird mitigation and recommended that the Commission consider the following advice when it revises the seabird CMM 2007-04:

a. Southern Hemisphere
   SC8 recommended that fisheries south of 30°S are required to use at least two of these three measures: weighted branchlines, night setting and bird scaring lines. When using bird scaring lines, the descriptions outlined in SC8-EB-WP-06 should be used.
b. Northern Hemisphere
   SC8 recommended that the table in CMM 2007-04 be revised to eliminate redundancy by removing weighted branchlines and underwater setting chute in column B.
c. Branchline weighting
   With regard to branchline weighting, SC8 recognized that research in Australia (SC8-EB-WP-09 and SC8-EB-WP-10) has demonstrated that the use of at least one weight of 40 g within 50 cm of the hook, or of 45–60 g within 1 m of the hook, is more effective in quickly sinking baited hooks beyond the depths at which they may be available to seabirds. Other options using weights at greater distances from the hook are not as effective.
d. Vessel length
   SC8 recommended that the potential impacts of the North Pacific vessel size exemption be addressed. Nations conducting longline fishing in the North Pacific to the north of 23°N should provide vessels numbers for those <24 m and ≥24 m for recent years. Annual Reports-Part 1 have statistics on vessel size by gross registered tons, however statistics on vessel length should be presented to SC9.
e. Spatial management
   SC8 reiterated advice that a spatial management approach should be employed for seabird mitigation. In clearly defined areas south of 30°S and north of 23°N, exemption from the following requirements could be considered if seabird interaction rates can be scientifically demonstrated to be minimal, with observer coverage rates that are sufficient to quantify rare events in these areas. SC should determine appropriate (minimal) levels of interaction rates when representative observer data are available.
f. ROP data fields
   SC8 recommended that TCC give consideration to the inclusion of data fields on: the amount of additional weight attached to branchlines, distance between weight and hook (in meters), and the fate (dead, alive or injured) and number of seabirds for each species in each of these categories and whether the seabirds were released alive or discarded dead.

FAD bycatch and mitigation

90. SC8 supported the research objectives of the International Sustainable Seafood Foundation (ISSF) bycatch research cruises, and encourages further work by ISSF and all CCMs to: develop and test purse-seine mitigation efforts that prioritize avoidance or selective release of bycatch from the net; maximize the condition factor of released animals; and scientifically verify their post-release condition using pop-up archival tags and other technology.

Food security issues with bycatch

91. SC8 requested that the Commission's science services provider continue to produce and update the type of analysis presented in "Estimation of catches and fate of edible bycatch species taken in the equatorial purse-seine fishery" (SC8-EB-WP-18) for presentation to the SC, with analyses to include the WCPO longline fishery and to address some of the issues raised in the Next Steps section of the paper.

OTHER RESEARCH PROJECTS

West Pacific East Asia Oceanic Fisheries Management Project

92. SC8 agreed that the West Pacific East Asia Oceanic Fisheries Management (WPEAOFM) Project has contributed significantly to the Commission's data holdings for these important fisheries.

93. SC8 recommended that the WCPFC Secretariat work with the Global Environment Facility (GEF)/United Nations Development Program (UNDP) to develop a further project to continue the improvement of data collection, fisheries management and governance for tuna species in the Southeast Asian region.

Pacific Tuna Tagging Project

94. SC8 adopted SC8-RP-PTTP-01, the Summary Report of the Sixth Steering Committee Meeting for the Pacific Tuna Tagging Project, and noted the importance of tagging data for stock assessments of tropical tunas in the WCPFC Convention Area.

FUTURE WORK PROGRAMME AND BUDGET

Review of SC work programme items

95. SC8 tasked the Secretariat with updating the SC list of work programmes (SC8-GN-WP-05 [rev. 2]), in accordance with the recommendations of the ISG as specified above.

Development of 2013 work programme and budget, and projection of 2014–2015 provisional work programme and indicative budget

96. The SC Vice-Chair introduced the proposed 2012–2013 SC Work Programme and Budget and 2013–2015 SC Provisional Work Programme and Budget (SC8-GN-WP-05). He noted that the budget includes additional costs for the following functions:

- USD 75,000 for Project 60 (purse-seine species composition);
- USD 40,000 for bigeye MFCL improvements (recommended by the bigeye peer review); and
- USD 160,000 for additional resourcing for SPC for stock assessment tasks and improvements as recommended by the bigeye peer review.

97. In addition, it was noted that there was a proposal to carry over USD 30,000 from 2012 unallocated funds to apply to Project 57 (limit reference points) in 2012–2013.

98. SPC noted that, as a general rule, under the current Service Agreement for Scientific Services, it can conduct two tuna stock assessments and one shark stock assessment. Any additional work would require additional funding.

Recommendation

99. SC8 tasked the science services provider with undertaking a review of data holdings for sailfish in order to inform discussions at SC9 regarding the necessary budget for undertaking further analyses.

100. SC8 recommended that the Commission consider the proposed 2013 Scientific Committee Work Programme and Budget and the Provisional 2014–2015 Scientific Committee Work Programme and indicative Budget (SC8-GN-WP-09). SC8 also considered SPC-OFP's indicative science services for 2013–2015 (SC8-GN-WP-10). Both documents are appended as Attachment I.

101. SC8 recommended that the Commission consider extending the Shark Research Programme conducted by the science services provider beyond December 2013 when current funding from the Commission expires.

102. SC8 recommended that the Management Objectives Workshop consider continued research and associated budgets (using funds available in the unobligated budget) for Project 58 (Evaluation of Reference Points and Decision Rules) and Project 66 (Identification and Evaluation of Target Reference Points) and recommended that the Commission consider the inclusion of this research within the SC work programme and budget.

List of Scientific Committee work programme titles and budget for 2013, and indicative budget for 2014–2015, which require funding from the Commission's core budget (in USD).

Research Activity / Project with priority	2013	2014	2015
Project 14. WPEAOFM	25,000	25,000	25,000
Project 35. Refinement of bigeye parameters	70,000	75,000	75,000
Project 42. Pacific-wide tagging project	10,000	10,000	10,000
Project 57. Limit reference points	30,000		
Project 66. Target reference points			
Project 63. Harvest control rules			
Project 60. Purse-seine species composition	75,000		
Sail Fish (Data analysis)			
Peer review of Pacific bluefin tuna			
Bigeye MFCL	40,000		
Additional resourcing SPC	160,000	160,000	160,000
SUBTOTAL	410,000	270,000	270,000
UNOBLIGATED BUDGET	83,000	83,000	83,000
SPC-OFP BUDGET[1]	871,200	871,200	871,200
GRAND TOTAL	**1,364,200**	**1,224,200**	**1,224,200**

ADMINISTRATIVE MATTERS

Peer review of stock assessments

103. SC8 recommended that:

- the TOR (Attachment J, SC7 Summary Report) be adopted for future stock assessment reviews, noting that minor revision may be required to address assessment-specific issues;
- the selection procedure of a review panel developed at SC7 (paras. 580 and 581, SC7 Summary Report) be used for future peer review of stock assessments; and
- the Commission requests the Northern Committee to conduct a scientific peer review of the Pacific bluefin tuna stock assessment once it is completed.

Future operation of SC

104. SC8 agreed that future SC meeting agendas would include Data and Statistics, Stock Assessment, Management Issues and Ecosystem and Bycatch themes only.

[1] Details of the SPC-OFP science services for 2013–2015 are tabulated below.

105. SC8 adopted the guidelines for the SC Chair and theme convenors contained in SC8-GN-WP-06 (Attachment J).

106. SC8 approved L. Kumoru as the new Data and Statistics Theme convenor and A. Batibasaga as one of the Ecosystem and Bycatch Theme co-convenors.

107. SC9 is provisionally scheduled for 6–14 August 2013, with a venue to be determined intersessionally and agreed on at WCPFC9.

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

Scientific Committee
Eighth Regular Session

Busan, Korea
7–15 August 2012

SUMMARY REPORT

AGENDA ITEM 1 – OPENING OF THE MEETING

1.1 Welcome address

1. The meeting was opened by the Chair of the Scientific Committee, N. Miyabe. Opening remarks were presented by the Western and Central Pacific Fisheries Commission (WCPFC) Executive Director G. Hurry, and a welcome address was delivered by J-H Son, President of Korea's National Fisheries Research and Development Institute (Attachment A).

2. Papua New Guinea (PNG), on behalf of the Eighth Regular Session of the Scientific Committee (SC8) participants, thanked J-H Son for his remarks, and the hosts, the Republic of Korea, for the excellent meeting arrangements.

3. The following WCPFC Members, Cooperating Non-Members, and Participating Territories (CCMs) attended SC8: Australia, China, Cook Islands, European Union (EU), Federated States of Micronesia (FSM), Fiji, French Polynesia, Indonesia, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Palau, Papua New Guinea (PNG), Philippines, Samoa, Solomon Islands, Chinese Taipei, Tokelau, Tonga, Tuvalu, United States of America (USA), Vanuatu, Vietnam and Wallis and Futuna. The list of participants is appended as Attachment B.

4. Observers from the following inter-governmental organizations attended SC8: Agreement on the Conservation of Albatrosses and Petrels (ACAP), Inter-American Tropical Tuna Commission (IATTC), Pacific Islands Forum Fisheries Agency (FFA), Parties to the Nauru Agreement (PNA), Secretariat of the Pacific Community (SPC), and Southeast Asian Fisheries Development Center (SEAFDEC).

5. Observers from the following non-governmental organizations attended SC8: Greenpeace, International Seafood Sustainability Foundation (ISSF), Pacific Islands Tuna Industry Association (PITIA), Pew Environment Group, and World Wide Fund for Nature (WWF).

1.2 Meeting arrangements

6. In response to a question, the Secretariat clarified that draft recommendations from the theme sessions would be circulated in hard copy format to all delegations in advance of their consideration during the SC plenary.

1.3 Issues arising from the Commission

7. The Secretariat presented working paper SC8-SC8-GN-WP-03, which lists 12 issues arising from SC7, including assessments of South Pacific swordfish, southwest Pacific striped marlin, and North Pacific striped marlin; stock assessments for sharks and evaluation of mitigation measures; seabird mitigation measures, food security of food fish, the Commission's data provision requirements, species composition of purse-seine catches, review of the SC work programme, stock assessments to be presented to SC8, including a peer review of the bigeye assessment; high priority projects for 2012; and future operation of the SC. The paper also refers to three issues arising from WCPFC8: terms of reference for the Management Issues Theme, limit reference points, and an assessment for South Pacific swordfish.

1.4 Adoption of agenda

8. It was agreed that Japan's paper on reducing fishing mortality of bigeye tuna associated with fish aggregating devices (FADs) would be discussed under Agenda Item 5.5.1.

9. One CCM requested that adequate time be provided in the agenda for brief presentations, and questions and answers, on CCM Annual Reports. The provisional agenda was adopted (Attachment C).

1.5 Reporting arrangements

10. The Secretariat explained that if time allows, the Executive Summary will be adopted along with the Summary Report on the final day of the meeting. If not, the Executive Summary will be prepared by the Secretariat and adopted through circulation. The WCPFC list of acronyms and abbreviations and the list of SC8 meeting documents are appended as Attachment D and Attachment E respectively.

1.6 Intersessional activities of the Scientific Committee

11. The Secretariat presented working paper SC8-GN-WP-04 on the intersessional activities of the SC. The paper highlighted the contribution of the WCPFC's science services provider (SPC), which produced 30 papers and reports for SC8 in addition to ongoing data collection and management work, and attendance at Commission and other meetings. It also reported on progress with seven projects within the SC's work programme, and documented the Secretariat's work in representing the Commission at various science-related meeting, progressing the Western Pacific East Asia Oceanic Fisheries Management Project, and administering the Japanese Trust Fund Programme.

AGENDA ITEM 2 – REVIEW OF FISHERIES

2.1 Overview of the western and central Pacific Ocean fisheries

12. P. Williams from SPC, and P. Terawasi from FFA, presented working paper SC8-GN-WP-01, which contains a broad description of the major fisheries in the Western and Central Pacific Fisheries Commission Statistical Area, and highlights activities during the most recent calendar year (2011), including the most recent version of catch estimates by gear type and species.

13. The provisional total Statistical Area tuna catch for 2011 was estimated at 2,244,776 mt, the lowest since 2005 and 300,000 mt less than the record in 2009 (2,544,679 mt) (Fig. 1). This catch represented 79% of the total Pacific Ocean catch of 2,833,020 mt, and 55% of the global tuna catch (the provisional estimate for 2011 is 4,077,814 mt, the lowest for 10 years). The 2011 Statistical Area catch of skipjack (1,540,189 mt – 69% of the total catch) was only the fifth highest recorded and around 215,000 mt less than the record catch of 2009 (1,756,628 mt). The Statistical Area yellowfin catch for 2011

(430,506 mt – 19%) was the lowest since 1996 and more than 170,000 mt less than the record catch taken in 2005 (602,892 mt) due to poor catches in the purse-seine fishery. The Statistical Area bigeye catch for 2011 (151,533 mt – 7%) was close to the average for the past decade. The 2011 Statistical Area albacore catch (122,548 mt – 5%) was relatively stable and close to the average for the past decade. The 2011 Statistical Area albacore catch includes catches of North and South Pacific albacore in the Statistical Area, which comprised 81% of the total Pacific Ocean albacore catch of 152,195 mt in 2011. The South Pacific albacore catch in 2011 was 75,258 mt.

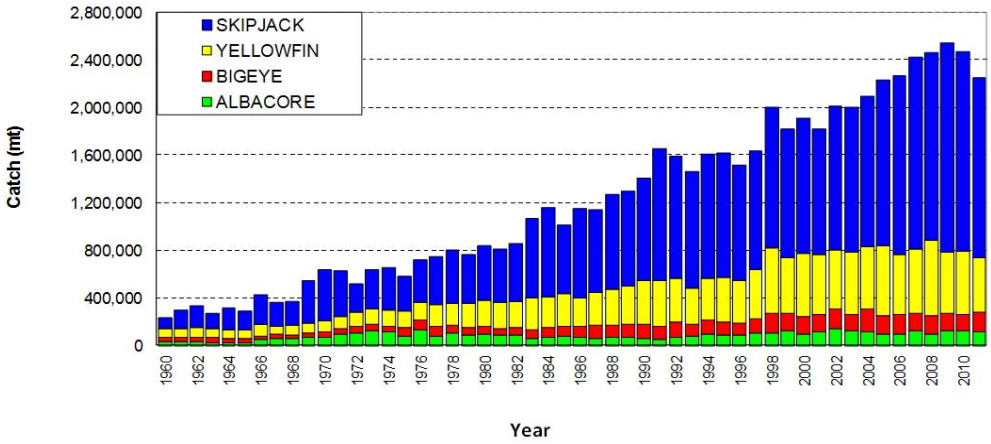


Figure 3: Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCPFC Statistical Area.

14. The provisional 2011 Statistical Area purse-seine catch of 1,688,336 mt was the lowest catch for five years and more than 220,000 mt less than the record attained in 2009 (1,919,424 mt). The 2011 purse-seine skipjack catch (1,330,667 mt) was also the lowest for five years and significantly less (nearly 200,000 mt) than the record catch in 2009. The 2011 purse-seine catch estimate for yellowfin tuna (280,251 mt – 17%) was the lowest since 1996 and significantly less (150,000+ mt) than the record catch taken in 2008 (434,149 mt). The provisional catch estimate for bigeye tuna for 2011 (77,095 mt) was among the highest on record but may be revised once all observer data for 2011 have been received and processed. The high bigeye catch in 2011 coincides with a record number of associated sets and a pulse of bigeye recruitment in the purse-seine fishery. In addition, there may have been changes in catchability in some areas of the fishery. While the purse-seine catch declined in 2011, the number of vessels and effort (both in terms of days fishing and number of sets) were at an all-time high.

15. The 2011 Statistical Area pole-and-line catch (164,416 mt) was the lowest annual catch since the mid-1960s, and continued the trend in declining catches for three decades. 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 (reduced to only 90 vessels in 2011, the lowest on record).

16. The Solomon Islands fleet recovered from low catch levels experienced in the early 2000s (only 2,773 mt in 2000 due to civil unrest), reaching a level of 10,448 mt in 2003. This fleet ceased operating in 2009, but resumed fishing in 2011 (Fig. 2).

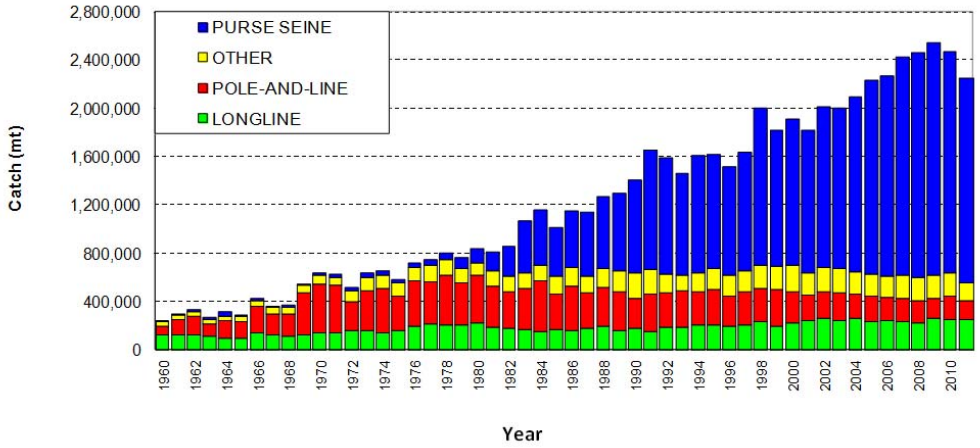


Figure 4: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the WCPFC Statistical Area, by longline, pole-and-line, purse-seine and other gear types.

17. The provisional Statistical Area longline catch (251,298 mt) for 2011 was the fifth highest on record, at around 15,000 mt less than the highest on record attained in 2002 (266,963 mt). The Statistical Area albacore longline catch (96,219 mt – 38%) for 2011 was the second highest on record, 6,000 mt less than the record (102,763 mt in 2010). In contrast, the provisional bigeye catch (67,599 mt – 27%) for 2011 was the lowest since 1997, but may be revised upwards when final estimates are provided. The yellowfin catch for 2011 (86,187 mt – 34%) was stable but slightly higher than the average catch level for this species over the period 2000–2010.

18. The 2011 South Pacific troll albacore catch (3,119 mt) was higher than catches from the past two years, mainly due to higher catches experienced in the New Zealand domestic fishery. The New Zealand troll fleet (162 vessels catching 2,798 mt in 2011) and the USA troll fleet (6 vessels catching 321 mt in 2011) typically account for most of the albacore troll catch, with minor contributions coming from the fleets of Canada, Cook Islands and French Polynesia when their fleets are active (which was not the case in 2011).

19. In regards to the economic condition of the Statistical Area fishery, the over-riding issue with canned tuna raw materials and sashimi-grade products in 2011 was that of supply. The increasingly tight management measures with pressure for sustainably produced tuna and tuna products; relatively poor fishing conditions under the prevalence of La Niña conditions; the residual effects of global financial crises, including those in Europe; continuing high fuel and food prices, and changing consumer preferences; political disruptions in some of emerging markets; and natural disasters such as those in Japan and Thailand, all contributed to defining the supply and demand conditions during the year. Against this backdrop, prices increased to unprecedented levels in the case of canned tuna raw materials while long-stagnant, sashimi tuna product prices also increased.

20. Prices in the major markets for Statistical Area skipjack catches rose steeply in 2011. The Bangkok benchmark averaged USD 1,726/mt, a substantial 42% rise over the previous year. The Yaizu average price for skipjack was JPY 143/kg (USD 1,785)/mt, up 15% (27%) from 2010. The price trend for purse seine-caught yellowfin rose even more, with Bangkok prices up by 57% to USD 2,435/mt while the Yaizu prices averaged JPY 306/kg (USD 3,825/mt) or 21% (34% in US dollar terms).

21. The estimated delivered value of the entire purse-seine tuna catch in the Statistical Area for 2011 is USD 3,092 million, 23% higher than 2010, driven by increases in both skipjack and yellowfin values. Yellowfin values increased by 22% and skipjack by 25%.

22. The pole-and-line price at Yaizu in 2011 averaged JPY 189/kg (USD 2,362/mt) as against an average of JPY 197/kg (USD 2,239/mt) in 2010, a decline of 4% in Japanese yen terms (an improvement of 6% in US dollar terms). The estimated delivered value of the total catch in the Statistical Area pole-and-line fishery for 2011 is USD 372 million, almost the same as in 2010 caused by almost equal offsetting movements in catch (down 12%) and overall price (up 13%).

23. Japanese fresh yellowfin import prices from Oceania fell by 6% (rose 9% in US dollar terms) to JPY 889/kg (USD 11.15/kg). In USA, market prices were also higher at USD 9.07/kg. Japanese frozen bigeye import prices rose 7% (18%) to JPY 814/kg (USD 10.21/kg). The average price for fresh bigeye from Oceania declined by 9% to JPY 1,015/kg (USD 12.74/kg). USA fresh bigeye import prices were higher by 10% at USD 8.87/kg. The Bangkok albacore market benchmark price averaged USD 2,778/mt in 2011 up 11% while Thai frozen albacore import prices improved by 14% to USD 3,044/mt. The USA fresh albacore import prices increased by 8% to USD 4.56/kg.

24. The USA swordfish market price (fresh and frozen) averaged USD 8,340/mt in 2011 up 9% from 2010. The overall price trend in this US market had been trending upward since 2000. In contrast to the uptrend in prices, the volume of imports into USA had been on a gradual decline. The estimated freight on board (FOB) value of the longline swordfish catch in the Statistical Area for 2011 is USD 164 million, a moderate 3% increase on 2010 but a 17% decline from the peak of almost USD198 million in 2007.

25. The estimated delivered value of the longline tuna catch (excluding swordfish) in 2011 is USD 1,853 million, an increase of USD 145 million on the estimated value of the catch in 2010. The value of albacore catch increased by USD 18 million, bigeye by USD 37 million and yellowfin by USD 90 million.

26. The total estimated delivered value of the Statistical Area catch in 2011 is USD 5.5 billion, an increase of 15% from 2010. The purse-seine value was predominant, accounting for 56% of the total value while the longline fishery accounted for 33%. By species, skipjack represented 48% of the total value with yellowfin 29%, bigeye tuna 17% and albacore 7%.

Discussion

27. In response to questions from SC8, SPC clarified the following points relating to the western and central Pacific Ocean (WCPO) fisheries in 2011 (SC8-GN-WP-01):

- The total catch in 2011 was the lowest since 2005 (Fig. 2) and it was suggested that the main factor for the decline may have been the strong La Niña from the latter months of 2010 to the first quarter of 2011 and in late 2011. The purse-seine fishery was concentrated in a small area of the western part of the region (Fig. 9) and this may have caused local depletion.
- The catch estimate for Indonesia in 2011 was carried over from 2010 (Table 2, SC8-ST–IP–01).
- Although catches declined in 2011, the value of the catch was a record high. High prices were related to poor fishing conditions. Also, while the consumption of canned tuna in USA has declined in recent years, the consumption has increased in Europe and in emerging markets.
- In 2011, yellowfin catches were higher in Australia due to La Niña and environmental drivers of recruitment.

- Small skipjack (<30 cm), were absent from the catch in 2011 (Fig. 52 of SC8-GN-WP-01). It was suggested that this may have been due to changes in the artisanal fisheries of Indonesia and the Philippines. If the absence of small skipjack was due to recruitment, then its effect may continue for several years.
- From 2005 to 2010, the lengths of most bigeye caught by purse-seine were small, 50–80 cm, whereas in 2011, there was also a considerable catch of mid-sized fish, 90–130 cm (Fig. 62). This may reflect a pulse of bigeye recruitment. However, the data on which Figure 62 are based cover primarily the first and second quarters of 2011; length data for the second half of 2011 will provide more information in this regard.
- Skipjack catch rates for purse-seine were average in the first and second quarters, then declined in the third quarter (Fig. 20). This was due to the FAD closure, but, in contrast to previous years, catch rates remained low in the fourth quarter.
- The number of purse-seine vessels increased since 2006 (Fig. 4). It was not known whether the increase was due to recently constructed vessels.
- Estimates of purse-seine catches were based on species compositions determined from grab samples collected by observers and corrected for selectivity bias (see SC8-ST–WP–03, Case B).

28. FFA members noted that the data from 2011 confirm indications from 2010 of overall flattening and declining catches, but also noted that two years of La Niña effects may have reduced recruitment. Concentration of the fishery in the west in 2010–2011 may be causing a subregional depletion effect.

29. FFA members also reiterated their concern about the doubling of catches since 2000, declining catch per unit effort (CPUE), and an increase in effort (including the influx of vessels from the Indian Ocean, increase in domestic fleet size, and more high seas fishing) for South Pacific albacore, a fishery of special significance to many FFA members. FFA members suggested that a reduction of fishing mortality and catch of South Pacific albacore should be recommended to the Commission.

2.2 Overview of eastern Pacific Ocean fisheries

30. K. Schaefer, IATTC presented a summary of the eastern Pacific Ocean (EPO) tuna fishery and assessments of the major exploited tuna stocks (SC8-GN-WP-02).

31. The fishing capacity of the purse-seine fleet fishing in the EPO increased rapidly during 1995 to 2005, but has been fairly steady since about 2006. The reported nominal longline effort has fluctuated between about 300 million hooks and 100 million hooks set annually over the past 30 years. Since the highest peak in 2002–2003 of about 300 million hooks there has been a distinct decline to about 100 million hooks. Total tuna catches increased starting in 1996, peaked in 2003, and in 2011 were close to the average of the past eight years.

32. 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, a slight increase in 2009 and 2010, and again a decline in 2011. The 2011 catch on dolphin-associated schools decreased from the previous two years. Catches of yellowfin in unassociated schools in 2011 remained low, similar to the past six years. The current stock assessment method being used for yellowfin is Stock Synthesis 3. Since 2004, recruitment has been relatively low, although not quite as low as it was during 1977 through 1983. Recent estimates indicate that the yellowfin stock in the EPO is not overexploited ($S=S_{MSY}$), and that overfishing is not taking place ($F<F_{MSY}$). The current status of the stock is considerably more pessimistic if a stock recruitment relationship is assumed.

33. The status of the skipjack stock has been evaluated using eight different data and model-based indicators. The purse-seine catch has been significantly increasing since 1994, and in 2011 was similar to other peak years over the past decade, and just below 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. However, for 2011, this value is the highest in the past five years. Except for 2010, biomass and recruitment have been relatively high over the past several years including for 2011, and the exploitation rate has remained relatively high over the past decade. There is uncertainty about the status of skipjack tuna in the EPO, and there may be differences in the status of the stock among regions. However, there is no evidence that indicates a credible risk to the skipjack stock(s).

34. There have been substantial historical changes in the bigeye fishery in the EPO. Beginning in 1994, purse-seine catches have increased substantially to targeting tunas associated with drifting FADs in the equatorial EPO. Longline catches have been relatively low during the past 8 years versus the previous 22-year period and the estimated longline catch in 2011 of only about 25,000 mt is the lowest on record in the past 30 years. The current stock assessment method used for bigeye is Stock Synthesis 3. Recruitment estimates have been above average since around 2001. Recent estimates indicate that the bigeye stock in the EPO is not overexploited ($S>S_{MSY}$), but that overfishing is taking place ($F>F_{MSY}$). The current status of the stock is considerably more pessimistic if a stock recruitment relationship is assumed.

35. A tuna conservation resolution was adopted by IATTC in June 2011 for the three-year period (2011–2013). This includes an EPO-wide closure for purse-seine (>182 mt) fishing of 62 days in each of those years, along with a 30-day closure of a core offshore FAD fishing area. There is a special provision for class 4 vessels (182–272 mt), which permits 30 days of fishing during the EPO closure provided an observer is onboard. For longline vessels (> 24 m), the resolution includes fixed bigeye catch limits for China, Japan, Korea, and Chinese Taipei, and other CPCs[2] are required not to exceed 500 mt or their respective catches in 2001, whichever is greater.

Discussion

36. In response to questions from SC8, K. Schaefer clarified the following points relating to the EPO fisheries in 2011 (SC8-GN-WP-02):

- There appear to be periodic changes in the average level of yellowfin recruitment (Fig. B–2). It was noted that productivity regimes in recruitment indices have been explored in recent years, but they are not directly taken into consideration in management issues. The productivity regime shifts in the EPO appear to be related to the physical oceanography.
- Maps of movements of tagged bigeye (Fig. D-1) indicate less mixing between the WCPO and the EPO than indicated in the presentation given earlier by A. Punt on the review of the bigeye assessment (Agenda Item 4.1.1). However, it is difficult to generalize about movements of bigeye (and yellowfin), and levels of mixing, since they depend on when and where the fish were tagged. Tropical tuna usually remain within ~ 1,000 miles of the location where they are tagged and released. The purse-seine observer programme in the EPO has 100% coverage. The level of coverage for distant-water fishing nation longline fleets was queried; however, no information was readily available.

37. FFA members noted the value of the presentation, particularly the information on the movement of bigeye between the WCPO and EPO. FFA members also commended both IATTC and WCPFC on the data exchange agreement that is now operational.

[2] IATTC Party, cooperating non-Party, fishing entity or regional economic integration organizations are collectively called “CPCs”.

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

38. Each CCM briefly presented its Annual Report Part 1, focusing on important changes in their fisheries over the past year.[3]

Discussion

39. ACAP noted that a number of the annual reports made no mention of seabird interactions, even though interactions are known, or are highly likely to have occurred in the fleets of some CCMs who have not reported interactions. SC8 was reminded that under CMM 2007–04: "CCMs shall annually provide to the Commission, in Part 1 of their Annual Reports, all available information on interactions with seabirds, including bycatches and details of species, to enable the Scientific Committee to estimate seabird mortality in all fisheries to which the WCPF Convention applies."

40. Noting the increase in catches of North Pacific albacore from 2008 to 2010 and in 2011, some CCMs were asked whether there were any changes in those fisheries; however, information was not immediately available and the query was forwarded to SPC.

41. With regard to China's Annual Report, it was noted that the numbers of Chinese ice fresh tuna longline (IFLL) and deep frozen tuna longline (DFLL) reported to be active in 2011 was 155 and 93, respectively, whereas the total number of longline vessels reported to be active was 275 (Section 2.1, Fleet Structure, Longline). It was also noted that the catch of oceanic whitetip sharks by Chinese longline vessels in 2010 was 532 mt, whereas the catch in 2011 was 0 mt (Table 3).

42. China explained that the discrepancy in vessel numbers arose because 2011 fleet data had not been updated. The total number of longline vessels is 275, including 79 DFLL and 196 IFLL, all of which have now been reported to WCPFC. China also explained that as a result of a resolution adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT) in 2010, a poster was sent to longline operators, stating that oceanic whitetip sharks cannot be landed.

43. With regard to Fiji's Annual Report, it was noted that Table 5, Annual Estimated Catch of Species of Special Interest, 2011, reported the number of interactions ("No.") and the number of mortalities ("Dead"). It was also noted that the rate of observer coverage of the Fiji longline fleet was 3% in 2011 (Table 9).

44. With regard to the Solomon Islands' Annual Report, the map of catches by the Japanese longline fleet in the waters of the Solomon Islands (Fig. 9b) shows a marked shift in the distribution from 2010 to 2011. It was asked whether the shift was real or the result of the limited data that were available for 2011; the answer, however, was not immediately forthcoming.

45. The Annual Reports Part 1 of several CCMs were not available by the start of the meeting, and the quality of the reports submitted was highly variable. SC8, therefore, noted the need to improve the timeliness and quality of the reports.

[3] CCM Annual Reports-Part 1 for 2011 can be found on the WCPFC website on the SC8 meeting page at http://www.wcpfc.int/node/4587

2.4 Reports from regional fisheries bodies and other organizations

46. SEAFDEC reported that during the past year it has developed a draft Collaborative Research Programme on Tuna Resources in the Sulu Sulawesi Sub-regional Area as requested by SEAFDEC member countries. Specific objectives of the collaborative activity include assessing the status of tuna stocks and the maximum sustainable yield; identifying spawning and nursery grounds of tuna resources; and investigating the impacts of FADs on tuna populations. To achieve the collaborative programme, a consultation meeting will be conducted this year to finalize the work plan. It is expected that project activities will be started in 2013.

AGENDA ITEM 3 – DATA AND STATISTICS THEME

47. The Data and Statistics Theme was convened by P. Maru (Cook Islands). I. Freeman (FFA) and S. Nicol (SPC) served as rapporteurs for this session.

3.1 Data gaps

3.1.1 Data gaps of the Commission

48. P. Williams (SPC) presented working paper SC8-ST-WP-01 on the major developments over the past year with regard to filling gaps in the provision of scientific data to the Commission.

49. All CCMs with fleets active in the WCPFC Convention Area have now provided 2011 annual catch estimates. Several CCMs continue to provide estimates for the key shark species (which is in accordance with the change in the requirements to include key shark species catches) and some coastal States have begun using the new extended longline logsheets that have the provision for reporting sharks at the species level.

50. In general, the timeliness of the provision of aggregate catch and effort data continues to improve, with nearly all CCMs providing data by the deadline of 30 April 2012. The quality of aggregate data provided has also improved, with a reduction in the number of notes assigned to the aggregate data in recent years. Operational data for the EU Spanish longline fleet (2004–2011) was provided for the first time, and catch estimates for four new fleets were provided for the first time (Tuvalu longline, Wallis and Futuna longline, and Vietnam purse-seine and gill net). The IATTC-WCPFC Memorandum of Cooperation on Data Exchange has resolved the issue of gaps in aggregate longline data for the entire South Pacific Ocean, which is the area of interest for the stock assessments of albacore tuna and swordfish.

51. Key gaps in aggregate catch and effort data include missing shark species data for most CCMs, and missing aggregate catch and effort data from Indonesia. With respect to operational catch and effort data, only four main fleets are not covered by the provision of these data types, and these CCMs, therefore, need to provide estimates of catch and effort, broken down by year and exclusive economic zone (EEZ) and high seas areas, according to the rules for WCPFC scientific data provision.

52. The backlog in Regional Observer Programme (ROP) data provision and processing has improved with observer service providers and the ROP data management team becoming more settled in dealing with the requirements for 100% coverage in the purse-seine fishery. Some of the shortfall in submission of observer data to SPC is due to, *inter alia*, the rejection of problematic data for some first-time observers during the post-trip debriefing process.

53. The Western Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP), which provides support to the Philippines, Indonesia and Vietnam with respect to establishing tuna fishery data collection and management systems, is now in the last of its three-year term. Over the past year, the main developments have included: a) improved estimates of catch from the Philippines municipal hook-and-line fishery; b) for the first time, annual catch estimates for Vietnam's tuna fisheries for 2000–2011; c) for the first time, annual catch estimates for Indonesia's tuna fisheries, including catches in archipelagic waters. However, there remains significant work to improve the coverage and quality of port sampling and observer data, and the reliability of annual catch estimates for certain gear types. For Indonesia, the main data gap continues to be the lack of aggregate catch and effort data (logbook data). For the Philippines, the main data gap is the reliability of historical estimates for small-scale artisanal, hook-and-line fisheries. For Vietnam, the main data gap is the complete lack of historical annual catch estimates prior to 2000.

54. Progress was made in the past year with the attribution of catch under chartering arrangements, with a new database established to facilitate the assignment of charter nation to the catch. However, information is still sought from some flag States to ensure that double-counting of catches from chartered vessels is not occurring.

Discussion

55. FFA members thanked SPC for the information presented in working paper SC8-ST-WP-01, and reiterated previous views that full submission of high quality data is critical to the functioning of SC in terms of the ability to produce quality scientific advice. FFA members were pleased to note that this year's report indicates a gradual improvement in the amount, quality and timeliness of data that are available to the Commission. FFA members thanked and congratulated those CCMs that are highlighted in the working paper as having improved the data that they provide.

56. CCMs were encouraged by the high rate of submission of operational-level catch and effort data to WCPFC but noted that the domestic rules of some CCMs prevented the submission of operational-level data and only aggregate data were provided.

57. Japan noted that it provides operational-level data for the work of WCPFC through conducting collaborative studies with WCPFC scientists.

58. Korea noted that it will make available operational-level data for the use of stock assessment for conducting collaborative work with the scientists undertaking stock assessments.

59. SC8 noted that while making data available to scientists is not the same as the providing data to the Commission, it is a positive step forward for the stock assessment process, and SC8 thanked Korea for making its data available for use in future stock assessments.

60. Some CCMs noted that there have been improvements to recent stock assessments due to the inclusion of additional operational data, but while there are fewer gaps in the data held by the Commission, those gaps generally relate to operational data.

61. FFA members reminded all CCMs of a decision by WCPFC7 that any CCM not providing operational data must submit a data improvement plan to TCC7, explaining what the constraint to compliance is and how it is being addressed. However, no data improvement plans have been submitted to date. FFA members urged CCMs to overcome whatever national constraints they face to the provision of this information.

62. Some CCMs noted that some aspects of the Annual Reports Part 1 required access to ROP data. For CCMs requiring these data, SC was advised that CCMs need to make a formal request to the WCPFC Secretariat to provide the ROP data for their fleets according to the Commission's data dissemination rules.[4]

63. FFA members acknowledged the ongoing difficulties that SPC faces in the possible double-counting of chartered vessels' catch. FFA reminded CCMs that it is the responsibility of the chartering State to provide information on chartered vessels, therefore flag States should remove these vessels from aggregated data that they submit to the Commission to avoid double-counting for scientific purposes.

64. SC8 requested that the next Data Gaps Report include references to the relevant Commission CMMs to clarify data obligations, particularly with regard to chartered vessels.

65. It was noted that information paper SC8-ST-IP-02 states that some of the purse-seine observer data (23% for 2010 and 41% for 2011) have not yet been sent to SPC. Clarification was requested on whether: a) the rejection criteria used in the national and subregional programmes are consistent; b) SPC should handle data rejection through its data audit process; and c) there is documentation on the extent of data rejected.

66. SPC advised SC8 that it would prefer that all data be provided to SPC and that data quality control (data rejection and/or acceptance) be undertaken by SPC in collaboration with national and subregional observer programmes. SPC noted that significant effort has been placed into observer training and debriefing, which is improving data quality although continual feedback is required from the national and subregional observer programmes to understand and resolve remaining and emerging issues.

67. SC8 endorsed the recommendations in Section 3 of working paper SC8-ST-WP-01 "Enhancements to Guidelines for WCPFC Data Provision", relating to the inclusion of text to Sections 1, 3, 4 and 5 of the "Scientific data to be provided to the Commission".

Management recommendations

68. SC8 noted the request by the Commission's science services provider for CCMs to review their data provision status on WCPFC's website (http://www.wcpfc.int/statprov) to ensure the provisions of scientific data reflect what they have provided to the Commission, and to acknowledge and plan to resolve any of the gaps highlighted.

69. SC8 recognized the importance of the provision of operational-level catch and effort data for the work of the Commission, with an important example highlighted as a recommendation in an earlier SC8 presentation summarizing the outcomes of the WCPO bigeye tuna assessment peer review (refer to SC8-SA-WP-01).

70. SC8 noted that several CCMs have not provided operational catch and effort data, and none of these CCMs have submitted a Data Improvement Plan, as recommended by WCPFC7.

71. SC8 recommended the following.

a. CCMs that have not yet provided operational-level catch and effort data, to provide Data Improvement Plans to TCC8. It was also recommended that until operational catch and effort data are provided, these CCMs should provide annual catch estimates

[4] http://www.wcpfc.int/doc/data-02/rules-and-procedures-protection-access-and-dissemination-data-compiled-commission-revise

by gear type and species for waters of national jurisdiction and high seas areas separately, as per the scientific data provision rules of the Commission.

b. **Working paper SC8-ST-WP-01 Rev.1 be forwarded to TCC8 to highlight data gaps that need addressing and for use in the compliance with conservation and management measures (CCMM) process.**

c. **The Data Gaps Report should include references to relevant WCPFC CMMs to clarify data obligations of CCMs, particularly in regards to chartered vessels.**

   a. WCPFC9 adopt and include the recommended length size class intervals in Section 5 of "Scientific Data to be provided to the Commission", as follows:

   - **Skipjack tuna – 1cm**
   - **Albacore tuna – 1cm**
   - **Yellowfin tuna – ideally 1cm, but not more than 2 cm**
   - **Bigeye tuna – ideally 1cm, but not more than 2 cm**
   - **Billfish – ideally 1cm, but not more than 5 cm**

d. **WCPFC9 adopt and include the following text into Sections 1 and 5 of "Scientific data to be provided to the Commission":**
   "The statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data. Where feasible, this shall also be applied to all historical data."

e. **WCPFC9 adopt and include the following text into Sections 3, 4 and 5 of "Scientific data to be provided to the Commission":**
   "Information on operational changes in the fishery that are not an attribute in the data provided is to be listed and reported with the data provision."

3.1.2 Species composition of purse-seine catches

72. T. Lawson (SPC) presented working paper SC8-ST-WP-02 on "Collection and Evaluation of Purse-seine Species Composition (Project 60)". The number of trips covered by paired grab and spill samples under Project 60 increased from 18 in August 2011 (SC7) to 23 in August 2012 (SC8). The number of sets covered increased from 275 sets, including 248 sets on associated schools and 27 sets on unassociated schools, to 348 sets, including 266 sets on associated schools and 82 sets on unassociated schools. An additional seven trips have been completed; the data are currently being submitted to SPC and processed. Additional trips will be undertaken during the remainder of 2012 and 2013. The number of trips by vessel nationality is presented in Table 1.

Table 1: Target number of paired sampling trips determined at the Fifth Regular Session of the WCPFC Scientific Committee, and the numbers of successful and unsuccessful trips completed as of July 2012.

Vessel nationality/Arrangement	Target number of trips	Trips as of July 2012	
		Successful	Unsuccessful
FSM Arrangement	8	16	
China	2		
Japan	6	3	
Korea	8	2	4
New Zealand	2		4
Philippines	2		
Solomon Islands	2	2	
Chinese Taipei	8	1	2
United States of America	8	3	2
Vanuatu	2	3	
European Union and eastern Pacific Ocean-based fleets	2		
Total	**50**	**30**	**12**

73. Additional analyses on sampling bias that were undertaken include: a) the estimation of selectivity bias using splines was developed and applied to paired grab and spill sampling data covering 23 trips; b) the effect of layering by size during brailing on the selectivity bias was examined; c) historical grab samples were corrected with new estimates of the selectivity bias; d) a model-based approach to estimate the species composition of purse-seine catches from grab samples corrected for selectivity bias and spill samples was further developed; and e) the catches determined from the model-based estimates of the species composition were used to scale purse-seine length frequencies. The spill sampling protocol was documented and referred to the aim of spill sampling and the equipment used and the six steps of the spill sampling protocol. The dimensions of the spill sampling bin are still being determined.

74. A project in the Solomon Islands was implemented in conjunction with National Fisheries Development Ltd, to compare species compositions determined from: a) logsheets, b) grab samples, c) spill samples, d) cannery receipts and e) port samples of species and size categories landed at the cannery in Noro, Solomon Islands. The first paired sampling trip was taken in November–December 2011; 10 trips will be undertaken by 2013.

75. Funding is currently available to conduct additional paired sampling trips through the end of 2012, but additional funds will be required to conduct trips in 2013.

76. T. Lawson (SPC) also presented working paper SC8-ST-WP-03, which: a) updates the estimation of the selectivity bias of grab samples collected by observers at sea with recent paired grab and spill sampling data; b) considers the effect of layering by size during brailing on the selectivity bias; c) corrects historical grab samples with new estimates of the selectivity bias; d) further develops a model-based approach to estimate the species composition of purse-seine catches from grab samples corrected for selectivity bias and spill samples; and e) uses the catches determined from the model-based estimates of the species composition to scale purse-seine length frequencies.

77. The increase in the number of paired samples from unassociated sets that are now available has allowed for more reliable estimates of the selectivity bias for larger fish. The use of splines, rather than categorical covariates, results in continuous estimates of the bias as a function of fish length. Layering by

size during brailing is shown to occur and may be an important cause of the selectivity bias in grab samples.

78. The species compositions of purse-seine catches during 1967–2011, were estimated with models in which geographic area was included as either a) the MULTIFAN-CL (MFCL) Skipjack Areas 2 and 3 (the "low resolution" models), or b) a two-dimensional spline of latitude and longitude (the "high resolution" models). The heat maps of the effect of the latitude–longitude spline on the species composition shows that within each of the MFCL Skipjack Areas, the species composition varies considerably with location, which supports the use of the "high resolution" models to estimate species composition.

Discussion

79. Concerns were raised about the testing and potential adoption of spill sampling by ROP given the recent experience of the ISSF cruise where paired spill and grab sampling was conducted (i.e. lengthy time to process spill sample, potential for repetitive strain injury, compromising other observer duties). It was suggested that a compromise between the size of the spill sample and the necessary volume of data should be determined while incorporating other modifications such as a false bottom in the spill sample bin to reduce back strain.

80. SPC advised that the daily logs maintained by the observers that have conducted spill sampling during the 23 paired spill and grab sampling trips for which the data have been received at SPC have not indicated any issues regarding the time taken to complete spill sampling or repetitive strain injury. The spill sampling on the ISSF cruise was more intensive than that usually undertaken by observers, which most likely explains the difficulties experienced. Also, the bin used in the ISSF sampling was larger than the bins used on other spill sampling trips and this may have contributed to concerns. Regarding the practicality of an observer taking spill samples from every tenth brail as well as all other observer duties, SPC noted that several such trips have been undertaken in PNG and that this will be examined further under Project 60. Noting that Project 60 will probably terminate in 2013, SPC suggested that a long-term plan for mainstreaming spill sampling into observer duties should be developed under ROP.

81. Some CCMs acknowledged the importance of assessing observer workloads to ensure that all tasks are achievable.

82. CCMs also queried the effect of corrected and uncorrected spill and grab sampling on the estimated species composition. The importance of an accurate understanding of the catch composition of the purse-seine fleet (the largest fleet in the region) was emphasized.

83. SPC advised that significant differences in species composition are observed between sampling methods and referred CCMs to papers on this topic presented at SC6 and SC7.

84. FFA members expressed concerns about the magnitude of changes in purse-seine catch composition estimates from year to year. With recent improvements in re-estimation data and methods, statistical correction of historical datasets provides the best way forward at this time, however, longer term solutions to improve the accuracy of collected data should be examined. If spill sampling is identified as the most promising solution, options for when and how to mainstream its use in ROP should be considered. FFA members noted that practical difficulties in accurate species composition recording should not be used as an excuse for the mis-reporting of purse-seine catches. FFA members urged those CCMs identified in Table 1 of meeting paper SC8-SC8-WCPFC8-08 to collaborate with SPC and the WCPFC Secretariat to further increase the number of paired sampling trips, and that this issue be referred to the Technical Compliance Committee (TCC) for action.

85. FFA members requested Japan and SPC to collaborate to verify grab and spill sample estimates through paired sampling on Japanese vessels that employ rigorous unloading monitoring procedures when landing domestically.

86. Japan offered to assist with the development of the spill sampling methodology. On the basis that spill, or paired spill and grab, sampling has occurred on Japanese vessels, Japan offered to assist with the corresponding port sampling of species and size categories of landings to validate the accuracy of the total catch of the cruise by species as estimated through observer sampling.

87. Some CCMs requested that future versions of Tables 4 and 5 in working paper SC8-ST-WP-03 include an extra column showing the deviance explained for each parameter.

88. SC8 supported an extension of Project 60 to include further paired sampling trips and comparisons of species compositions determined from logsheets, grab samples, spill samples, cannery receipt and port sampling of landing categories of catches delivered to the cannery in Noro, Solomon Islands in 2013.

Recommendations

89. SC8 recommended the following.

a. **Meeting paper SC8-WCPFC8-08, "Plan for the improvement of the availability and use of purse-seine catch composition data", be referred to TCC8 for consideration, and to consider the broader application of spill sampling across ROP.**
b. **Future papers relating to the availability of purse-seine catch composition data should indicate the level of improvement in the accuracy of logsheet reporting of purse-seine species composition by fleet.**
c. **CCMs identified in Table 1 of meeting paper SC8-WCPFC8-08 should collaborate with SPC and the WCPFC Secretariat to further increase the number of paired sampling trips.**
d. **Project 60 be continued through 2013. The study has a target of 50 trips to be sampled, of which 35 trips will be completed by the end of 2012. The Data and Statistics Theme forwarded a 2013 budget request of USD 75,000 based on USD 5,000 per trip for the remaining 15 trips.**

3.1.3 Data issues with ISC

90. CCMs were invited to comment on the progress of data reconciliation of the Commission and ISC data holdings for North Pacific stocks to identify and address data gaps.

Discussion

91. No issues were reported for data exchange with ISC.

Recommendations

92. SC8 noted that no significant issues have arisen in the past year, and that the Commission's science services provider continue to carry out informal dialogue with ISC.

3.2 Requests from CMM 2008-01

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

93. In accordance with para. 39 of CMM 2008-01, SC8 was invited to review estimates of fishing effort or proposals provided by CCMs for the provision of effort data for other commercial tuna fisheries fishing for bigeye and yellowfin tuna.

Discussion

94. FFA members noted that no CCM has provided the information required under para. 39 of CMM 2008-01, and suggested that TCC consider this issue as a compliance issue.

95. SC8 noted that this issue can be discussed in the Data Gaps Report and need not be covered as a separate item on the SC agenda.

Recommendations

96. SC8 recommended that a) because no reports for "Other Commercial Tuna Fisheries Fishing for Bigeye and Yellowfin Tuna" were received, in accordance with para. 39 of CMM 2008-01, the issue be forwarded to TCC8 for consideration; and b) Agenda Item 3.2.1 be removed from future SC agendas, and be addressed in the Data Gaps Report.

3.3 Regional Observer Programme

97. SC8 was invited to consider a report on auditing ROP, issues related to scientific data collection and data gaps, and issues relating to para. 7, Annex C of CMM 2007-01.

Discussion

98. FFA members thanked the WCPFC Secretariat for the ROP audit summary, and noted that most of the minimum data fields of the Commission have been incorporated and used under the FFA/SPC observer forms. These CCMs expressed general satisfaction with the authorization of observer programmes but recognized that some have yet to comply with all standards, including those relating to data quality. FFA members also noted the need for additional financial resources to sustain Pacific Island observer programmes.

99. Some CCMs noted the importance of timely submission of quality observer data for scientific purposes and appreciated the development of the debriefing and debriefing training programmes with the help of the FFA, SPC, National Marine Fisheries Service (NMFS) and WCPFC.

100. ACAP drew CCMs' attention to working paper SC8-EP-WP-07, which will be discussed in the Ecosystem and Bycatch Theme, but relates to the Data and Statistics Theme in terms of additional data to be collected to support analyses for bycatch mitigation.

101. Some CCMs recognized that although the CMM for ROP does not specify the area of application for the 5% observer coverage for longline fisheries, longline observer coverage should be spatially and temporally representative of fishing effort. It was acknowledged that existing longline observer coverage may not be sufficient to satisfy some taxa-specific data issues.

102. The Convenor provided an update from the ROP Manager in his absence. SC8 was advised that issues relating to para. 10 of CMM 2007-01, in particular minimum vessel size, that the intersessional working group (IWG)-ROP could not reach consensus. The issue was forwarded to TCC who also could not reach consensus. The exemption has been extended to 2015.

Recommendations

103. SC8 endorsed the report on "Summary of Regional Observer Programme Audits" (SC8-ST-IP-03).

104. SC8 noted that, consistent with previous SC advice, observer coverage should be spatially and temporally representative of each fishery operating in the Convention Area.

AGENDA ITEM 4 – STOCK ASSESSMENT THEME

105. The Stock Assessment Theme was convened by J. Brodziak (USA) and M. Ogura (Japan). T. Beeching (WCPFC), S.K. Chang (Chinese Taipei), D. Itano (USA), H. Kiyofuji (Japan), P. Kleiber (USA), M. Lee (Korea), S. Nicol (SPC), H. Okamoto (Japan), K. Piner (USA), H. Ijima (Japan) and K. Uosaki (Japan) served as rapporteurs.

4.1 WCPO bigeye tuna

4.1.1 Review of research and information

a. Peer review of 2011 bigeye tuna stock assessment

106. A. Punt, Chair of the international Peer Review Panel for the bigeye tuna assessment in the WCPO, presented the findings and recommendations of the Panel, which also included Drs Jim Ianelli and Mark Maunder (SC8-SA-WP-01). The Panel's work was focused around nine terms of reference (TOR) established by the Commission. During onsite review in Noumea, New Caledonia, the Panel requested that additional model runs be conducted by the SPC scientists who conducted the assessment in order to explore the behavior of the assessment, identify potential conflicts in the data, and understand what in the data determines the scale and trend in population biomass and recruitment. The Panel identified 26 general recommendations and 12 specific recommendations related to the assessment software used for the assessment, MFCL. In general, the Panel agreed that the assessment is state-of-the-art; they were particularly impressed by the extent to which the raw data have been analyzed. The Panel noted that some of the data sources appear to be in conflict, such that re-weighting some data sources can lead to qualitatively different outcomes from the assessment.

107. Key Panel recommendations called for:

a. conducting a Pacific-wide assessment to test the assumption that a WCPO-only assessment is appropriate;
b. addressing the uncertainty related to the tagging data for eastern Australia and the early CPUE data from the Japanese longline fisheries as a priority in the next assessment; and
c. removing Japanese "training vessel" length-frequency data from the assessment until these data are better understood.

Finally, the Panel found no definite basis to select between estimating B_{MSY} based on the entire sequence of recruitment and spawning biomass estimates versus more recent values, and recommended consideration of harvest strategies based on fishing mortality as these should be robust to this uncertainty.

Discussion

108. In response to a question regarding whether the estimated increasing trend of recruitment is true and reliable, A. Punt noted that the Panel had examined this closely but no single cause of the recruitment trend was found. In response to a follow-up question regarding whether an abundance index based on purse-seine catches is useful, A. Punt considered that much more analysis would be necessary before this could be considered reliable.

109. In response to a question regarding whether the Panel considered that procedures used in the stock assessment to weight the longline CPUE indices in various regions were appropriate, A. Punt responded that the approach used thus far is sensible.

110. SPC referred SC8 to its detailed response to the Panel's recommendations contained in information paper SC8-SA-IP-02, noting that SPC accepts the recommendations in the review and is working to address them.

111. Regarding the implications of formulating management strategies on the basis of F_{MSY}, A. Punt clarified that using F_{MSY} for management does not require information of unfished recruitment or unfished biomass in comparison to using B_{MSY} and is, therefore, more robust. Also, an F_{MSY} approach does not require as much management action in response to biomass changes.

112. In response to a question regarding what criteria should be applied to determine whether a Pacific-wide assessment is needed, A. Punt suggested that recruitment trends in the WCPO alone should be contrasted with Pacific-wide trends, and if there are differences then this would imply the need for regular Pacific-wide assessments.

113. Some CCMS stated that they are comfortable with the results of the review and the finding that the SPC stock assessments are state-of-the-art and provide a good basis for management. These members asked whether the regional stock assessment results could validly be used for domestic management and whether older fishermen should be consulted to help resolve conflicts in historical data.

114. With regard to the first question, A. Punt replied in the affirmative but suggested that the influence of total catch levels, and other broad-scale factors, need to be taken into account and that it would be useful to also conduct separate assessments in national waters. He also considered that obtaining historical information through interviews with older fishermen would be useful, and noted a tendency not to scrutinize historical data as thoroughly as current data.

115. One CCM noted a preference for cooperative, on-site reviews such as this one rather than "desktop" reviews. Noting that the outcomes of the peer review would be discussed in an Informal Small Group (ISG) later during SC8, this CCM requested that A. Punt highlight the highest priority recommendations for immediate implementation.

116. A. Punt considered that determining whether a Pacific-wide assessment is needed is the most important issue, and that investigation of data conflicts should be the next priority.

117. CCMs agreed that all of the TOR were addressed by the Panel, and the responses and recommendations were reasonable. There were 26 general recommendations and 12 recommendations specific to MFCL.

118. The ISG1 drafted a table (Attachment F), showing each recommendation, an SPC response (SC8-SA-IP-02), implications for SC to consider, a suggested priority, the preferred timing (ongoing, next assessment, longer term) for completion, the agencies responsible, and applicability to other species. Budget implications were estimated at USD 160,000 annually to the science services provider to address the general recommendations, and USD 40,000 to complete MFCL recommendations. Further discussions were deferred to Agenda Item 11.2.

b. Indicator analysis

119. S. Harley (SPC) presented working paper SC8-SA-WP-02 on a compendium of fisheries indicators for the principal target tuna species of bigeye, skipjack, yellowfin, and South Pacific albacore, and for South Pacific swordfish. The fishery indicators presented here complement the information provided in full assessments, and provide the latest fishery information for stocks for which full assessments have not been conducted. The indicators that are documented include: total catch by gear type, nominal CPUE trends, spatial distribution of catch and associated trends, size composition of the catch, and trends in average size. These include data loaded into WCPFC databases on 5 July 2012.

Discussion

120. CCMs welcomed the working paper SC8-SA-WP-02 as useful in providing some information on bigeye and other species for which formal stock assessments had not been prepared this year. However, some participants sought clarification on how to interpret the trends in catch, CPUE, and area covered by the fisheries.

121. SPC, as well as some CCMs, cautioned that management actions should not be based on results outlined in the paper but rather on the results of stock assessments. In particular, it was clarified that the CPUE trends plotted in the paper were not standardized as would be the case in a stock assessment. However, an indicator approach was considered useful in providing insight into stock status when a new stock assessment was not available, and may be valuable when considering harvest control rules.

122. Specific queries were raised relating to the concentration of longline effort suggested by Figure 4, and the bigeye size class data from Indonesia and the Philippines shown in Figure 5.

123. With regard to the potential concentration of longline effort in Figure 4, SPC explained that this issue will be addressed in conjunction with the suggestion from the bigeye stock assessment peer review to consider taking spatial variation in effort into account when constructing CPUE indices. With regard to the size data from Indonesia and the Philippines, SPC clarified that these data are only for artisanal fisheries of Indonesia and the Philippines, and that longline and purse-seine fisheries data from these fleets are included in the other data categories (colors) shown in Figure 5.

124. Support was voiced for the science services provider to present similar working papers to future SC meetings, but it was suggested that the paper could be improved by a more complete explanation of the indicators and figures, and a description of the origin and processing of data presented therein.

Recommendations

125. SC8 noted that fishery indicators provide information on trends in the fishery for years when a stock assessment is not conducted. SC8 recommended that future versions of SC8-SA-WP-02 should present explanatory detail for the figures and a brief interpretation of the trends.

c. Progress report on Project 35 (Refinement of Bigeye Parameters Pacific-wide)

126. S. Nicol (SPC) presented "Bigeye tuna age, growth and reproductive biology (Project 35)" (SC8-SA-WP-03), which reported on the progress of Project 35, a three-year project to collect bigeye tuna otoliths and gonads for WCPO-wide bigeye tuna age, growth and reproductive analyses. The work plan for 2012 includes the collection of 500 otoliths and 150 gonads from the equatorial WCPO with a concentration of effort to collect gonads from the central Pacific region. As requested by SC7, an itemized budget for 2013 was presented to SC for endorsement.

Discussion

127. CCMs noted that the biological information obtained by Project 35 is important for stock assessment of bigeye, and supported its extension to skipjack, yellowfin, and striped marlin, with the caveat to avoid duplication with other biological sampling programmes. Such extension of the project would incur additional costs to gather and analyze more samples. The cost of analysis could be deferred, pending the receipt of additional funding because the biological samples in question (otoliths) do not deteriorate.

128. Some CCMs also suggested that Project 35 could be extended to additional areas such as Vietnam or even the entire Pacific.

Recommendations

129. SC8 noted the progress of Project 35 and recommended its continuation in 2013.

4.1.2 Provision of scientific information

130. SC8 noted that no stock assessment was conducted and there is no new information to inform stock status for WCPO bigeye in 2012; therefore, the stock status and trends, and management advice and implications from SC7 are still current.

4.2 WCPO yellowfin tuna

4.1.1 Review of research and information

131. S-I. Lee presented working paper SC8-SA-WP-09 on the standardization of yellowfin tuna CPUE by the Korean longline fisheries in the WCPO. This is the first attempt to estimate the standardized CPUE of yellowfin tuna by the Korean tuna longline fisheries in the WCPO. This standardization was conducted for 1978–2011, using general linear model (GLM) methods. The data used in the GLM were catch (number), effort (number of hooks) and number of hooks between floats (NHF) by year, month and 5°x5° area. Explanatory variables for the GLM analysis were year, quarter, area and NHF. The results suggested that area and quarter effects were the largest factors affecting the nominal CPUE. Standardized CPUEs generally showed a declining trend and then were stable in recent years.

Discussion

132. CCMs noted that the two regions included in the analysis are very large, which leads to the question of how the spatial distribution of the Korean longline fishery might have shifted over time. It was suggested that it would be useful to focus the analysis on core areas that have been subject to consistent fishing activity over time.

133. CCMs noted and supported the inclusion of a year-by-area interaction in the standardization. However, it was also noted that this interaction complicates the derivation of an annual CPUE index and thus the approach to deriving the annual CPUE index should be explained.

134. CCMs also suggested that it would be useful to document the changes from nominal CPUE through the various stages of the standardization. It would furthermore be useful to compare the standardized CPUE with CPUE indices from previous stock assessments.

Recommendations

135. SC8 noted Korea's CPUE analysis as a preliminary analysis, and encouraged expansion of the work because it appears to be a useful approach and may provide an index of yellowfin tuna abundance in the future.

4.1.2 Provision of scientific information

136. SC8 noted that no stock assessment was conducted and there is no new information to inform stock status for WCPO yellowfin in 2012; therefore, the stock status and trends, and management advice and implications from SC7 are still current.

4.3 WCPO skipjack tuna

4.1.1 Review of research and information

137. No new information was presented to SC8.

4.1.2 Provision of scientific information

138. SC8 noted that no stock assessment was conducted and there is no new information to inform stock status for WCPO skipjack in 2012; therefore, the stock status and trends, and management advice and implications from SC7 are still current.

4.4 South Pacific albacore

4.4.1 Review of research and information

a. Review of Project 39 (Stock Structure and Life-History Characteristics of South Pacific Albacore)

139. CCMs were referred to information paper SC8-SA-IP-15, which presented the results of a study of the population biology stock structure and life history characteristics of albacore tuna within the South Pacific.

b. Review of 2012 stock assessment (South Pacific albacore)

140. S. Hoyle (SPC) presented the 2012 stock assessment for South Pacific albacore (SC8-SA-WP-04) and referred CCMs to information paper SC8-SA-IP-14, which describes the standardization of CPUE used in the assessment. Excerpts from the Executive Summary of the assessment are provided below, as are several figures and tables regarding trends based on a reference case model and stock status based on the median of the uncertainty grid as decided by SC for the determination of current stock status and the provision of management advice.

141. The structure of the assessment model was similar to the previous (2011) assessment, but there were some substantial revisions to key datasets. In particular, revised longline CPUE indices, catch, and size data were used in the current assessment. There were also substantial changes to some of the biological parameters: the ogive defining spawning potential at age, and the growth curve. In addition, the assumed steepness for the reference model was increased from 0.75 to 0.8 to be consistent with other tuna assessments and a lognormal bias adjustment was applied to the mean recruitment estimate for reference point calculation. Cumulatively, these revisions resulted in a change in the key results from the 2011 assessment, with increases in the overall level of biomass and increases in the estimates of MSY, $B_{current}$ / B_{MSY} and $SB_{current}$ / SB_{MSY}.

142. The model currently includes only a single sex and the same growth curve for all locations, whereas albacore growth is now known to vary between sexes and with longitude (Williams et al. 2012).[5] The model results are highly sensitive to the growth curve, so this is a key source of structural uncertainty.

143. The main conclusions of the assessment are:

a. Estimated stock status based on the median of the grid is similar to 2009 and 2011 estimates (Table ALB1; Figure ALB5).
b. The fishing mortality reference point $F_{current}/F_{MSY}$ has a median estimate of 0.21 (90% CI 0.04-1.08), and on that basis we conclude that there is low risk that overfishing is occurring. The corresponding biomass-based reference points $B_{current}/\widetilde{B}_{MSY}$ and $SB_{current}/\widetilde{SB}_{MSY}$ are estimated to be above 1.0 (median 1.6 with range of 1.4–1.9, and median 2.6 with range of 1.5–5.2, respectively), and therefore the stock is not in an overfished state.
c. The median estimate of MSY from the structural sensitivity analysis (99,085 mt (46,560–215,445 mt) is comparable to recent levels of (estimated) catch from the fishery ($C_{current}$ 78,664 mt, C_{latest} 89,790 mt).
d. There is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries.
e. Longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing. These trends may be significant for management.
f. Management quantities are very sensitive to the estimated growth curve. Given that biological research indicates spatial and sex-dependent variation in growth, which is not included in the model, these uncertainties should be understood when considering estimates of management parameters.

Discussion

144. Some CCMs sought clarification on the use of life history information in the stock assessment. It was noted that model results were sensitive to the growth curve and the assessment team was asked whether it had considered other published growth curves for stock assessment.

145. SPC clarified that the current analysis includes different growth curves as alternative scenarios.

146. Some CCMs asked if the available tagging data could be used to estimate natural mortality (M).

[5] Williams A.J., Farley J.H., Hoyle S.D., Davies C.R. and Nicol S.J. 2012. Spatial and sex-specific variation in growth of albacore tuna (*Thunnus alalunga*) across the South Pacific Ocean. PLoS ONE 7: e39318. Access online at http://www.plosone.org/article/info:doi/10.1371/journal.pone.0039318

147. SPC clarified that tagging data had been used to estimate M in a previous assessment but that the M estimate was not considered to be reliable. It was also noted that this approach may be revisited in future improvements to the assessment model.

148. CCMs sought additional information on the analysis and use of CPUE information in the stock assessment. Specifically, a clarification was sought regarding which areas showed declines in CPUE in the most recent period and whether catchability for Pacific Island fleets was estimated to be increasing through time in the reference case. For fleets that switched targets, this was expected but for other fleets that had not changed targets the plausibility of the increasing catchability was questioned.

149. SPC indicated that CPUE had declined in Regions 2, 3 and 4. It was also noted that increasing efficiency of fleets in addition to target switching would influence estimates of catchability.

150. Chinese Taipei considered that albacore CPUE had declined in some regions for recent years based on the moving average CPUE series provided by SPC, which was not presented to nor discussed by SC8.

151. CCMs then asked a series of questions about data and data structure in the assessment. Further detail on whether the assessment team will reconsider model area definitions given the apparent spatial structure of the sizes of fish in the population was requested, and whether there are inconsistencies between Japanese length and weight data.

152. SPC responded that redefining model areas is always possible based on additional information or analyses. SPC explained that weight data from Japan was not used in the stock assessment.

153. CCMs then sought clarification on assessment model results. In particular, it was questioned why the time series of the estimated ratios of B to B_{MSY} was less variable than the ratio of SB to SB_{MSY} in the reference model, and whether the model scenarios in the grid should receive differential weighting.

154. SPC explained that the lower variability in B versus B_{MSY} may be due to a shift in selectivity on albacore to the largest sizes which disproportionately affected both the reference points and spawning biomass estimates. With regard to model scenario weighting, SPC indicated that although the weightings might be subjective, differential weighting might be appropriate.

155. Overall, SC endorsed the assessment results as the best available science for the basis of management. However, several CCMs, while agreeing that the assessment results were the best available science, wanted to emphasize concerns about increasing trends in catch and decreasing trends in CPUE.

4.4.2 Provision of scientific information

a. Status and trends

156. The 2012 assessment results are generally similar to, but more optimistic than those of the 2009 and 2011 assessments (Table ALB1).

157. Time trends in estimated recruitment, biomass, fishing mortality and fishery impacts are shown for the reference case model in Figures ALB1−4.

158. Key conclusions, based on the median of the grid, are that overfishing is not occurring and the stock is not in an overfished state (Fig. ALB5). Spawning potential depletion levels ($SB_{curr}/SB_{curr_{F=0}}$)

of albacore were moderate at ~37%. However, SC8 noted that depletion levels of the exploitable biomass is estimated to be between 10% and 60%, depending on the fishery, having increased sharply in recent years.

Table ALB1: Management parameters estimated from the 2012 base case (determined as the median from the structural uncertainty grid), the 2011 base case model, and the 2009 assessment, for comparison. Note that the definitions for current change through time.

Management quantity	2012 base case (grid median)	2011 base case	2009 base case	2009 median
$C_{current}$	78,664	54,520	66,869	65,801
C_{latest}	89,790	56,275		
MSY	99,085	85,130	97,610	81,580
$C_{current}$/MSY	0.79	0.64	0.69	0.80
C_{latest}/MSY	0.90	0.66		
F_{mult}	4.81	3.86		
$F_{current}/F_{MSY}$	0.21	0.26	0.25	0.29
SB_0	442,350	400,700	460,400	406,600
SB_{MSY}/SB_0	0.23	0.26	0.26	0.24
$SB_{current}/SB_0$	0.59	0.59	0.59	0.60
SB_{latest}/SB_0	0.56	0.47		
$SB_{current}/SB_{MSY}$	2.56	2.25	2.28	2.44
SB_{latest}/SB_{MSY}	2.38	1.82		
$SB_{curr}/SB_{curr_{F=0}}$	0.63	0.63	0.68	0.64
$SB_{latest}/SB_{latest_{F=0}}$	0.58	0.6		

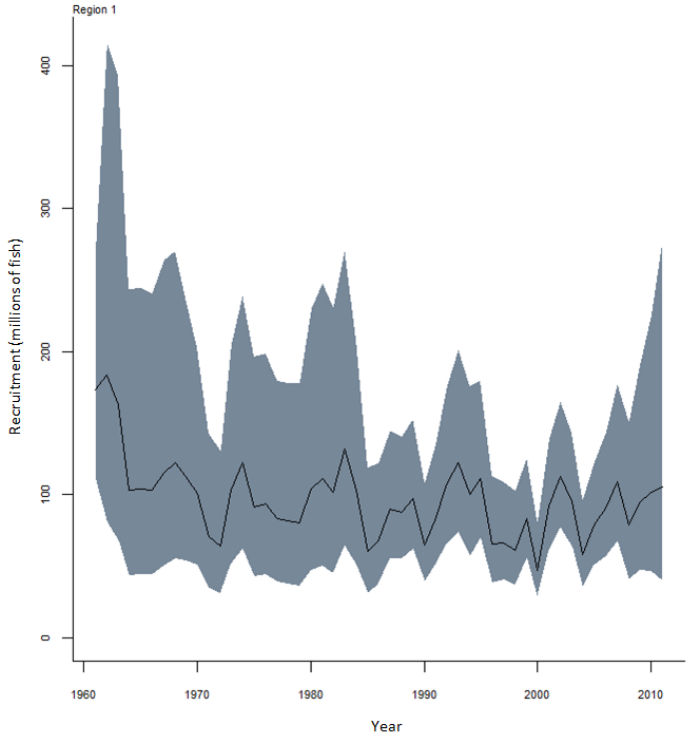


Figure ALB1: Annual recruitment (number of fish) estimates from the reference case model. Grey area represents parameter uncertainty estimated from the Hessian matrix.

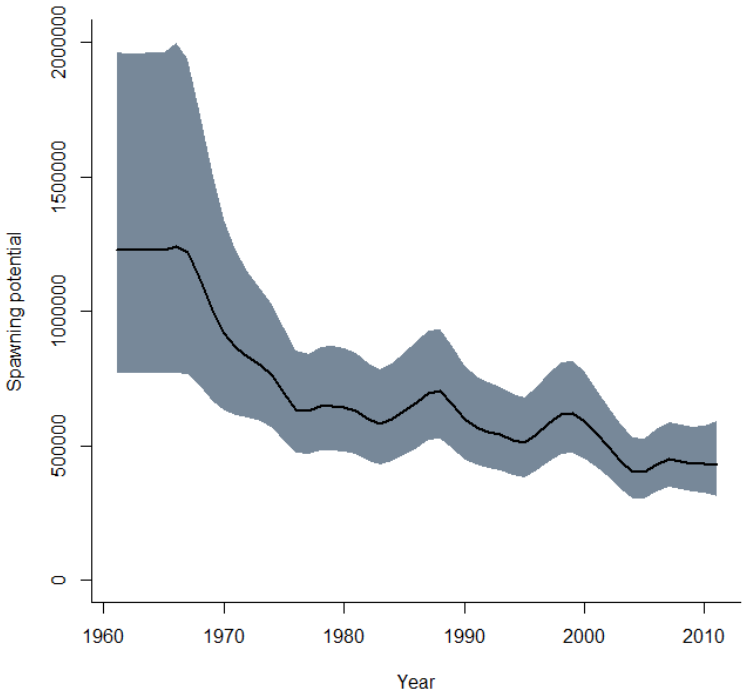


Figure ALB2: Annual estimates of spawning potential from the reference case model. Grey area represents parameter uncertainty estimated from the Hessian matrix.

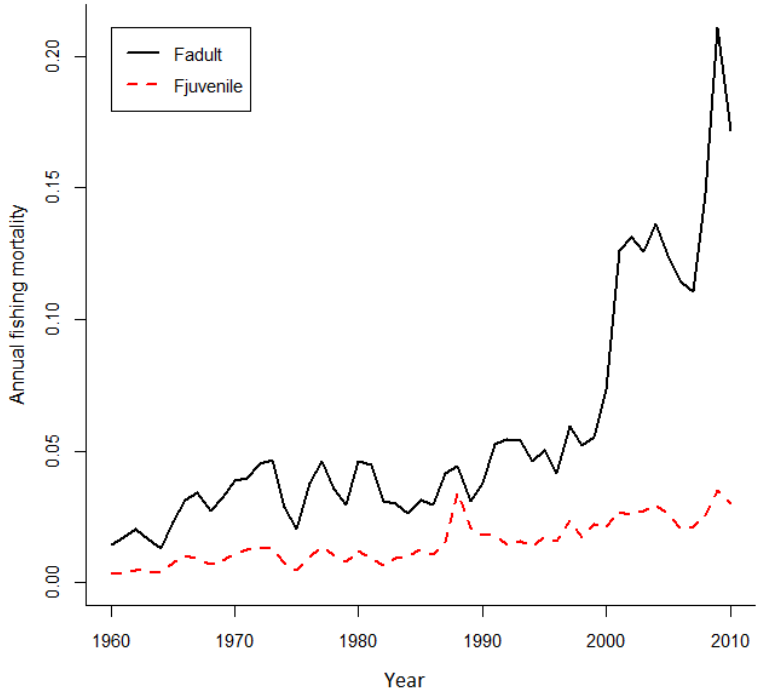


Figure ALB3: Annual estimates of fishing mortality for juvenile and adult South Pacific albacore from the reference case model.

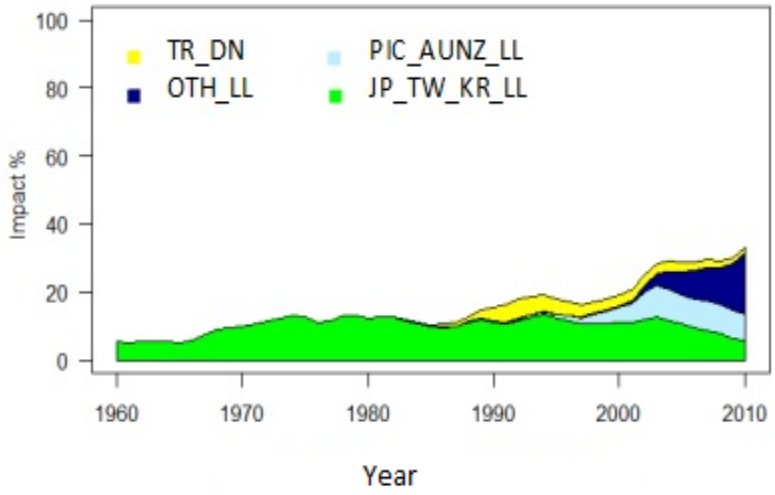


Figure ALB4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) attributed to various fishery groups (TR_DN = troll and driftnet fisheries; OTH_LL = "Other" longline fisheries; PIC_AUNZ_LL = Pacific Island, Australian and New Zealand longline fisheries; JP_TW_KR_LL = Japanese, Korean and Chinese Taipei distant-water longline fisheries).

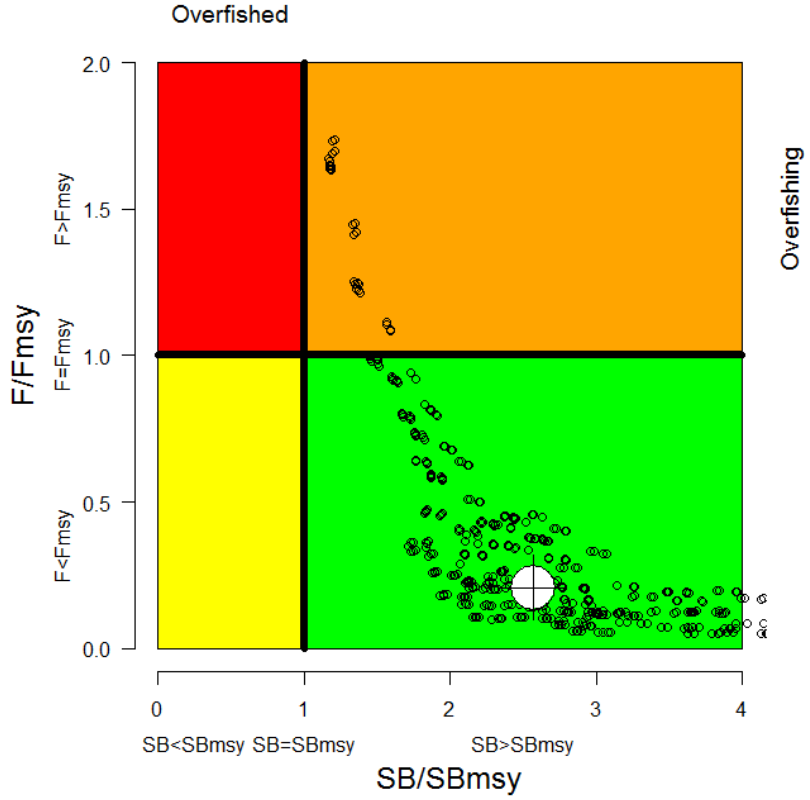


Figure ALB5: $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for 540 model runs in the uncertainty grid (black hollow circles) and the median (large white circle). Note that some grid model runs extend as far as 7 for $SB_{current}/SB_{MSY}$.

b. Management advice and implications

159. The South Pacific albacore stock is currently not overfished and overfishing is not occurring. Current biomass is sufficient to support current levels of catch. However, for several years, SC has noted that any increases in catch or effort are likely to lead to declines in catch rates in some regions, especially for longline catches of adult albacore, with associated impacts on vessel profitability. SC8 further noted that vessel activity must be managed, as per the requirements of CMM 2010-05.

160. Given the recent expansion of the fishery and recent declines in exploitable biomass available to longline fisheries, and given the importance of maintaining catch rates, SC8 recommended that longline fishing mortality be reduced if the Commission wishes to maintain economically viable catch rates.

Recommendations

161. SC8 requested that the science services provider conduct deterministic projections for South Pacific albacore to be presented to WCPFC9. Projections would be based on scalars of the 2010/2011 [final year] catches as used in the assessment. Specifically, longline scalars of 0.7 to 1.5 in 0.1 increments and scalars of 1, 2, 5 for the surface troll fishery are proposed. Outputs should be similar to those commonly reported for projections, plus information on predicted changes in vulnerable biomass. In making this request it is noted that the management advice was based on the median of the uncertainty grid and some consideration will be required of the technical approaches to be used to undertake these projections.

162. SC8 recognized the potential for analysis of trade data to reduce the uncertainty in reported catch.

4.5 South Pacific swordfish

4.5.1 Review of research and information

163. S. Harley (SPC) and P. Kleiber (USA) presented working paper SC8-SA-WP-08, which describes initial work toward preparing a stock assessment for South Pacific swordfish. CCMs were also referred to an analysis of the spatial dynamics of South Pacific swordfish based on tagging data (SC8-SA-IP-05) and a description of the data and methods used to standardize CPUE for yellowfin, bigeye, broadbill swordfish and striped marlin caught by the longline sector of the Australian Eastern Tuna and Billfish Fishery (SC8-SA-IP-13).

Discussion

164. CCMs queried whether the recent increase in catch depicted in the presentation came from inside the WCPFC Convention Area or from the IATTC Convention Area.

165. The authors clarified that the recent increases occurred in the IATTC Convention Area.

166. K. Schaefer (IATTC) noted that a swordfish-specific conservation and management measure has not been adopted in the IATTC Convention Area, but that IATTC scientists conduct swordfish stock assessments.

167. CCMs requested further explanation on the standardization of CPUE data, and in particular, on the effort used in the standardization of the Spanish fleet's CPUE.

168. The authors clarified that the effort was the number of sets, but it was also noted that the Spanish fleet typically uses 1,100 hooks per set. It was further clarified that the catch is provided in weight rather than numbers of fish.

169. CCMs also requested further explanation of other important factors necessary to standardize effort.

170. The authors noted that fishing methods (e.g. targeting) can influence catch rates of swordfish and information on these factors will be important in the standardization.

171. CCMs commented on the procedures used to filter the data used in the CPUE analysis of the Spanish data, and noted that the filtering methods resulted in a loss of a significant number of observations. Concerns were expressed regarding a loss of information about serial depletion resulting from this loss of observations.

172. The authors clarified that the filtering methods are not yet finalized and are subject to revision, but it did not appear that the filtering procedure resulted in a loss of spatial coverage of the fishery because all areas were well represented in the filtered data.

173. CCMs also questioned whether the numbers of vessels used in the analysis were affected by the filtering.

174. The authors clarified that, depending on the filtering methods, 10–28 vessels are used in the analysis. The goal of the analysis is to find a representative set of vessels to characterize changes in a population's relative abundance, and not to describe catch rates of the fleet. Based on preliminary exploration, the level of filtering in the analysis did not greatly change the results of the analysis.

175. EU noted that its understanding from the last session of the Commission was that the results of the swordfish stock assessment should be presented to WCPFC9.

176. FFA members noted that while the WCPFC8 report is currently not finalized, the draft report states that WCPFC8 agreed that the science services provider should begin work on the swordfish stock assessment and present the available results to SC8. SPC committed to commencing the initial work, describing the data and trends, presenting the interim results to SC8, and continuing the work post-SC8, as necessary. FFA members stated that there was no understanding at WCPFC8 that an assessment that had not been approved by SC would be presented to WCPFC9.

177. The importance of the study and the significant amount of work necessary to complete the stock assessment was recognized. It was noted that if it is necessary to incorporate sex structure into the stock assessment, it would entail a delay in the completion of the stock assessment. There was general consensus that an update on the progress of the assessment, including trends from CPUE, could be presented to the Commission in December. However, it was considered that all stock assessments should first be reviewed by SC before being given to the Commission.

178. EU indicated that it did not intend that recommendations on scientific matters be formulated without the participation of SC, but that such recommendations could be formulated intersessionally. It

also noted its understanding that post-SC8 work referred to work prior to WCPFC9. Otherwise, the swordfish stock assessment would have simply been deferred to SC9.

179. Some CCMs noted that intersessional review of stock assessments is not a preferred practice, except if a peer review is conducted.

Recommendations

180. SC8 recommended that, if possible, sex-specific growth and other biological parameters should be incorporated prior to undertaking the next stock assessment. SC8 recommended that SPC conduct the South Pacific swordfish stock research under the proposed work plan as follows:

- **a. finalize the development of the method of sex-specific stock assessment;**
- **b. stock assessment conducted through collaboration from EU and the results presented at SC9;and**
- **c. the science services provider will present an update on its analysis of South Pacific swordfish as a component of their stock status report to WCPFC9.**

4.5.2 Provision of scientific information

a. Status and trends

181. SC8 noted that no stock assessment was conducted for South Pacific swordfish for SC8. Therefore, the stock status description from SC5 is still current.

b. Management advice and implications

182. SC8 noted that no stock assessment was conducted for South Pacific swordfish in 2012. Therefore, the management recommendations from SC5 are still current.

183. Because there was no stock assessment conducted in 2012, SC8 recommended that the provision of management advice to the Commission be deferred to SC9.

4.6 Southwest Pacific striped marlin

4.6.1 Review of research and information

a. Review of 2012 stock assessment (Southwest Pacific Striped Marlin)

184. N. Davies presented working paper SC8-SA-WP-05, which contains the results of a stock assessment on striped marlin (*Kajikia audax*) in the southwest Pacific. SPC thanked all CCMs who contributed to the assessment, acknowledging contributions from Australia (SC8-SA-IP-07) and New Zealand (SC8-SA-IP-08), which were partially funded under WCPFC's Scientific Committee Project 64. CCMs were also referred to information paper SC8-SA-IP-09 which describes the CPUE standardization used in the southwest Pacific striped marlin stock assessment.

185. Excerpts from the stock assessment are provided below, as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice. This assessment is supported by several other analyses that are documented separately, but should be considered when reviewing this assessment as they underpin many of the fundamental inputs to the models. These include standardized CPUE analyses of aggregate Japanese and Taiwanese longline catch and effort data (Hoyle and Davies 2012); standardized

CPUE analyses of operational catch and effort data for Australian longline fishery (Campbell 2012); standardized CPUE for the recreational fisheries in Australia (Ghosn et al. 2012) and New Zealand (Holdsworth and Kendrick 2012); and new biological estimates for growth, the length-weight relationship, and maturity at age (Kopf 2009, 2011). The assessment includes a series of model runs describing stepwise changes from the 2006 assessment model (bcase06) to develop a new "reference case" model[6] (Ref.case), and then a series of "one-off" sensitivity models that represent a single change from the Ref.case model run. A subset of key model runs was taken from the sensitivities that represent a set of plausible model runs, and these were included in a structural uncertainty analysis (grid) for consideration in developing management advice.

186. Besides updating the input data to December 2011, the main developments to the inputs compared with the 2006 assessment included:

a. Japanese longline catches for 1952–2011 revised downwards by approximately 50%;
b. Nine revised and new standardized CPUE time series (with temporal coefficients of variation) derived from:
- aggregate catch and effort data for Japanese and Taiwanese longline fisheries,
- operational catch and effort data for the Australian longline fishery,
- operational catch and effort data for the Australian and New Zealand recreational fisheries, and
c. size composition data for the Australian recreational fishery.

187. The main developments to model structural assumptions were to: fix steepness at 0.8; fix growth at the published estimates; estimate spline selectivities for the main longline fisheries; estimate logistic selectivity for the Australian recreational fishery; include time-variant precision in fitting the model to standardized CPUE indices; and remove conflict among CPUE indices by taking only the Japanese longline index in Model Area 2 as being representative for the Ref.case. A summary of these and the alternative assumptions for the other key model runs are provided below.

Component	2006 assessment (bcase06)	2012 assessment (Ref.case)	2012 alternatives
Longline CPUE	Japanese and Australian indices areas 1–4, no temporal weighting of standardized effort	Japanese indices area 2 only, temporal weighting of standardized effort	- Japanese aggregate indices area 1 only - Japanese aggregate indices area 3 only - Japanese aggregate indices area 2 and Australian indices areas 2 and 3
Steepness	Estimated	Fixed = 0.8	0.65, 0.95
Selectivity	Logistic for most fisheries	Logistic for recreational fisheries only	Logistic for recreational fisheries and longline fisheries in area 3
Growth	Fixed k=0.6, estimate $L_{min,max}$	Fixed at Kopf estimates	Fixed k=0.6, estimate $L_{min,max}$
Size data	High weight	Moderate weight	Down-weighted
Natural mortality	0.4	0.4	0.2, 0.6

[6] While the Ref.case model run is designated the "reference case" 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 SC.

188. The primary factors causing the differences between the 2006 and 2012 assessments are:

- the approximately 50% reduction in Japanese longline catches over the entire model time period;
- faster growth rates;
- steepness fixed at 0.8 rather than estimated (0.546);
- selectivities for the major longline fisheries use cubic splines, and are not constrained to be asymptotic; and
- removing conflict among CPUE indices by separating conflicting indices into different models.

189. Together these changes produce an estimated absolute biomass that is around 30% lower than the 2006 base case, and MSY is estimated to be 20% lower. Current biomass levels are higher relative to MSY reference point levels.

190. The main conclusions of the current assessment (based on the median of the uncertainty grid estimates, and the plausible range of key model runs) are as follows:

a. The decreasing trend in recruitment estimated in the 2006 assessment remains a feature of the current assessment, particularly during the first 20 years. It is concurrent with large declines in catch and CPUE in the Japanese longline fishery in Model Area 2. Recruitment over the latter 40 years of the model period declines slightly.

b. Estimates of absolute biomass were sensitive to assumptions about selectivity and to conflicts among the standardized CPUE time series. The reference case model (Ref.case) estimated selectivity functions that decrease with age for the main longline fisheries that achieved the best fit to the size data. The CPUE time series for the Japanese longline fishery in Area 2 was selected for fitting the Ref.case model because this time series was considered to be the most representative of changes in overall population relative abundance. Alternative options for selectivity assumptions and the CPUE time series included in the model fit were explored in sensitivity and structural uncertainty analyses, and are presented as the key model runs.

c. Estimates of equilibrium yield and associated reference points are highly sensitive to the assumed values of natural mortality and, to a lesser extent, steepness in the stock-recruitment relationship. Estimates of stock status are, therefore, uncertain with respect to these assumptions.

d. If one considers the recruitment estimates since 1970 to be more plausible and representative of the overall productivity of the striped marlin stock than estimates of earlier recruitments, the results of the "MSY_recent" analysis could be used for formulating management advice. Under this productivity assumption MSY was 16% lower than the grid median value, but the general conclusions regarding stock status were similar.

e. Total and spawning biomass are estimated to have declined to at least 50% of their initial levels by 1970, with more gradual declines since then in both total biomass ($B_{current}/B_0$= 36%) and spawning biomass ($SB_{current}/SB_0$=29%).

f. 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, for the period 2007–2010, spawning potential is at 43% of the level predicted to exist in the absence of fishing, and for 2011 is at 46%.

g. The attribution of depletion to various fisheries or groups of fisheries indicates that the Japanese longline fisheries have impacted the population for the longest period, but this has declined to low levels since 1990. Most of the recent impacts are attributed to the "Other" group of longline fisheries in Areas 1 and 4, and to a lesser extent the "Other" and Australian fisheries in Areas 2 and 3.

h. Recent catches are 20% below the MSY level of 2182 mt. In contrast, the "MSY-recent" analysis calculates MSY to be 1839 mt, which places current catches 5% below this alternative MSY level. Based on these results, we conclude that current levels of catch are below MSY but are approaching MSY at the recent [low] levels of recruitment estimated for the last four decades.
i. Fishing mortality for adult and juvenile striped marlin is estimated to have increased continuously since the beginning of industrial tuna fishing. Apart from those model runs that assumed lower natural mortality or steepness, $F_{current}/F_{MSY}$ was estimated to be lower than 1. For the grid median, this ratio is estimated at 0.58. Based on these results, we conclude that overfishing is not occurring in the striped marlin stock.
j. The reference points that predict the status of the stock under equilibrium conditions at current F are $B_{F_{current}}/B_{MSY}$ and $SB_{F_{current}}/SB_{MSY}$. The model predicts that at equilibrium biomass and spawning biomass would increase to 129% and 144%, respectively, of the level that supports MSY. This is equivalent to 39% of virgin spawning biomass. Current stock status compared with these reference points indicates that the current total and spawning biomass are close to associated MSY levels ($B_{current}/B_{MSY} = 0.96$ and $SB_{current}/SB_{MSY} = 1.09$) based on the medians from the structural uncertainty grid. The structural uncertainty analysis indicates a 50% probability that $SB_{current} < SB_{MSY}$, and 6 of the 10 key model runs indicate the ratio to be < 1. Based on these results, and the recent trend in spawning biomass, we conclude that striped marlin is approaching an overfished state.

Discussion

191. SC8 noted that the stock assessment document includes several recommendations for future improvements and that SC8 supports these, particularly those that can be undertaken by relevant CCMs, such as tagging and greater characterization of fisheries capturing striped marlin and greater inclusion of tag-related mortality in recreational fisheries.

192. CCMs requested clarification on the meta-analysis that was undertaken for western and central North Pacific striped marlin to document plausible estimates of natural mortality.

193. SPC advised that it attended the ISC Billfish WG where a meta-analysis was presented that included a) a review of all known estimates of striped marlin steepness, including the 2006 WCPFC assessment of southwest Pacific striped marlin; b) a description of the analytical methods used; and c) a description of the data. The point estimate of steepness from the meta-analysis was M = 0.38 with a credible range of 0.3 to 0.5. Based on the results of this meta-analysis, SPC considers that the southwest Pacific striped marlin model runs where M was set to be 0.2 and 0.6 should have a low weight as they are probably outside the plausible range of natural mortality rates.

194. CCMs also requested clarification on whether the median presented was for the entire grid or only the seven key model runs, as the value presented was quite different to the reference case estimates in Table 8 of working paper SC8-SA-WP-05.

195. SPC explained that the median was for the entire grid, but offered to produce the median and range for the seven key model runs and present it to SC8.

196. CCMs queried whether catches from the extreme northeastern area of the South Pacific should be included in this assessment or whether these catches may be from an eastern stock of striped marlin.

197. SPC considered that there is limited information on the mixing of stocks in that region. However, it was also noted that the paper by Chambers (SC8-SA-IP-06, not provided to SC8) documented some tag recoveries from the western Pacific region near the Marquesas Islands.

198. CCMs noted that there are seasonal trends in the CPUE information presented for Area 2, and requested some discussion of these seasonal trends in the working paper. It was also noted that hooks between floats (HBF) information is not available for sets before 1975 and so could not be used to standardize CPUE prior to that time. It was recommended that for this reason, future analyses be undertaken to compare CPUE pre- and post-1975.

199. SPC advised that seasonal catchabilities are estimated in the model and it is assumed that the standardization averages out the impact of these effects. It also noted that CPUE standardization was improved when operational rather than aggregate data were used because targeting and vessel or gear effects can be more effectively accounted for in the standardization model.

200. Japan agreed with SPC's response and offered to continue to collaborate with SPC to improve CPUE standardization for southwest Pacific striped marlin.

201. SPC advised that the Japanese longline CPUE in Model Area 2 showed a sudden decline in the late 1990s, and this coincided with lower catches of southwest Pacific striped marlin.

202. SC8 requested clarification on whether this decline reflected operational-level changes in the fishery.

203. SPC responded that operational changes were likely to have played some role in the observed trend and noted that this was why its influence was tested in the key model runs. The observed trend was consistent with the Australian longline CPUE trend, which suggests that both trends were strongly influenced by factors other than operational changes in the fishing patterns of the Japanese longline fleet. Outputs from a key model run (i.e. a one-off sensitivity to the reference case that included the combined CPUE indices for the Japanese Model Area 2 and Australian longline Model Areas 2 and 3 in the model fit) were very similar to the reference case suggesting that this aspect of the data was not influential on the results of the assessment.

204. CCMs also requested clarification on why post-release mortalities were not included in recreational CPUE analyses and whether this was due to difficulties in re-adjusting the size data. SC8 also requested advice on whether accounting for this mortality would change the relative fisheries impact, as depicted in Figure 28 of working paper SC8-SA-WP-05.

205. SPC replied that the size data for the recreational catch was aggregated into larger bins because individual fish sizes are estimated rather than measured. SPC advised that this coarse resolution of tag-release size bins can be accommodated within the current model structure and it is unlikely that the change in the size stratification will have a large effect on model results. Although that post-release mortality has been estimated at ~25% (pers. comm., M. Musyl, US Pacific Islands Fisheries Science Center), it was unlikely that this minor mortality rate in comparison to the magnitude of commercial landings would lead to any important changes in assessment results.

4.6.2 Provision of scientific information

a. Status and trends

206. SC selected the reference case model from the assessment to characterize stock status and selected several key sensitivity runs to characterize uncertainty in trends in abundance and stock status (Figs. MLS1-MLS5 and Tables MLS1 and MLS 2). It was noted that the use of the reference case and key sensitivities selected by SC8 (see Table MLS1) leads to slightly different conclusions in terms of stock status compared with that based on the uncertainty grid used in the assessment. The reference case and five of the six other key sensitivity runs estimated $F_{current}/F_{MSY}$ to be less than one, indicating that overfishing is unlikely to be occurring. However, when considering $SB_{current}/SB_{MSY}$, the reference case and four of the six other key sensitivity runs are estimated to be less than one, indicating evidence that the stock may be overfished.

Table MLS1: Estimates of management quantities for selected stock assessment models from the 2012 Ref.case model and the six plausible key model runs. For the purpose of this assessment, "current" is the average over the period 2007–2010 and "latest" is 2011.

	Ref.case	**sel_JP_AU_3log**	**CP_JP2_AU_2_3**	**h=0.65**	**h=0.95**	**Growth_est**	**Sz_data_wt**
$C_{current}$	1758	1753	1785	1759	1759	1707	1764
C_{latest}	1522	1523	1512	1522	1522	1476	1521
MSY	2081	2017	2256	1914	2276	2182	2179
$C_{current}$/MSY	0.85	0.87	0.79	0.92	0.77	0.78	0.81
C_{latest}/MSY	0.73	0.76	0.67	0.80	0.67	0.68	0.70
F_{mult}	1.24	1.10	1.39	0.83	1.98	1.79	1.42
$F_{current}/F_{MSY}$	0.81	0.91	0.72	1.21	0.51	0.56	0.71
SB_0	15,130	14,530	16,590	16,790	14,220	15,360	16,000
SB_{MSY}/SB_0	0.27	0.27	0.27	0.32	0.22	0.28	0.26
$SB_{current}/SB_0$	0.24	0.22	0.25	0.21	0.25	0.31	0.25
SB_{latest}/SB_0	0.24	0.23	0.25	0.22	0.26	0.32	0.26
$SB_{current}/SB_{MSY}$	0.87	0.81	0.92	0.67	1.14	1.11	0.95
SB_{latest}/SB_{MSY}	0.90	0.84	0.92	0.70	1.19	1.14	1.00
$SB_{curr}/SB_{curr_{F=0}}$	0.34	0.32	0.37	0.34	0.34	0.44	0.37
$SB_{latest}/SB_{latest_{F=0}}$	0.37	0.34	0.39	0.37	0.37	0.46	0.40
Steepness (h)	0.80	0.80	0.80	0.65	0.95	0.80	0.80

Table MLS2: Comparison of southwest Pacific Ocean striped marlin reference points from the 2012 reference case model and the range of the seven models in Table MLS1; the 2006 base case model (steepness estimated as 0.51).

Management quantity	2012 assessment Ref.case (uncertainty)	2006 assessment Base case
Most recent catch	1,758 mt (2011)	1,412 mt (2004)
MSY	2,081 t (1,914–2,276)	2,610 t
$F_{current}/F_{MSY}$	0.81 (0.51–1.21)	1.25
$B_{current}/B_{MSY}$	0.83 (0.70–0.99)	0.70
$SB_{current}/SB_{MSY}$	0.87 (0.67–1.14)	0.68
$Y_{Fcurrent}$/MSY	0.99 (0.93–1.00)	0.99
$B_{current}/B_{current,\ F=0}$	0.46 (0.44–0.53)	0.53
$SB_{current}/SB_{current,\ F=0}$	0.34 (0.32–0.44)	NA

NA = not available

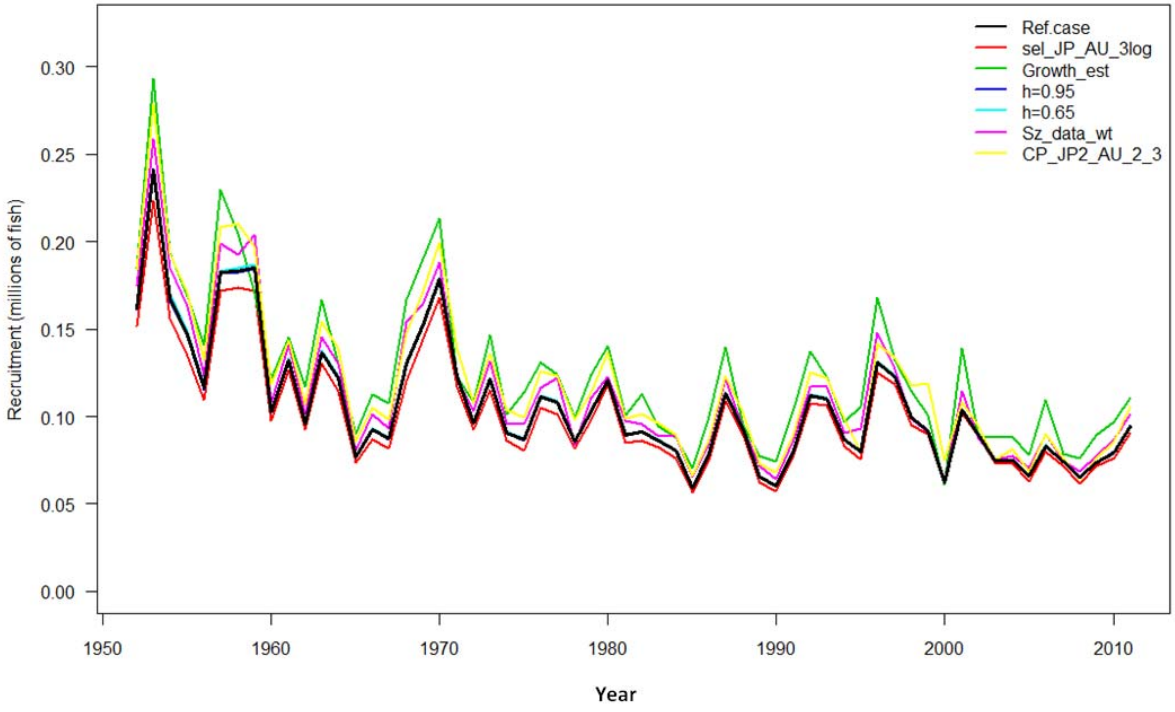


Figure MLS1: Estimated annual recruitment (millions of fish) for southwest Pacific Ocean striped marlin obtained from the Ref.case model (black line) and the six plausible key model runs.

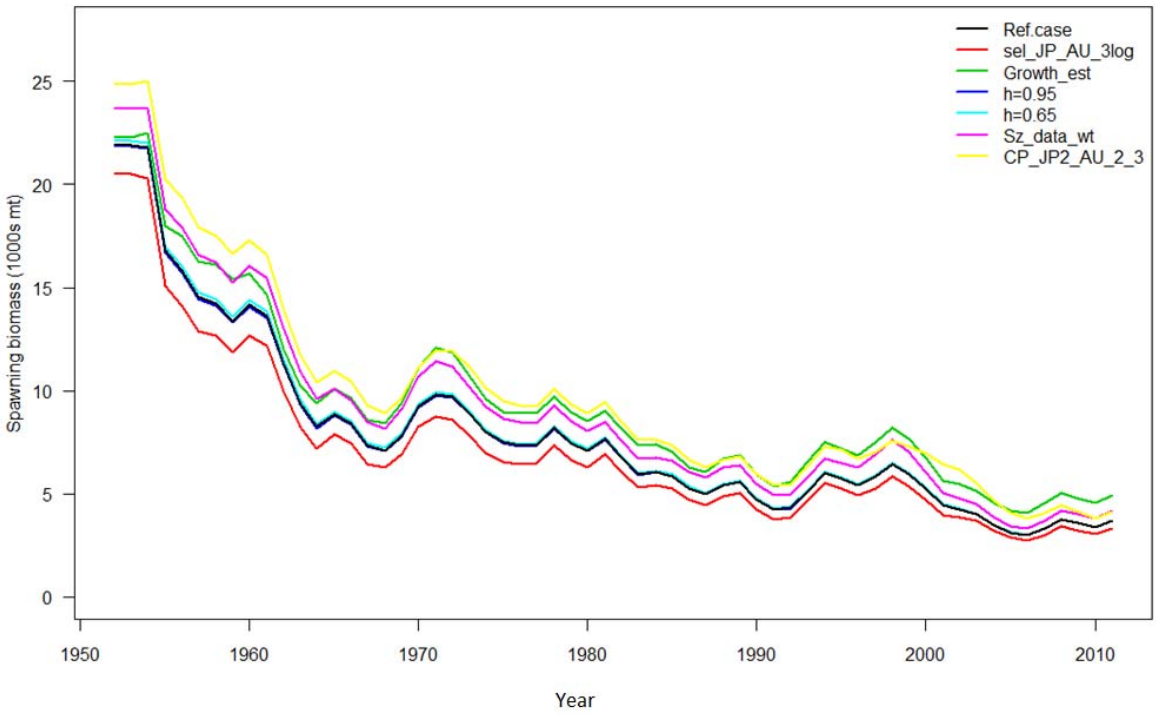


Figure MLS2: Estimated annual average spawning potential for southwest Pacific Ocean striped marlin obtained from the Ref.case model (black line) and the six plausible key model runs.

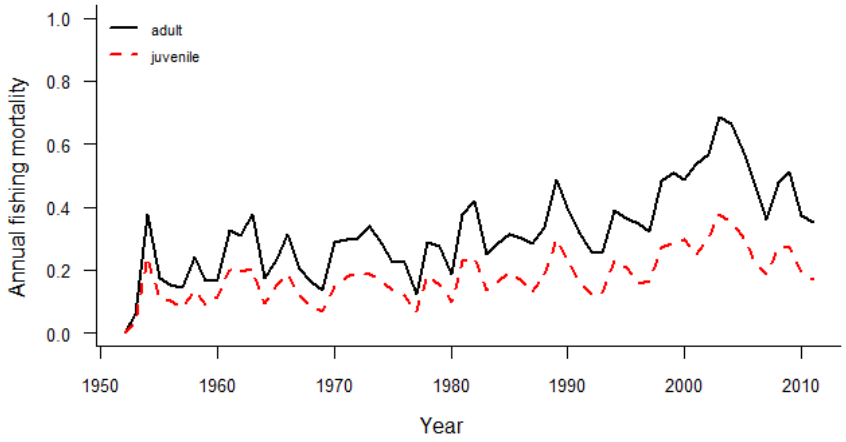


Figure MLS3: Estimated annual average juvenile and adult fishing mortality for southwest Pacific Ocean striped marlin obtained from the Ref.case model.

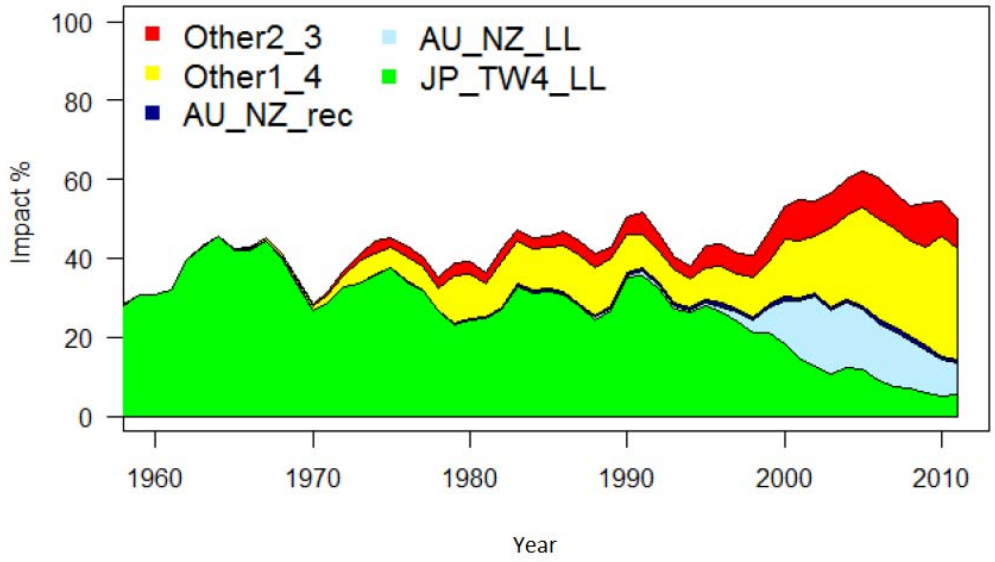


Figure MLS4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) for southwest Pacific Ocean striped marlin attributed to various fishery groups (Ref.case model). JP_TW4+LL = Japanese longline fisheries in sub-areas 1 to 4 and Taiwanese longline fishery in sub-area 4; AU_NZ_LL = Australian and New Zealand longline fisheries; AU_NZ_rec = Australian and New Zealand recreational fisheries; Other1_4 = all longline fisheries in sub-areas 1 and 4 excluding Taiwanese in sub-area 4 and excluding Japanese; Other2_3 = all longline fisheries in sub-areas 2 and 3 excluding Japanese, Australian and New Zealand.

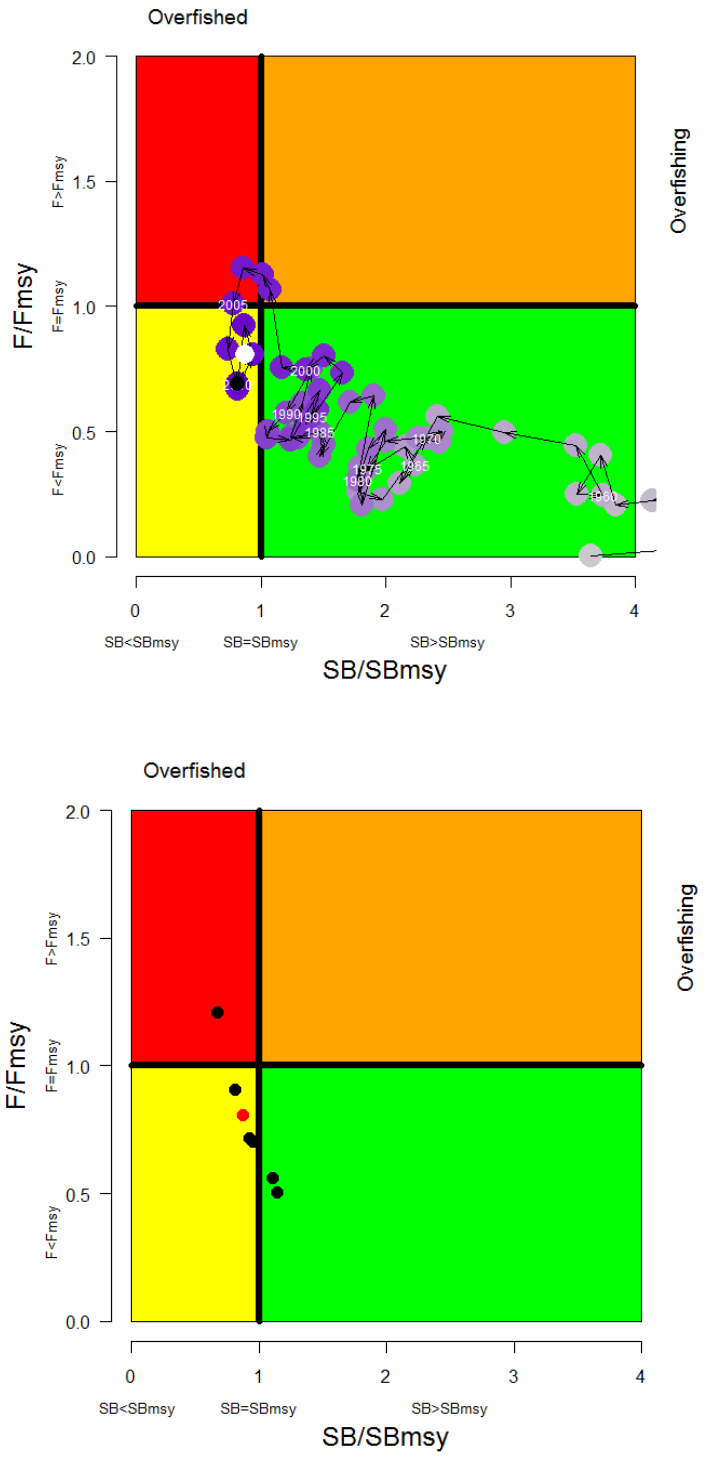


Figure MLS5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the Ref.case (top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the Ref.case (red circle) and the six plausible key model runs. See Table MLS1 to determine individual model runs.

b. Management advice and implications

207. The southwest Pacific striped marlin assessment results indicate that the stock is fully exploited, is not experiencing overfishing, but may be overfished. SC8 noted that recent catches are close to MSY, and that recent fishing mortality is slightly below F_{MSY}, and that recent spawning biomass is slightly below SB_{MSY}. The recent catch increase is driven in part by increases in catch in the northern area of the stock area that is not subject to the current CMM for this stock.

208. SC8 recommended measures to reduce the overall catch of this stock, through the expansion of the geographical scope of CMM 2006-04, in order to cover the distribution range of the stock.

209. In designing such a measure to implement this recommendation from SC8, the Commission may need to consider the historic trends in the fishery, including catch declines in the traditional central and southern areas and the recent catch increases in the northern areas.

210. SC8 recognized that striped marlin is often caught as a non-target species. SC8, therefore, recommended that data analysis be conducted to identify areas of high catch concentration that could be subject to targeted management.

4.7 North Pacific striped marlin

4.7.1 Review of research and information

a. Review of 2012 stock assessment

211. K. Piner (USA) presented the results of the stock assessment for the North Pacific striped marlin conducted by ISC (SC8-SA-WP-10 and SC8-SA-IP-16). The ISC Billfish WG conducted a new stock assessment of striped marlin in the western and central North Pacific (WCNP). The assessment area was based on a new definition of stock structure, which suggested a separate WCNP stock west of 140°W. New information on life history, catch, size composition and CPUE from the WCNP area were included in a stock synthesis model. Results of the base case model run indicate that current F=0.76 (average 2007–2009) is 24% above F_{MSY} levels and spawning stock biomass (SSB) is 35% of SB_{MSY} levels. Projections based on the base case results, which included eight potential harvest strategies, were analyzed to provide managers a range of options and likely outcomes of those options. Figures WCNPSTR1–4 and Table WCNPSTR1 contain further details of the assessment.

Table WCNPSTR1: Reported catch (mt), population biomass (mt), spawning biomass (mt), relative spawning biomass (SB/SB_{MSY}), recruitment (1,000s), fishing mortality (average ages 3 and older), relative fishing mortality (F/F_{MSY}), exploitation rate, and spawning potential ratio of western and central North Pacific striped marlin.

Year	2004	2005	2006	2007	2008	2009	2010	Mean[a]	Min[a]	Max[a]
Reported catch	4,047	3,703	3,706	3,195	3,691	2,560[b]	2,560	6,011	2,560	10,528
Population biomass	11,679	9,545	10,371	8,430	7,414	5,335	6,625	14,141	5,335	24,886
Spawning biomass[c]	1,731	2,010	1,992	1,824	1,625	1,106	938	2,439	909	5,104
Relative spawning biomass	0.64	0.74	0.73	0.67	0.60	0.41	0.35	0.90	0.33	1.88
Recruitment (age 0)	116	434	125	204	133	349	326	453	116	1,620
Fishing mortality	0.58	0.56	0.62	0.58	0.86	0.84	0.75	0.79	0.53	1.46
Relative fishing mortality	1.22	0.95	0.92	1.01	0.95	1.41	1.37	1.30	0.86	2.38
Exploitation rate	35%	39%	36%	38%	50%	48%	38%	44%	29%	69%
Spawning potential ratio	19%	19%	17%	19%	12%	13%	14%	14%	7%	21%

[a] During 1975–2010.
[b] Assumed equal to 2009 value.
[c] Female.

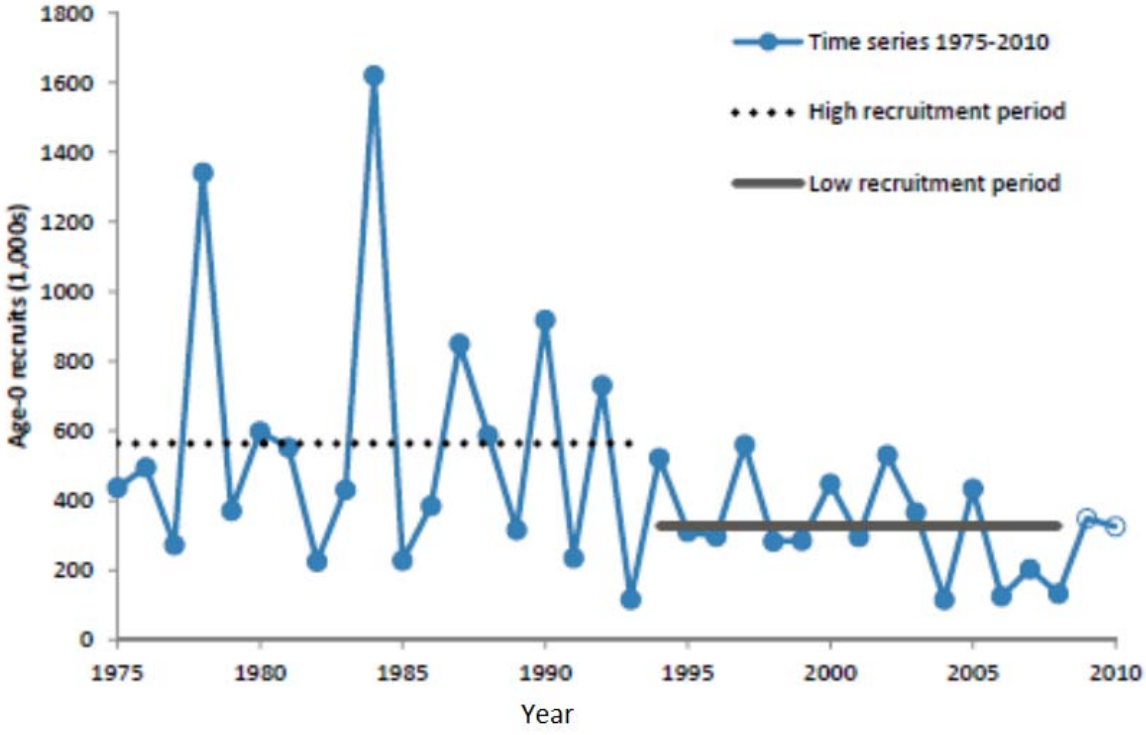
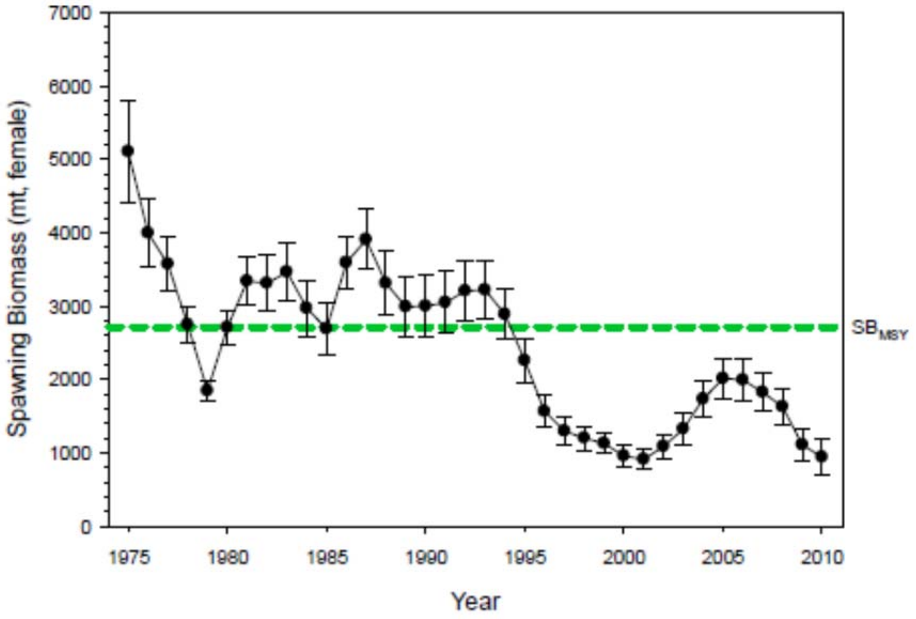


Figure WCNPSTR1: Historical trends in the recruitment of western and central North Pacific Ocean striped marlin (age-0) estimated by the SS3 base case model and the assumed periods of low recruitments used for future projection scenarios.



FigureWCNPSTR2: Trends in estimates of spawning biomass of western and central North Pacific striped marlin (*Kajikia audax*) during 1975–2010, along with 80% confidence intervals.

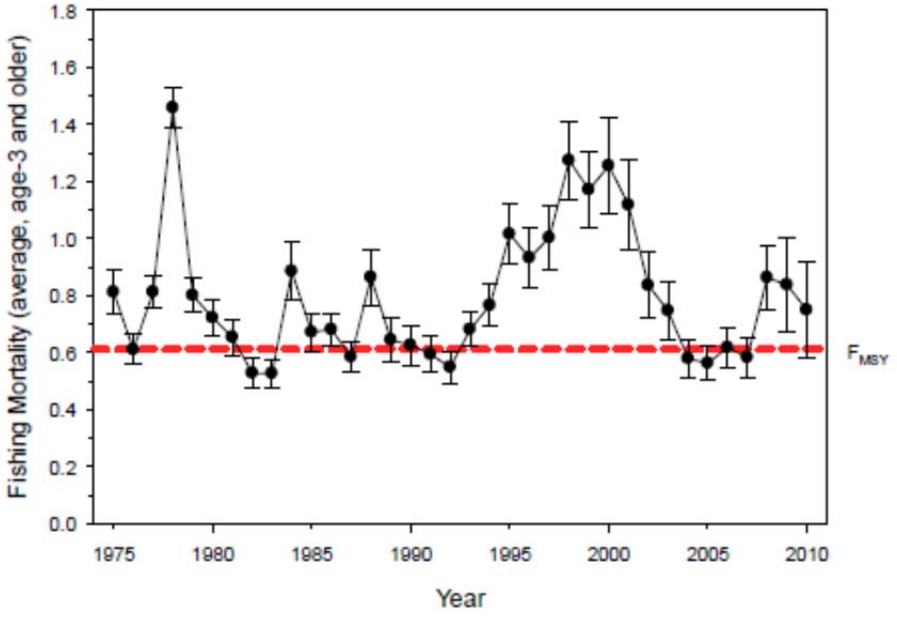


Figure WCNPSTR3: Trends in estimates of fishing mortality of western and central North Pacific striped marlin (*Kajikia audax*) during 1975–2010 along with 80% confidence intervals.

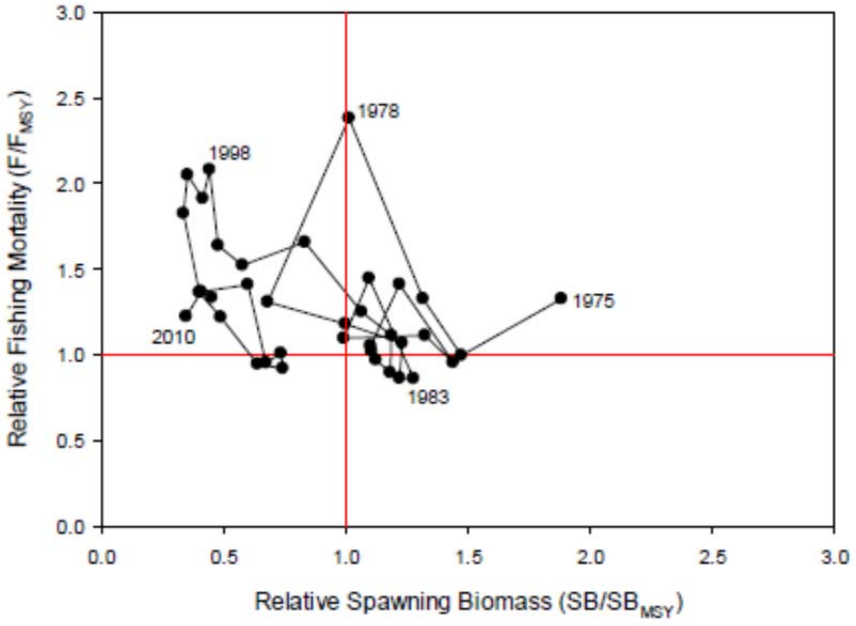


Figure WCNPSTR4: Kobe plot of the trends in estimates of relative fishing mortality and relative spawning biomass of western and central North Pacific striped marlin (*Kajikia audax*) during 1975–2010.

Discussion

212. CCMs queried whether recreational fisheries that might be expected to have asymptotic selectivity were included in the stock assessment data.

213. K. Piner responded that recreational fisheries were a minor component of the fisheries in the western and central Pacific region covered by this stock assessment, and that reliable catch and effort statistics were not available. However, it was noted that recreational fishery data were available for a Pacific-wide stock assessment of striped marlin but that the current assessment is only for the western and central north Pacific.

214. CCMs also questioned why the stock projection appeared to be optimistic even though the stock status was reported to be pessimistic.

215. K. Piner noted that the projected recruitment sets a lower limit for biomass projections, which constrains the degree of pessimism. Furthermore, the final three values in the estimated recruitment time series were negative deviations from the expected recruitment curve and were, therefore, below the recruitment level used at the onset of the projection. As a result, recruitment in the projection was higher than the most recent observations. The fact that one of harvest strategies in the set of projections coincided with the current CMM implies that the current regulation should eventually lead to improvement in stock status.

216. Despite this explanation, some CCMs expressed concern that the current CMM is not strong enough.

217. CCMs asked whether the decline in recruitment since the 1990s could be a result of changes in the environment and/or oceanographic dynamics.

218. K. Piner noted that an investigation of environmental correlates with assessment results has not yet been done. He also noted that the decline in recruitment could also have been driven by the decrease in spawning biomass to record low levels.

219. Some CCMs expressed disappointment that the assessment documents had not been made available prior to the meeting.

Recommendation

220. Noting the delay in the western and central North Pacific striped marlin assessment, and the associated lack of timely submission of assessment documents, SC8 recommended that the Commission consider tasking the science services provider with conducting the next assessment, unless ISC can demonstrate that it will prevent such delays in the future and that the ISC Chair cooperates for more timely submission of stock assessment analyses and reports.

4.7.2 Provision of scientific information

a. Status and trends

221. The western and central North Pacific striped marlin stock is overfished and experiencing overfishing. The current (2010) spawning biomass is 65% below SB_{MSY}=2,713 mt and the current fishing mortality (2007–2009) exceeds F_{MSY}=0.61 by 24% (Fig. WCNPSTR4). Reducing fishing mortality would likely increase SSB and may improve the chances of higher recruitment.

b. Management advice and implications

222. SC8 noted ISC's conservation advice for the Commission's consideration is as follows.

Noting that the last year of the model was 2010 and F_{2012} is likely to be different to $F_{current}$, current fishing mortality (average 2007–2009) is estimated to be 24% above F_{MSY}. Fishing at F_{MSY} would lead to an estimated spawning biomass increase of roughly 45–72% by 2017. Seven additional harvest scenarios were also modeled using either resampled recruitment estimates from 1994–2008, or randomly generated deviations around the assumed spawner-recruit relationship. Included in the alternative harvest scenarios were: constant catch at 2,500 mt, which represents 80% of average catches during 2007–2009; constant catch at 3,600 mt, which represents catch levels prescribed in CMM 2010-01; fishing at the current F (average 2007–2009); and fishing at the average F (2001–2003).

- **Fishing at a constant catch of 2,500 mt was estimated to increase spawning biomass by 133–223% by 2017.**
- **Fishing at a constant catch of 3,600 mt was estimated to increase spawning biomass by 48–120% by 2017.**
- **In comparison, fishing at the current (2007–2009) fishing mortality rate was estimated to increase spawning biomass by 14–29% by 2017, and fishing at the average 2001–2003 fishing mortality rate would lead to a spawning biomass decrease of 2% under recent recruitment to an increase of 6% under the stock-recruitment curve assumption by 2017.**

223. SC8 recommended that ISC conduct an additional set of projections of western and central North Pacific striped marlin based on 2012 stock assessment results. Projections should be based on

resampling only recruitment from the most recent five-year period (2004–2008). Recruitment during that period is below the average of 1994–2008, and may represent a different and more pessimistic recruitment regime than assumed in the current projections. The eight harvest scenarios examined in the 2012 stock assessment should be evaluated with this more pessimistic assumption, and an additional run using this recruitment scenario and constant catch at the 2011 level should also be included. Probabilities of stock recovery as well as trajectories of spawning biomass and catch should be documented and presented to WCPFC9.

224. Given the current pessimistic status of the stock, SC8 recommended that the Commission strengthen the existing CMM to ensure the recovery of North Pacific striped marlin, based on information provided by ISC.

4.8 Northern stocks

225. Information on northern stocks of albacore, Pacific bluefin tuna and swordfish were presented by ISC representatives.

4.8.1 North Pacific albacore tuna

4.8.1.1 Review of research and information

226. J. Brodziak (USA) presented the ISC12 conservation advice for North Pacific albacore tuna:

- The stock is considered to be healthy at average historical recruitment levels and fishing mortality ($F_{2006\text{-}2008}$).
- Sustainability is not threatened by overfishing because the $F_{2006\text{-}2008}$ level (current F) is about 71% of $F_{SSB\text{-}ATHL}$ and the stock is expected to fluctuate around the long-term median SSB (~ 400,000 mt) in the short- and long-term future.
- If future recruitment declines by about 25% below average historical recruitment levels, then the risk of SSB falling below the SSB-ATHL threshold with $F_{2006\text{-}2008}$ levels increases to 54%, indicating that the impact on the stock is unlikely to be sustainable.
- Increasing F beyond $F_{2006\text{-}2008}$ levels (current F) will not result in proportional increases in yield as a result of the population dynamics of this stock.
- The current assessment results confirm that F has declined relative to the 2006 assessment, which is consistent with the intent of the previous (2006) WG recommendation.

Discussion

227. Some CMMs questioned the reference points for the North Pacific albacore stock. In particular, it was suggested that the interim reference point $F_{ssbathl}$ is not suitable as a target reference point, and may not be suitable as an LRP.

228. Several CMMs requested that ISC update SC on the outcome of the 2011 Center for Independent Experts (CIE) peer review of the North Pacific albacore stock assessment and the ISC Billfish WG's response to that review.

229. J. Brodziak (USA) responded that the peer review documents are expected to be posted soon on ISC's website as part of the package of documents associated with the ISC12 Plenary Report.

4.8.1.2 Provision of scientific information

a. Status and trends

230. SC8 noted that no stock assessment was conducted for North Pacific albacore in 2012. Therefore, the stock status description and management recommendations from SC7 are still current.

b. Management advice and implications

231. SC8 noted that no stock assessment and management advice had been provided since SC7. Therefore, the advice from SC7 should be maintained, pending a new assessment or other new information.

4.8.2 Pacific bluefin tuna

4.8.2.1 Review of research and information

a. Review of 2012 stock assessment

232. Y. Takeuchi, chair of ISC's Pacific Bluefin Tuna Working Group (PBFWG), summarized the stock status and conservation advice for Pacific bluefin tuna as determined by ISC. Because there has been no new stock assessment since July 2010, ISC carried over its previous advice on stock status for Pacific bluefin, albeit with the precautionary note that the uncertainty in stock status has increased with the passage of time and that the condition of the stock may have deteriorated since the last assessment. Given that stock biomass may have continued to decline since the last stock assessment and because of the increased uncertainty concerning stock status, PBFWG noted it is even more important to re-emphasize the previous conservation advice. ISC12 also noted that since the last assessment (2010) there appears to be a continuing decline in stock biomass and catch rates, as was projected in the 2010 assessment.

Discussion

233. The Pew Environment Group expressed concerns about stock status, and noted the 2012 stock assessment had not been completed as planned. It was also noted that ISC does not operate with the same transparency as does SC. The Commission was requested to consider alternative ways to complete the assessment if ISC cannot complete it.

234. Another CMM requested progress reports on implementation of CMM 2010-04.

235. Several other CMMs then noted that those reports have been submitted as requested.

4.8.2.2 Provision of scientific information

a. Status and trends

236. SC8 noted that no stock assessment was conducted for Pacific bluefin tuna in 2012. Therefore, the stock status description and management recommendations from SC7 are still current.

b. Management advice and implications

237. SC8 noted that no stock assessment and management advice had been provided since SC7.

238. SC8 noted the following conservation advice from the ISC:

> **Until a new stock assessment result becomes available, ISC12 agreed to carry over the previous conservation advice, albeit with the precautionary note that the uncertainty in the stock status has increased through the passage of time and stock biomass may have declined since the last stock assessment. The advice on Pacific bluefin stock status from ISC11 is: "Given the conclusions of the July 2010 PBFWG workshop (ISC/10/ANNEX/07), the current (2004–2006) level of F relative to potential biological reference points, 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."**

4.8.3 North Pacific swordfish

4.8.3.1 Review of research and information

239. J. Brodziak (USA) presented the ISC12 conservation advice for North Pacific swordfish.
"The WCPO and EPO stocks of swordfish are healthy and above the level required to sustain recent catches."

4.8.3.2 Provision of scientific information

a. Status and trends

240. SC8 noted that no stock assessment was conducted for North Pacific swordfish in 2012. Therefore, the stock status description and management recommendations from SC6 are still current.

b. Management advice and implications

241. SC8 noted that no stock assessment and management advice had been provided since SC6. Therefore, the advice from SC6 should be maintained, pending a new assessment or other new information.

4.9 WCPO sharks

4.9.1 Oceanic whitetip shark

4.9.1.1 Review of research and information

242. J. Rice (SPC) presented a stock assessment of oceanic whitetip sharks in the WCPO (SC8-SA-WP-06). Excerpts from the stock assessment are provided below as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

243. This paper presents the first stock assessment of oceanic whitetip shark in the WCPO. The assessment used the stock assessment model Stock Synthesis.[7] The oceanic whitetip shark model is an age

[7] Stock Synthesis version 3.21B http://nft.nefsc.noaa.gov/Download.html

(36 years)-structured, spatially aggregated (one region) and two-sex model. The catch, effort, and size composition of catch, are grouped into four fisheries covering the time period from 1995 through 2009.

244. Oceanic whitetip sharks are most often caught as bycatch in Pacific tuna fisheries, although some directed and mixed species (sharks, tunas, billfishes) fisheries do exist. Commercial reporting of landings has been minimal, as has information regarding the targeting and fate of sharks encountered in the fisheries. Useful data on catch and effort is mostly limited to observer data held by SPC, but observer data also suffer from poor coverage, especially in the longline fishery. Therefore, multiple data gaps had to be overcome through the use of integrated stock assessment techniques and the inclusion of alternate data that reflected different states of nature.

245. Multiple models with different combinations of the input datasets and structural model hypotheses were run to assess the plausible range of stock status for oceanic whitetips. Each model was given a weight based on the plausibility of the assumptions and data used in each model. The reference case presented here was the highest weighted run. This reference case model is used as an example for presenting model diagnostics. The sensitivity of the reference model to key assumptions (i.e. regarding the stock recruitment relationship, the catch per unit effort time series, the purse-seine catch and size data) were explored via sensitivity analyses. We have reported stock status in relation to MSY-based reference points, but the actual reference points to be used to manage this stock have not yet been determined by the Commission.

246. The key conclusions of the first stock assessment for oceanic whitetip sharks in the WCPO are as follows.

a. Notwithstanding the uncertainties inherent in the input data, the catch, CPUE, and size composition data all show consistent declines over the period of the model (1995–2009).

b. This is a low fecundity species and this is reflected in the low estimated value for F_{MSY} (0.07) and high estimated value for SB_{MSY}/SB_0 (0.424). These directly impact the conclusions about overfishing and the overfished status of the stock.

c. Estimated spawning biomass, total biomass and recruitment all decline consistently throughout the period of the model. The biomass declines are driven by the CPUE series, and the recruitment decline is driven through the tight assumed relationship between spawning biomass and recruitment.

d. Estimated fishing mortality has increased to levels far in excess of F_{MSY} ($F_{CURRENT}$ / F_{MSY} = 6.5) and across all model runs undertaken estimated F values were much higher than F_{MSY} (the 5th and 95th quantiles of the grid are 3 and 20). Based on these results we conclude that overfishing is occurring.

e. Estimated spawning biomass has declined to levels far below SB_{MSY} ($SB_{CURRENT}/SB_{MSY}$ = 0.153) and across all model runs undertaken $SB_{current}$ is much lower than SB_{MSY} (the 5th and 95th quantiles of the grid are 0.082 and 0.409). Based on these results we conclude that the stock is overfished.

f. Noting that estimates of SB_0 and SB_{MSY} are particularly uncertain as the model domain begins in 1995, it is also useful to compare current stock size to that at the start of the model. Estimated spawning biomass has declined over the model period by 86% and across all model runs undertaken $SB_{CURRENT}$ is much lower than SB_{1995} (the 5th and 95th quantiles indicate a decline to 8.7% and 45.8% of SB_{1995}).

g. Current catches are lower than the MSY (2,001 versus 2,700), but this is not surprising given the estimated stock status and fishing mortality. Current (2005–2008 average) and latest (2009) catches are significantly greater than the forecast catch in 2010 under F_{MSY} conditions (230 mt).

h. The greatest impact on the stock is attributed to bycatch from the longline fishery, with lesser impacts from target longline activities and purse seining.
i. Given the bycatch nature of fishery impacts, mitigation measures provide the best opportunity to improve the status of the oceanic whitetip population. Existing observer data may provide some information on which measures would be the most effective.
j. Given recent decisions to improve logsheet catch reporting and observer coverage in the longline fishery it is recommended that an updated assessment be undertaken in 2014.

Discussion

247. CCMs questioned whether the stock assessment data from "targeted shark fisheries" included both longline fisheries data coded in the SPC database as targeting "shark and other species" and any longline sets that recorded the use of special shark lines deployed with the intent to harvest surface dwelling sharks.

248. SPC replied in the affirmative, explaining that these two criteria typically overlap in the database. Within these categories, mixed shark species dominated by silky and oceanic whitetip were most common in tropical waters, whereas mako and blue sharks were dominant at higher latitudes.

249. CCMs queried whether the nominal and standardized CPUE indices for oceanic whitetips were similar, with one CCM noting that standardized CPUE trends were noticeably lower than nominal CPUE in some cases. The necessity to further improve CPUE standardization and sensitivity model runs using nominal CPUE was highlighted. Questions regarding the effect of changes in depth of sets over time, and the higher uncertainty in catch rates prior to 2000 were also raised.

250. SPC replied that these trends were strongly influenced by vessel effects likely due to small sample sizes in some runs and that every effort should be made to collect more and higher quality data on shark catch rates and fate. It was acknowledged that some CPUE standardizations can suffer from heterogeneous data and that in this case could be responsible for the apparent non-normal distribution of model residuals.

251. CCMs noted that the vast majority of observer data used in the assessment were collected from high latitude fisheries while the core tropical habitat of oceanic whitetip sharks had very low observer coverage, and it was questioned how many fleets had even achieved the targeted 5% coverage for 2012. It was noted that the two catch estimates (SC8-SA-IP-12) were based on the same observer dataset.

252. SPC concurred with the importance of increasing the quantity and representativeness of observer coverage. It was explained that the alternative catch estimates derived from different treatment of the observer data than that in Lawson 2011(SC7-EB-IP-02).

253. FFA members commented on the high fishing mortality levels for oceanic whitetip sharks that have contributed to depressed stock conditions within the WCPO. In order to reduce shark mortality, FFA members suggested further efforts to release sharks alive and uninjured, and notified SC8 of their intention to table a comprehensive measure on the shark CMM at WCPFC9.

254. PNA supported FFA's statement and added that reference points based on the guidance of the Convention should be developed specifically for non-target species, such as sharks.

255. CCMs expressed their appreciation for the stock assessment and suggested a range of further studies, including investigation of biological and life history information, the impact of wire versus monofilament trace, operational factors such as set depth and environmental factors, and tagging studies.

4.9.1.2 Provision of scientific information

a. Status and trends

256. Spawning biomass, total biomass and recruitment have all exhibited a declining trend since 1995 (the first year of the assessment) (Fig. OCS 1). Current spawning biomass is low and is estimated to be at 15% of SB_{MSY}.

257. Fishing mortality from the non-target longline fishery has been on an increasing trend since 1995, while fishing mortality from the targeted longline fishery and purse-seine fisheries has varied without any trend (Fig. OCS 2). Current fishing mortality is high and is estimated to be more than six times greater than F_{MSY}.

258. The key conclusions are that overfishing is occurring and the stock is in an overfished state relative to MSY-based reference points ($SB_{current}/SB_{MSY}$ = 0.153 [range: 0.082–0.409]) and depletion-based reference points ($SB_{current}/SB_0 = 0.065$ [range: 0.034-0.173]) (Tables OCS1 and OSC2). This conclusion is robust to uncertainties in key model assumptions (Figs. OCS 3 and OCS 4).

Table OCS 1: Estimates of management quantities for the reference case and sensitivity runs.

Management Quantity	Units	Reference	Catch_2	Catch_3	CPUE_2	Nat_M_1	Nat_M_3	Steep_1	Steep_3	Init_F_1	Init_F_3_	Samp.Sz_2	SigmaR_2
C_{Latest}	t	1,802	3,160	6,321	1,451	2,534	1,468	1,984	1,630	1,820	1,779	1,803	1,785
$C_{Current}$	t per annum	2,001	3,707	7,414	1,891	2,822	1,625	2,195	1,811	2,028	1,967	2,004	2,010
$\widetilde{Y}_{F_{MSY}}$	t per annum	2,700	1,645	3,290	2,606	3,596	2,244	2,279	3,000	2,380	3,318	2,697	2,734
$\widetilde{B}_0$	t	110,447	67,513	135,032	106,461	230,313	70,350	122,226	99,683	97,390	135,715	110,327	111,860
$\widetilde{B}_{MSY}$	t	46,780	28,593	57,188	45,102	99,195	29,001	54,400	39,828	41,249	57,483	46,729	47,377
$B_{current}$	t	7,295	11,212	22,426	4,493	11,436	5,647	8,896	5,917	7,543	7,006	7,327	7,405
$\widetilde{SB}_0$		3,537	2,162	4,324	3,409	6,380	2,330	3,914	3,192	3,119	4,346	3,533	3,582
$\widetilde{SB}_{MSY}$		1,498	916	1,831	1,444	2,748	960	1,742	1,275	1,321	1,841	1,496	1,517
$SB_{current}$		229	347	694	137	366	156	288	177	237	220	231	230
$B_{current} / \widetilde{B}_0$		0.066	0.166	0.166	0.042	0.050	0.080	0.073	0.059	0.077	0.052	0.066	0.066
$B_{current} / \widetilde{B}_{MSY}$		0.156	0.392	0.392	0.100	0.115	0.195	0.164	0.149	0.183	0.122	0.157	0.156
$SB_{current} / \widetilde{SB}_0$		0.065	0.161	0.161	0.040	0.057	0.067	0.074	0.055	0.076	0.051	0.065	0.064
$SB_{current} / \widetilde{SB}_{MSY}$		0.153	0.379	0.379	0.095	0.133	0.163	0.165	0.139	0.179	0.120	0.154	0.152
$SB_{Current} / SB_{1995}$		0.139	0.342	0.342	0.086	0.161	0.127	0.158	0.119	0.121	0.181	0.141	0.140
$\widetilde{B}_{MSY} / \widetilde{B}_0$		0.424	0.424	0.424	0.424	0.431	0.412	0.445	0.400	0.424	0.424	0.424	0.424
$\widetilde{SB}_{MSY} / \widetilde{SB}_0$		0.424	0.424	0.424	0.424	0.431	0.412	0.445	0.400	0.424	0.424	0.424	0.424
$F_{current}$		0.469	0.662	0.655	0.861	0.479	0.202	0.535	0.459	0.356	0.249	0.243	0.464
F_{msy}		0.070	0.071	0.071	0.070	0.047	0.091	0.051	0.092	0.070	0.070	0.070	0.070
$F_{current} / \widetilde{F}_{MSY}$		6.694	9.298	9.197	12.324	10.287	2.229	10.560	4.992	5.080	3.556	3.469	6.616

Table OSC2: Estimates of management quantities for the reference, median, 5th, and 95th quantiles of the uncertainty grid.

Management Quantity	Units	Reference	Grid Median	Grid 5%	Grid 95%
C_{Latest}	t	1,802	2,218	1,295	6,962
$C_{Current}$	t per annum	2,001	2,703	1,593	8,131
$\widetilde{Y}_{F_{MSY}}$	t per annum	2,700	2,713	1,484	4,831
$\widetilde{B}_0$	t	110,447	111,973	56,366	309,263
$\widetilde{B}_{MSY}$	t	46,780	47,300	22,321	133,204
$B_{current}$	t	7,295	8,672	3,864	26,001
$S\widetilde{B}_0$		3,537	3,554	1,848	8,566
$S\widetilde{B}_{MSY}$		1,498	1,505	739	3,690
$SB_{current}$		229	280	112	820
$B_{current} / \widetilde{B}_0$		0.066	0.073	0.034	0.192
$B_{current} / \widetilde{B}_{MSY}$		0.156	0.175	0.079	0.454
$SB_{current} / S\widetilde{B}_0$		0.065	0.069	0.034	0.173
$SB_{current} / S\widetilde{B}_{MSY}$		0.153	0.166	0.082	0.409
$SB_{Current} / SB_{1995}$		0.139	0.181	0.087	0.458
$\widetilde{B}_{MSY} / \widetilde{B}_0$		0.424	0.424	0.399	0.449
$S\widetilde{B}_{MSY} / S\widetilde{B}_0$		0.424	0.424	0.399	0.449
$F_{current}$		0.469	0.461	0.243	0.909
F_{msy}		0.070	0.070	0.035	0.093
$F_{current} / \widetilde{F}_{MSY}$		6.694	6.940	3.001	20.026

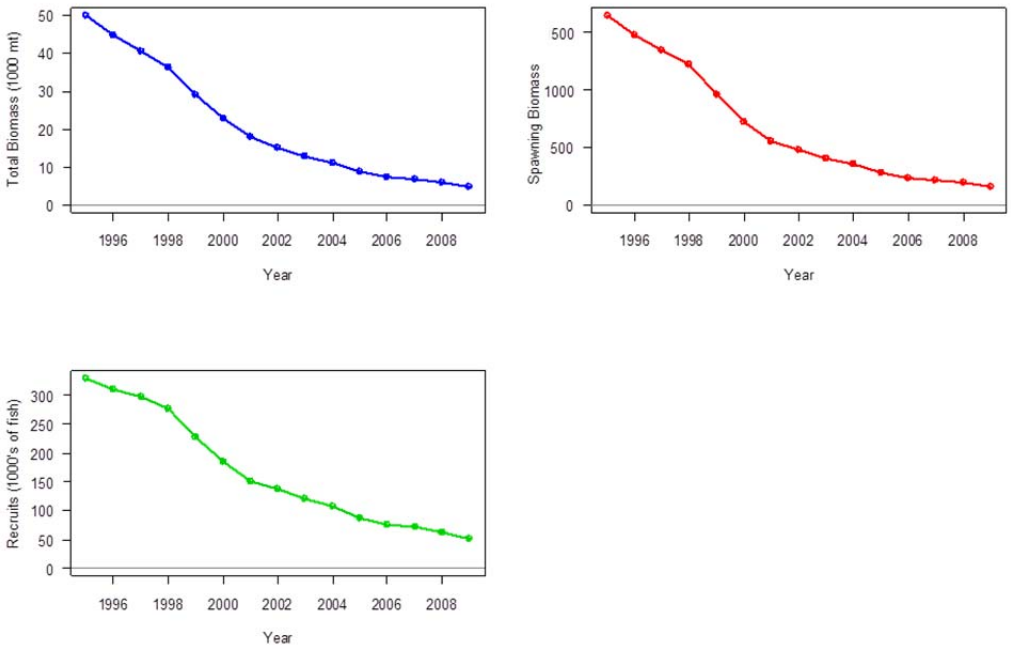


Figure OCS 1: Estimated total biomass (top left, 1,000 mt), estimated spawning biomass (top right) and estimated annual recruitment (1,000s of fish) in the WCPO for the reference case.

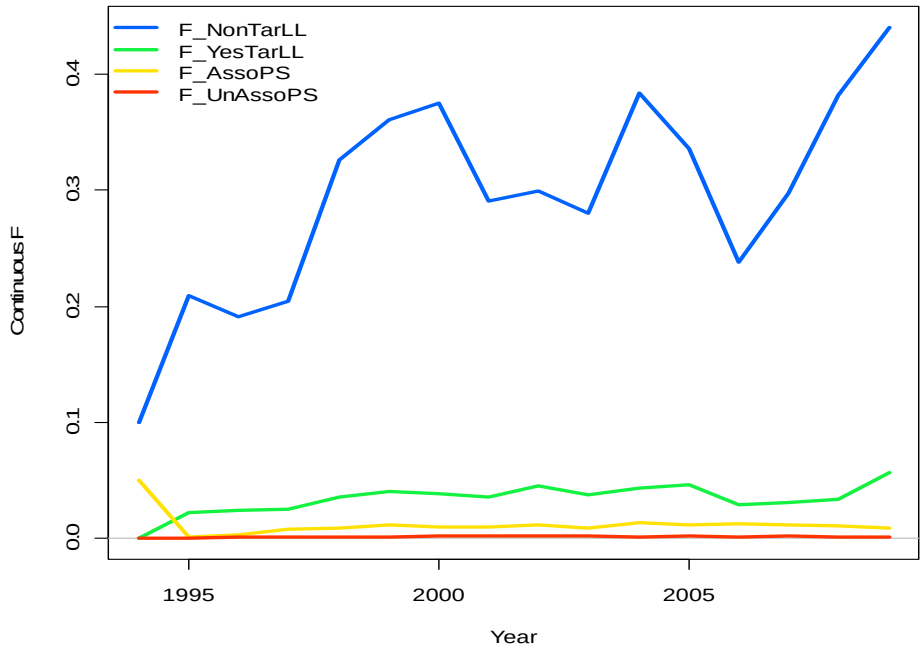


Figure OCS 2: Estimated fishing mortality by fleet for the reference case over the model period.

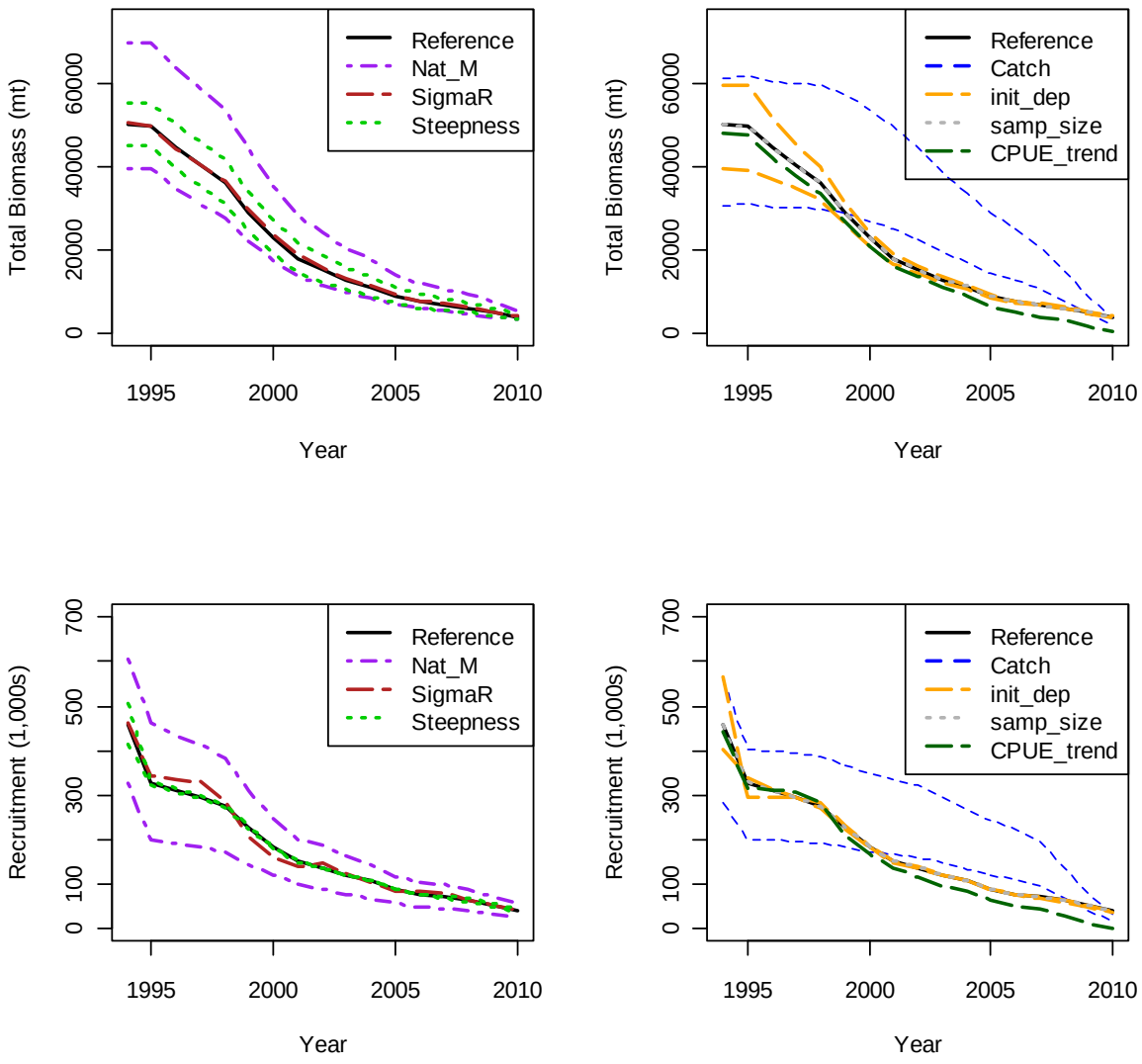


Figure OCS 3: Sensitivity analysis effects on total biomass (top) and recruitment (bottom) of alternate variable levels on the reference case. Figures on the left show the effects of natural mortality, SigmaR (the s.d. on the recruitment devs.) and steepness. Figures on the right show the effects of changing the catch inputs, initial depletion, sample size down weighting, and CPUE inputs.

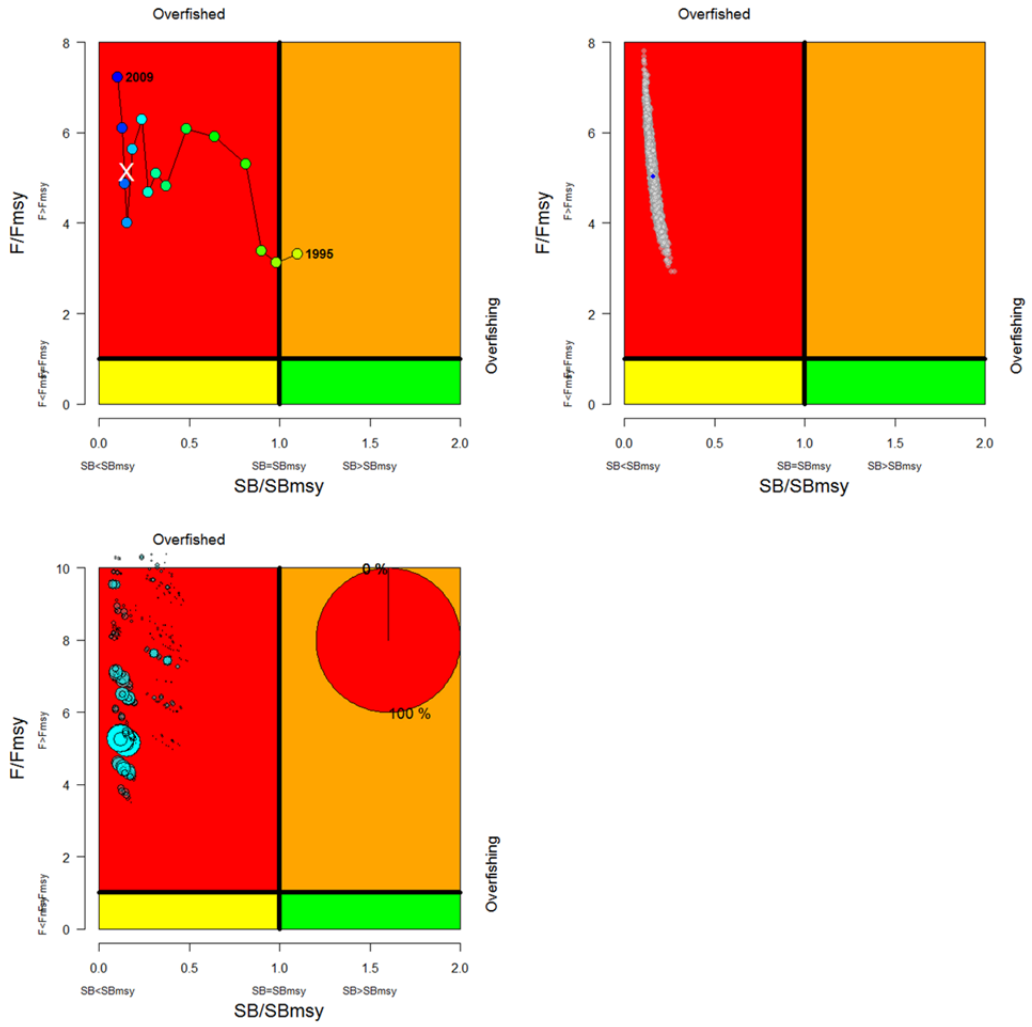


Figure OCS 4: Kobe plots indicating annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points. These present the reference model for the period 1995–2009 (top left panel), the statistical uncertainty based on the Markov chain Monte Carlo (MCMC) analysis for the current (average of 2005–2008) status (top right panel, blue dot indicates current estimates), and based on the current (average of 2005–2008) estimates for all 648 models in the grid (bottom panel). In the bottom panel, the size of the blue circles is proportional to the weight (plausibility) of the model run. The pie chart in the top right summarizes the proportion of model weight in each quadrant. Note that the y-axes range differ in the bottom plot.

b. Management advice and implications

259. Despite the data limitations going into the assessment, and the wide range of uncertainties considered, all of the accepted model runs indicate that the WCPO oceanic whitetip shark stock is currently overfished and overfishing is occurring relative to commonly used MSY-based reference points and depletion-based reference points. Management measures to reduce fishing mortality and to rebuild spawning biomass have been agreed to under CMM 2011-04, but mitigation to avoid capture is recommended.

260. Given the bycatch nature of most fishery impacts, mitigation measures provide the best opportunity to improve the status of the WCPO oceanic whitetip shark stock.

261. Reference points for non-target species, including oceanic whitetip sharks, should be developed as envisaged under Articles 5 and 10 of the WCPF Convention.

4.9.2 Silky shark

4.9.2.1 Review of research and information

262. J. Rice (SPC) presented a stock assessment of silky sharks in the WCPO (SC8-SA-WP-07). Excerpts from the Executive Summary of this paper are provided below. This summary includes several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

263. This paper presents the first stock assessment of silky shark in the WCPO. The assessment uses the stock assessment model Stock Synthesis.[8] The silky shark model is an age (36 years)-structured, spatially aggregated (one region) and two-sex model. Catch, effort, and size composition of catch, are grouped into four fisheries, all of which cover the time period from 1995 through 2009.

264. Silky sharks are most often caught as bycatch in Pacific tuna fisheries, although some shark targeted and mixed species (sharks, tunas and billfishes) fisheries do exist. Commercial reporting of landings has been minimal, as has information regarding the targeting and fate of sharks encountered in the fisheries. Useful data on catch and effort is mostly limited to observer data held by SPC, but observer data also suffer from poor coverage. Therefore, multiple data gaps had to be overcome through the use of integrated stock assessment techniques and the inclusion of alternate data that reflected different states of nature.

265. Multiple models with different combinations of the input datasets and structural model hypotheses were run to assess the plausible range of inputs and the resulting estimates of stock status. These models were each given a "weight" based on the *a priori* plausibility of the assumptions and data used in each model. The reference case presented here was the highest weighted run. This reference case model is used to represent the stock status along the additional model runs selected by SC to represent the uncertainty in the model. We have reported stock status in relation to MSY-based reference points, but the actual reference points to be used to manage this stock have not yet been determined by the Commission.

266. Key conclusions of the WCPO silky shark stock assessment are:

a. Notwithstanding the difficulties inherent in the input data, the size composition data shows consistent declines over the period of the model (1995–2009), which is coupled with increasing fishing mortality and a recently declining CPUE trend.
b. The results of the model can be split into two categories that are mutually exclusive with respect to the estimates of stock status. These two categories are characterized by the CPUE input. All runs that included the target longline and purse-seine CPUE trends estimated a current total biomass in excess of 150,000,000 mt, which is more than 18 times greater than the combined 2010 estimate of bigeye, South Pacific albacore, skipjack and yellowfin tuna total biomass combined. Therefore, these runs

[8] Stock Synthesis version 3.21B http://nft.nefsc.noaa.gov/Download.html

are not considered plausible and were dropped from the summary. The following results are based on the reference case and the minimum and maximum values of the runs selected by SC to depict the uncertainty in the model.

c. This is a low productivity species and this is reflected in the low estimated value for F_{MSY} (0.078) and high estimated value for SB_{MSY} / SB_0 (0.38). These directly impact on conclusions about overfishing and the overfished status of the stock.
d. Based on the highest probability model (the reference case), estimated spawning biomass, total biomass and recruitment all decline consistently throughout the period of the model. The biomass declines are driven by the CPUE series, and the recruitment decline is driven through the tight assumed relationship between spawning biomass and recruitment.
e. Estimated fishing mortality has increased to levels far in excess of F_{MSY}. The reference case estimate of $F_{CURRENT}/F_{MSY}$ = 6.4 (with a range of 4.2–10.2 based on the runs selected by SC to represent the uncertainty in the model). Based on these results we conclude that overfishing is occurring.
f. Estimated spawning biomass has declined to levels far below SB_{MSY}. The reference case estimate of $SB_{current} / SB_{MSY}$ = 0.66 (with a range of 0.48–0.81 based on the runs selected by SC to represent the uncertainty in the model). Based on these results we conclude that the stock is overfished.
g. Noting that estimates of SB_0 and SB_{MSY} are particularly uncertain because the model domain begins in 1995, it is also useful to compare current stock size to that at the start of the model. Estimated spawning biomass has declined over the model period to 62% of the 1995 value in the reference case (with a range of 0.51–0.95 based on the runs selected by SC to represent the uncertainty in the model).
h. Current catch based on the reference case is higher than MSY (5,950 mt vs 1,885 mt), further catch at current levels of fishing mortality would continue to deplete the stock below MSY. Current (2005 to 2008 average) and latest (2009) catches are significantly greater than the forecast catch in 2010 under F_{MSY} conditions (510 mt).
i. The greatest impact on the stock is attributed to bycatch from the longline fishery, but there are also significant impacts from the associated purse-seine fishery, which catches predominantly juvenile individuals, and the fishing mortality from the associated purse-seine fishery alone is above F_{MSY}.
j. Given the bycatch nature of fishery impacts, mitigation measures provides the best opportunity to improve the status of the silky shark population. Existing observer data may provide some information on which measures would be the most effective.
k. Given recent decisions to improve logsheet catch reporting and observer coverage in the longline fishery it is recommended that an updated assessment be undertaken in 2014.

Discussion

267. CCMs noted and acknowledged similarities and differences between the oceanic whitetip and silky shark stock assessments.

268. SPC explained that an important difference in the silky shark stock assessment was the significant impact that purse seine-associated effort has on the stock exacerbated by a high percentage of juveniles that are taken by that fishery. The basic life history of a K-selected species (slow growth, low fecundity, higher age at maturity) was also noted as a significant negative factor in determining silky shark stock conditions. Similar to the oceanic whitetip shark stock assessment, it was acknowledged that the silky shark assessment would benefit greatly from more and higher resolution data, particularly in observer programmes in Japan and Hawaii.

269. Japan stated it would consider making its data holdings available for analysis under similar conditions offered to the science services provider in the past.

270. SPC cited data availability as the main deterrent to conducting additional sensitivity analyses suggested by CCMs. It noted the apparent importance of a vessel effect in the difference between nominal and standardized CPUE series, and clarified that in delta-lognormal models both components (zeros and non-zeros) showed a similar trend.

271. USA highlighted that the divergence in nominal and standardized CPUE indices (SC8-SA-WP-07, Fig. 5) occurred post-2004, which coincides with a period of several years for which Hawaii longline observer data have not been provided to WCPFC due to domestic legal constraints. It was noted that the standardized catch rates of Walsh and Clarke (2011; SC7-EB-WP-03), which included the Hawaii longline data for the period 1995–2010, had not been used in the assessment. USA suggested that future assessments should use a longer and updated time series from its fleet if possible. The lack of correspondence between an increasing trend in fishing mortality and a decreasing trend in longline catches was also noted.

272. The IATTC representative was asked to comment on whether trends in silky shark stock status presented for the WCPO are similar to those seen in the EPO. The IATTC representative explained that silky shark assessment work in the EPO is ongoing and currently focused on resolving data issues.

273. FFA members emphasized the need to reduce the fishing mortality of sharks, noting the high mortality of juvenile silky shark in associated purse-seine sets, and calling for mitigation measures to be developed and adopted across all pelagic fisheries. FFA members' intention to introduce to WCPFC9 a new CMM discouraging targeting of sharks was reiterated along with a call for the development of appropriate reference points for non-target species.

274. CCMs expressed concerns over the levels of uncertainty in the assessment likely caused by limitations on data and data availability. For example, in the oceanic whitetip assessment, all four CPUE series showed similar trends, whereas trends differed significantly among CPUE series in the silky shark assessment. CCMs also noted that when the purse-seine CPUE series were used in the assessment, unrealistically high biomass estimates were obtained.

275. Japan expressed its view that it does not support an approach that treats shark species as a whole because it believes CMMs should be developed based on the stock status of each species.

4.9.2.2 Provision of scientific information

a. Status and trends

276. The 2012 silky shark assessment was the first assessment completed for this species. There is conflict among the different CPUE series and this conflict carries through the assessment to indicate very different management implications. The longline bycatch series suggests significant declines in abundance (and overfishing), while models incorporating the purse-seine CPUE series resulted in unrealistically high biomass estimates, with no sustainability concerns.

277. It might be expected that the CPUE series developed on longline bycatch would be more reflective of changes in abundance than the target longline CPUE series, which is extremely spatially limited, or the purse-seine CPUE series, which has no clear measure of fishing effort.

SC8 considered that the incorporation of additional existing observer data could lead to significantly different conclusions from the assessment, and therefore additional work is required. Therefore, SC8 concluded that it was not possible to determine estimates of stock status and yields.

278. SC8 noted the findings of WCPFC-SC7-2011/EB-WP-03 which state:

> "Although silky sharks have been shown to have declining catch rate trends in past studies in the Pacific, no strong trends were found in recent (2011) WCPO analyses. Nevertheless, declining size trends in two datasets, declining catch rates in these two datasets for the most recent years of the time series, and increasing removals all indicate a need for close, ongoing monitoring of indicators. Further research may allow better definition of trends and a clearer depiction of stock status."

Refining standardized CPUE and the assessment

279. There is large structural uncertainty in the silky shark assessment, which needs to be addressed in future assessments; however, the 2012 silky shark assessment represents the best available information. Conflicting trends in standardized longline (declines after 2004) and purse-seine (increases in most of the time series) fisheries require further investigation. The model fit to the highly influential bycatch longline series is poor. Particular investigation should be made on the divergence between standardized and nominal CPUE after 2004, which occurs when vessel effects are incorporated into the standardization process.

b. Management advice and implications

280. Noting SC8's concerns over the data conflict and potential biases in the silky shark assessment, it is not possible to provide management advice based on the assessment at this time. However, noting that some basic fishery indicators (e.g. mean lengths and some CPUE series) are showing declines in recent years, SC8 recommended no increase in fishing mortality on silky sharks.

281. Further, recognizing that the major fishery impacts relate to non-target fisheries, SC recommended that the Commission consider mitigation measures to reduce the impact of these non-target fisheries as a precautionary measure. SC8 also recommended that the silky shark assessment be updated to incorporate all potentially important data series.

282. Reference points for non-target species, including silky sharks, should be developed as envisaged under Articles 5 and 10 of the WCPF Convention.

4.10 Stock assessment methods

4.10.1 Review of research and information

283. CCMs were referred to information paper SC8-SA-IP-01, which describes recent developments in the MFCL stock assessment software.

AGENDA ITEM 5 – MANAGEMENT ISSUES THEME

284. The Management Issues Theme was convened by R. Campbell (Australia). Rapporteurs for this theme were S. Harley (SPC), V. Chan (USA), P. Kleiber (USA) and A. Beeching (WCPFC Secretariat). The convener informed the meeting that six working papers would be presented during this session and that a further two information papers had been prepared.

5.1 Terms of reference

285. The convener informed the meeting that SC7 had adopted draft TOR for this theme and forwarded these to the Commission for consideration. WCPFC8 reviewed these TOR and the adopted TOR are given in information paper SC8-MI-IP-01.

5.2 Limit reference points

286. The convener informed the meeting that WCPFC8 had endorsed the hierarchical approach to identifying LRPs recommended by SC7, and tasked the science services provider with undertaking the work recommended by SC7 on LRPs for the consideration of SC8. This work is summarized in working paper SC8-MI-WP-01, which was presented by A. Berger (SPC) and contains an evaluation of bigeye, skipjack, and yellowfin tuna stocks and southwest Pacific striped marlin stocks against potential LRPs.

287. Three important aspects of LRPs were addressed in the presentation.

- Background information providing context for the Management Objectives Workshop on what reference points are, and their purpose in fisheries management;
- Supporting analysis (as requested from SC7) that may allow SC to recommend specific LRPs to the Commission. This would allow us to refine the analytical material presented to the Management Objectives Workshop; and
- Some discussion of technical issues relating to how we incorporate uncertainty into our analyses when calculating or predicting (for projections) the probability that we have exceeded an LRP.

The paper updated SC7-MI-WP-04 specifically responding to requests made by SC7 for further analysis. Analyses were based on deterministic projections from a structural uncertainty grid (i.e. the same methodology as SC7-MI-WP-04) and covers the most recent stock assessments available at the time: the 2011 assessments reviewed by SC7 for bigeye, skipjack, and yellowfin tunas, and the 2012 assessments for South Pacific albacore and southwest Pacific striped marlin. Tables and figures are presented expressing the uncertainty in stock status in relation to various reference points on indicators relating to fishing mortality, spawning biomass relative to equilibrium virgin levels, and spawning biomass relative to the levels predicted to exist presently in the absence of fishing. The latter depletion estimator is recommended due to non-equilibrium conditions estimated for many WCPO stocks – especially when recent average recruitment is used for projections. The paper also considers the recommendation by Preece et al. (2011) that only $20\%SB_0$ be considered for skipjack, albacore, and billfish. Based on the recently published large-scale studies on growth and reproductive biology for South Pacific albacore tuna and southwest Pacific striped marlin, SPC believes that the uncertainties relating to key life-history parameters are no worse for these stocks than bigeye or yellowfin tunas, and hence that the stock assessments meet the "exception" of Preece et al. (2011), being instances where a thorough examination of model sensitivity exists.

Discussion

288. Some CCMs were concerned about how the level of depletion was set in relation to unfished biomass, noting the inherent uncertainties in estimating recruitment.

289. SPC replied that this uncertainty is addressed in part by including SB_0 from a representative period, noting that the selection of that period influences risk, but does not affect the identification of an LRP. SC6 had decided that recent average recruitment was appropriate for bigeye tuna, and consistency in estimating SB_0 is desirable. It was noted that as the estimation of recruitment in the last year of the assessment is highly uncertain, this year is not included. Spawning biomass is influenced by environmental factors and the length of the selected time period should take into account a background of changing oceanic regimes, and is a key point of uncertainty. On this basis, several CCMs requested additional advice from SPC as to the best period to select for each species.

290. There was also discussion on the level of acceptable risk for exceeding the LRP, and one CCM asked how the 10% risk level had been derived.

291. SPC stated that the level was suggested as a starting point for discussion but noted that according to the UN Fish Stocks Agreement, a precautionary approach accepts a low risk of exceeding an LRP. It was also noted that a 10% probability risk is a common value adopted in fishery management but should be evaluated in a management strategy evaluation. This level of risk can be traded off against other objectives in the fishery, noting that it is important to consider both the nature of the reference point itself, and the risk of exceeding it at the same time.

292. One CCM asked how one could know at what level recruitment overfishing occurs given that this had not been observed in WCPO stocks. SPC referred to meeting paper WCPFC-SC7-2011/MI-WP-03, which had reviewed this issue and suggested the use of a depletion estimator of 0.2 for WCPO tuna and striped marlin, and proposed an LRP of 20% spawning biomass where recruitment is calculated over a representative period.

293. Several CCMs proposed the adoption of $20\%SB_0$ as the biomass-based reference point for bigeye, yellowfin, skipjack and South Pacific albacore, stating that this was consistent with provisional recommendations last year. They also accepted a general risk allowance of 10% for tuna stocks but suggested that SC consider a more conservative risk level of 5% for skipjack and South Pacific albacore given the importance of both of these species to small island developing States. These CCMs also requested that the science services provider develop a common approach to the characterization of uncertainty and estimation of risk in relation to LRPs in order to ensure consistency in the provision of management advice to the Commission.

294. USA expressed a preference for fishing mortality-based (i.e. F-based) LRPs, noting that as fishing mortality is a parameter that the Commission controls, they are more likely to be robust against changes in recruitment, and they require less information about the biological responses of tunas, especially at lower biomass. This is pertinent to tunas in this region which have not been fished down to very low levels. USA also noted that tuna stocks were likely to have above-average resilience, and associated %SPR values would be expected to be between 15% and 25%. It was further noted that MSY is a natural LRP because it results in the optimum level of depletion. The uncertainties associated with biomass-based LRPs make them a less attractive option.

295. There was a suggestion that the science services provider be encouraged to continue investigation into appropriate F_{SPR} levels for bigeye, yellowfin and albacore tuna, but that a fishing mortality-based reference point is not necessary for skipjack.

296. Several CCMs noted the ongoing absence of reference points for northern stocks and the uncertainty that surrounds the $F_{SSB\text{-}AHTL}$ reference point adopted by the Northern Committee (NC) for North Pacific albacore. It was noted that SC7 had requested that ISC model the reference points provisionally agreed to last year for the northern stocks, including a comparison of the $F_{SSB\text{-}AHTL}$ reference point for albacore to conventional reference points. Some CCMs queried whether this work was undertaken but no response was provided.

Recommendations

297. SC8 noted the hierarchical approach to identifying key LRPs for key target species in the WCPFC recommended by SC7 and adopted by the Commission at WCPFC8.

298. SC8 recommended, noting the current level of research and the uncertainties in our knowledge on steepness, particularly on the level where recruitment overfishing may start, that LRPs for bigeye, yellowfin and South Pacific albacore be set at Level 2 with regard to the biomass-based LRP of $20\%SB_{recent,F=0}$, with deferral of a recommendation on the value of X% in the Level 2 fishing mortality-based LRP of $F_{x\%SPR}$ to SC9 (note that SPR refers to the spawning-potential-per-recruit and $SB_{recent,F=0}$ refers to the estimated average spawning biomass over a recent period in the absence of fishing). The LRP for skipjack was recommended to be set at Level 3, $20\%SB_{recent,F=0}$.

299. One CCM recommended $F_{20\%SPR}$ as an LRP for Level 2. This CCM stated that $F_{20\%SPR}$ is logically consistent with $20\%SB_{recent,F=0}$ as a means of maintaining a minimal spawning potential. This CCM noted that it is important to have LRPs for both harvest rate and depletion level to conserve spawning potential. Finally, this CCM stated that estimates of $F_{20\%SPR}$ are more robust to biological uncertainties than $20\%SB_{recent,F=0}$ because $F_{20\%SPR}$ does not require an estimate of unfished recruitment.

300. SC8 recommended that the probability of breaching an LRP should be very low.

301. SC8 recommended that the allowable risk of breaching an LRP may be applied on a species-specific basis, for example higher risk for yellowfin and bigeye tunas, but a more precautionary lower risk to skipjack and South Pacific albacore tunas.

302. SC8 noted that a range of risk levels of breaching the LRP were suggested by CCMs, with a majority of CCMs recommending a 10% level and that a lower, more precautionary value could be considered in some cases.

303. SC8 recommended that the Management Objectives Workshop review appropriate values for specifying the level of risk for individual species.

304. SC8 recommended that further work be undertaken by SPC on the identification of:

- **the appropriate period for estimating the average recruitment for each species in the LRP $20\%SB_{recent,F=0}$, and**
- **the appropriate values of X for each species in the LRP $F_{x\%SPRo}$,**

and that this work be presented to SC9 for review and for final specification of these LRPs.

305. SC8 recommended that work should continue to move all key WCPFC stocks to Level 1 reference points.

306. SC8 recommended that SPC further develop a common approach to characterization of uncertainty and estimation of risk in relation to LRPs, in order to ensure consistency in the provision of management advice to the Commission, and that this approach be reviewed at SC9.

307. SC8 further recommended that SPC present working paper SC8-MI-WP-01 to the Management Objectives Workshop, which is to be held prior to WCPFC9, for further discussion.

5.3 Target reference points for WCPFC

308. The convener reminded the meeting that SC7 had requested that the science services provider (SPC) prepare a paper for the Management Objectives Workshop to identify and evaluate candidate target reference points for skipjack, including empirical reference points such as those based on CPUE, as well possible target reference points derived from stock assessment models.

309. G. Pilling (SPC) presented a paper on target reference points for WCPO stocks with an emphasis on skipjack stocks (SC8-MI-WP-02). This paper is one of a suite of work contracted to inform the WCPFC Management Objectives Workshop, planned to be held prior to WCPFC9. This paper focuses on target reference points, and the other two papers focus on LRPs and harvest control rules. This paper: discusses biological, socioeconomic and empirical target reference points, their strengths and weaknesses, and decisions needed to operationalize them; raises issues to be recognized when considering candidate target reference points, including concepts of risk and trade-offs; provides a simple evaluation of the performance of five alternative target reference points for the WCPO skipjack tuna stock through stochastic projections; provides a preliminary evaluation of the utility of empirical indicators for this stock. Tables and figures examine the performance of alternative targets relative to: a) the risk involved with each target reference point, evaluated relative to candidate limit reference points: $20\%SB_0$, $20\%SB_{CurrentF=0}$ and SB_{MSY}; b) catch levels within the tropical purse-seine fishery over the projection period; and c) the stock biomass vulnerable to the FAD associated purse-seine fishery. The paper does not aim to identify which target reference point is "best" for WCPO skipjack. Target reference points should be defined by managers based on their desired goals for the fishery. In turn, the performance measures to be used when evaluating their performance should be linked to a manager's aims for the fishery, and allow decisions on the "acceptable" trade-offs between these and other consequences arising from a target reference point. Feedback was sought on:

- the planned goals of fishery managers, to help identify new candidate target reference points for evaluation and presentation;
- performance measures of interest to managers for evaluation, to allow a fuller analysis of the trade-offs inherent in alternative target reference points, and the timeframe for which they should be calculated;
- definition of LRPs to be used within evaluations; and
- alternative empirical indicator reference points for examination.

Discussion

310. FFA members thanked SPC for the paper but called for a greater recognition of multi-species implications of target reference points (i.e. that each species plays a different role in the overall fishery) in future papers. These members also noted that the identification of appropriate target reference points is likely to be more difficult than the identification of LRPs due to the need to also consider social, economic and political objectives as well as biological objectives.

311. In response, SPC stated that multi-species implications can be considered in this work, in particular by defining or informing risk levels for what may be considered non-target species in the analysis.

312. FFA members acknowledged a role for empirical indicators in the harvest strategy for the fishery, either in their own right or as a supplementary way of monitoring progress of the fishery against model-based reference points that are also under consideration. As such, they asked what additional information might be useful in understanding issues such as "effort creep" and hyper-stability to allow the use of indicators such as catch rates with a higher degree of certainty.

313. The convener noted that while the use of a CPUE indicator for skipjack in the purse-seine fishery may at present not be considered a reliable indicator of underlying biomass, there may be other fisheries where the use of a CPUE empirical indicator might be more useful, for example for bigeye and yellowfin tunas in the longline fisheries.

314. PNA members noted that they are working towards the adoption of a target reference point for skipjack in the range of 40–60% of unfished biomass or an equivalent measure, and called for the Commission to consider adopting a similar standard.

5.4 Harvest control rules

315. The convener reminded the meeting that SC7 had recommended that once adopted, LRPs and target reference points would need to be implemented along with harvest control rules (HCRs), and that development of these HCRs should be included in SC's work plan. The Commission had requested that SC8 review relevant work undertaken on the concept, structure and development of HCRs for WCPFC in preparation for the Management Objectives Workshop.

316. A. Berger (SPC) presented an introduction to harvest control rules for WCPO fisheries (SC8-MI-WP-03). This paper is one of a suite of work contracted to inform the WCPFC Management Objectives Workshop, which is currently scheduled to be held prior to WCPFC9 in late 2012. This paper aims to introduce the concept of HCRs for the WCPO as well as provide some specific examples of HCRs applied to the skipjack (effort-based rules) and South Pacific albacore (catch-based rules) fisheries in order to demonstrate the process for evaluating alternative HCRs and linking results to the Kobe II strategy matrix. Key features of HCRs are that they:

- provide a format to operationalize management objectives;
- integrate management parameters (e.g. target reference points and LRPs);
- specify pre-agreed management responses to changes in the status of the stock;
- increase transparency in how harvest management decisions are made; and
- provide a means for the development of rational fisheries management strategies through science-based decision-making.

The evaluation of alternative HCRs and eventual establishment of a harvest policy requires key inputs from stakeholders and managers before HCR management system evaluations can meaningfully be conducted. For each management system (e.g. WCPO skipjack tuna fishery), these include the need to: establish a clear set of management objectives; define management target reference points and LRPs consistent with those objectives; establish a set of performance metrics that correspond to the set of management objectives; define key system uncertainties that should be taken into account during analyses; identify alternative management options (e.g. type of harvest control measure, data to be used, or stock assessment procedures); and formulate candidate HCRs, using the above information to be evaluated through simulation analyses. Results from the illustrative examples highlight how the performance of alternative HCRs change when measured against different hypothetical management

objectives, and how alternative HCRs can be comparatively evaluated by looking at key trade-offs. These results emphasize some differences between HCRs that do not adjust harvest levels with stock status (more risk prone) and HCRs that do adjust (more risk averse), as well as some differences between the performance of effort-based and catch-based HCRs. Although designed to be illustrative, these examples provide insight into the process for developing HCRs for WCPO tuna fisheries.

Discussion

317. FFA members expressed support for HCRs, noting that they would add to the tools, such as the PNA purse-seine vessel day scheme and the development of zone-based arrangements for longline fisheries already used by FFA members. FFA members called for two improvements in future work on this topic: a) use of LRPs recommended by SC under Agenda Item 5.2; and b) inclusion of candidate target reference points on relevant figures, such as the Kobe plots of modelled 2021 outcomes under various harvest rules.

318. PNA members stated their support for further work on HCRs and for the preceding comments by FFA members.

319. One CCM, while noting that MSY is an important concept in the WCPF Convention, also noted that it is difficult to estimate and for this reason SC has also examined proxies. Noting that IATTC has systematic changes or regime shifts in the patterns of recruitment of yellowfin tuna in the EPO, such changes can have impacts on MSY-based quantities. It will be useful to examine the robustness of various reference points and HCRs to regime shifts in future work.

320. The convener noted that a range of reference points, not only MSY-based reference points, will be presented and discussed at the Management Objectives Workshop.

321. Another CCM reiterated that there is considerable uncertainty in comparing stock status against LRPs. This CCM also supported the consideration of environmental and socioeconomic factors at the Management Objectives Workshop.

322. Australia informed the meeting that it already uses reference points and HCRs to manage their Commonwealth fisheries, and urged the Commission to continue to progress toward adoption of these tools through the Management Objectives Workshop.

Recommendations

323. SC8 considered working papers SC8-MI-WP-02 and SC8-MI-WP-03 on target reference points and HCRs, and recommended that these papers be presented to the Management Objectives Workshop, which is to be held prior to WCPFC9.

324. SC8 also recommended that in preparing information for the Management Objectives Workshop that SPC take into consideration the following:

- **use of LRPs recommended by SC8;**
- **consideration of the multi-species implications of target reference points; and**
- **the role for empirical indicators in HCRs.**

5.5 Review of CMM 2008-01

325. The convener reminded SC8 that WCPFC8 had adopted CMM 2011-01 such that the measures applicable for 2011 under CMM 2008-01 (with several exemptions) shall remain in effect until 28

February 2013. Assisted by the science services provider, SC8 had been requested to review the ability of the measure to reduce fishing mortality of bigeye tuna and the effectiveness of CMM 2008-01 and provide scientific advice to the Commission for the development of a revised CMM for bigeye, yellowfin and skipjack tuna stocks. Two papers addressing this issue were considered by the meeting.

5.3.1 Review of the effectiveness of CMM 2008-01

a. Presentation on Bigeye Tuna Catch by Set Type

326. H. Okamoto (Japan) presented a paper on the relationship between bigeye tuna catch and set type by Japanese purse-seine vessels operating in tropical areas of the WCPO (SC8-MI-WP-04). As part of an approach to reduce bycatch of bigeye tuna by Japanese purse-seine vessels on FAD sets, the relationship between bigeye catch and set type was investigated. The study related to CMM 2008-01 (paras 25 and 26, juvenile tuna catch mitigation research). Catch information was collected from logbook and market slips (fish unloading data). In the last two years, sets on free schools (unassociated sets) by Japanese purse-seine vessels have dominated, and the proportion of associated sets has been reduced. At the same time, catches of bigeye tuna, small yellowfin and small skipjack decreased. Generalized linear model analysis indicated that the decrease of these catches is significantly influenced by the decrease in the proportion of associated sets relative to unassociated sets. Based on these results, it was suggested that the appropriate management of FAD set ratios or the number of FAD sets would be effective in controling purse-seine effort on FADs and fishing mortality of bigeye tuna.

Discussion

327. One CCM stated that given that a reduction in FAD fishing by the Japanese purse-seine fleet has resulted in reduced catches of juvenile bigeye, the FAD closure had been shown to be effective in achieving the objectives of the CMM and should, therefore, be extended.

b. Presentation on the Implementation and Effectiveness of Key Management Measures

328. J. Hampton (SPC) presented an overview of working paper SC8-MI-WP-06, which provides a review of the implementation and effectiveness of key management measures for tropical tuna, using the most current data and stock assessments available. The implementation of the CMM was reviewed for its key components: purse-seine effort, FAD closure, high seas pockets (HSP) closure, longline catches and catches by other fisheries. The main conclusions from the paper regarding implementation are as follows.

a. Purse-seine effort has expanded continuously since the introduction of CMM 2008-01, with effort (excluding domestic purse-seine vessels based in Indonesia and the Philippines) in 2011 estimated to have increased by approximately 31% compared with effort in 2004.
b. The incidence of reported activity related to the use of drifting FADs during the FAD closures was considerably lower in 2010 (6%) and 2011 (8.2%) compared with 2009 (16.1%). Effort remained at around normal levels throughout the closures. In 2010, the proportions of effort associated with FAD usage outside the closure period, particularly the months immediately before and after the closure, were lower than normal. In 2011, overall FAD usage returned to more typical levels prior to the 2011 closure. It is evident that several fleets (notably from Japan, Philippines, New Zealand) have substantially changed their fishing operations, focusing more on unassociated set fishing in 2010 and 2011 than they had in the past, but it is not known if this is a deliberate strategy or rather a response to the availability of surface schools. In spite of this, the total estimated number of FAD sets made in 2011 was a record high, largely due to increased purse-seine effort overall. Skipjack, yellowfin and total catches were slightly below average during the 2009 and 2010 closures. Sustained high total catches (particularly skipjack and bigeye) occurred between the 2010 and

2011 closures; however total (and skipjack) catches during the 2011 closure were very depressed. Catches recovered somewhat following the 2011 closure, but did not reach the levels experienced earlier in the year. Catches of bigeye tuna were strongly reduced during closure periods compared with other months of those years.

c. Available data from all sources indicate that the HSP closure since 1 January 2010 has largely been respected.
d. In 2011, reported longline catches of bigeye tuna were 64,175 tonnes, or 76% of the 2001–2004 level. For some flag States, current catches are lower than their limits and, therefore, there is scope for increased longline catches within existing management arrangements. Also, there is evidence that the reduction in bigeye tuna catches resulted more from reduced CPUE, possibly indicating stock declines, than from reduction in fishing effort.

329. To evaluate the effectiveness of CMM 2008-01, stock projections were undertaken using the reference case models for the 2011 assessments for bigeye, skipjack and yellowfin tunas. These models were adopted by SC7 for the provision of management advice. Similar methods were used as in previous years and the results are provided in the form of two Excel files with a separate worksheet for each species contained therein. Of particular interest from the projections is that the maintenance of bigeye tuna catch and effort levels observed in the fishery in 2009 results in F/F_{MSY} remaining high, with a projected level of 1.40 in 2021. However, for the scenario best approximating the reported catch and effort in the fishery in 2010, F/F_{MSY} declines and is at a projected level of 0.96 in 2021. This is driven by several factors: lower than usual FAD use in 2010, lower longline catches, and a large (30%) reduction in reported catches from the domestic fisheries of Indonesia and the Philippines. For the scenario approximating 2011 fishery conditions, F/F_{MSY} stabilizes at a projected level of 1.29. The difference between 2010 and 2011 fishery outcomes is mainly due to the return to higher levels of FAD-based purse-seine effort in 2011.

330. For scenarios that mimic a total purse-seine closure (i.e. where FAD effort is not transferred to unassociated fishing), there is a relatively small incremental reduction in F/F_{MSY} compared with that achieved by a FAD closure. However, this comes at a cost of substantial reductions in total catch, particularly in the purse-seine fishery. This conclusion is robust to the use of base years from 2001–2009 to characterize the differences.

331. The projection results were also used to quantify in an approximate way the impact of the various exemptions contained within CMM 2008-01. It was estimated that if the CMM was implemented without exemptions, approximately half of the overfishing that is estimated to occur under the CMM as written could be removed (reduction of bigeye tuna F/F_{MSY} from 1.35 to 1.17). This result is similar to previous analyses of this issue.

332. Finally, we estimated the individual impacts on bigeye tuna F/F_{MSY} of observed levels of catch or effort for the longline, purse-seine and domestic Philippines and Indonesia fishery groups in 2009 and 2010 against a base of 2004. The reduction in purse-seine FAD effort in 2010 has the greatest effect in terms of removing overfishing (67.4% of overfishing removed) followed by the reduction in longline catch in 2010 (34.7% of the overfishing removed).

Discussion

333. FFA members noted that fishing mortality on skipjack and yellowfin is estimated to remain sustainable under current conditions and that since fishing mortality on bigeye has not been reduced to the intended level, additional targeted measures to reduce fishing mortality on bigeye are necessary for all gear types. FFA members expressed concern that the reduction in catch at the same time as constant or even increasing effort suggests not a reduction in fishing mortality but a reduction in the availability of

fish. This situation was considered to further strengthen the need for management measures applicable to all sectors of the fishery.

334. In further support of this position, FFA members noted recent technical measures to better control fishing effort, such as PNA's designation of 2010 as an effort baseline for the future, and the establishment of zone-based limits in the EEZs of non-PNA members. FFA members considered that these measures will result in a change from the arrangements under CMM 2008-01 where effort limits were poorly defined, easily misunderstood, and largely open-ended to a more explicit articulation of the limits that are applicable in different areas. On this basis, FFA members stated that purse-seine effort is sustainable for its target stocks, and that improved bigeye conservation needs to come from other technical measures.

335. PNA members requested that skipjack and yellowfin projections be included in the paper as per Figure 10 for bigeye.

336. One CCM noted that based on the projection, which assumes that fishing conditions in 2010 will continue, fishing mortality on bigeye may drop below F_{MSY}. However, as more recent fishing activity indicates a record high of fishing on FADs, fishing mortality will likely remain very high and above F_{MSY}. On the other hand, the longline catch was either stable or decreasing.

337. Several CCMs recommended extending the FAD closure period and further controling purse-seine FAD activity outside of the closure period.

338. One CCM, referring to Figure 11 of the paper, queried why the projected total catch of bigeye does not decline given a continuation of the FAD closure.

339. SPC explained that total catch in the final year of the projection is influenced by substantial yield per recruit gains, especially for yellowfin where larger fish are caught. The analysis assumes that characteristics in the fishery are the same now as they would be in the future. There may be capacity for longline vessels to increase their catch of bigeye because of the reduction of catch by purse-seine vessels.

340. In response to a question regarding whether the analysis accounted for the potentially larger size of yellowfin caught in free schools, SPC explained that this was taken into account through the different selectivities adopted for each of the fisheries in the assessments.

341. FFA members considered that the analysis showed that there is no additional conservation gain for bigeye from a total closure compared with a FAD closure, whereas there would be an obvious and significant impact on total yields in the fishery. FFA members thus considered that a well-implemented FAD closure is the most appropriate management measure and asked that PNA's four-month FAD closure be evaluated in future analyses.

342. One CCM queried whether reducing the number of FAD sets rather than imposing a time closure would be more appropriate for achieving the objectives of CMM 2008-01. This CCM asked whether SPC could analyze historical data and determine what reduction of FAD fishing would be required.

343. SPC explained that fishing conditions in 2010 reduced fishing mortality to MSY levels and that looking at the number of FAD sets that year would answer the question.

344. FFA members stated their support for CCMs that are voluntarily reducing their reliance on FAD fishing, and encouraged other CCMs to follow suit.

345. PNA members noted that the FAD closure apparently made the largest contribution to removing bigeye overfishing, noting that in 2010, 67% of overfishing was removed by reduced use of FADs.

346. SPC clarified that the figure of 67% relates to the overall pattern in purse-seine fishing that occurred during 2010, including the FAD closure period (see Table 9 of SC8-MI-WP-06).

347. One CCM queried the declines in bigeye longline catches as shown in Figure 9 of the paper, asking whether it might be due to target shifting.

348. SPC stated that the analysis did not explicitly define longline targeting but clarified that the area used for the longline fleet was limited to the region 20°N to 10°S, and this should define tropical tuna targeting. The analysis of operational data would be the best way to answer this question.

c. Presentation on Mapping the WCPO Conservation Burden

349. Q. Hanich (Australia) presented a paper on mapping the conservation burden in the WCPO (SC8-MI-WP-05). The negotiation over the scope and application of a conservation measure is a negotiation over how the burden of conservation is distributed. The eventual decision will allocate costs (conservation limits) and benefits (fishing opportunities and future productivity improvements). Negotiations have to balance diverse interests and agree on how these interests are compromised. The WCPF Convention requires parties to ensure that CMMs do not result in transferring a disproportionate burden of conservation action on to developing States (Article 30), and prescribes various criteria to be considered when allocating catch or effort limits (Article 10). Determining the distribution of the conservation burden is a contentious issue because the Commission struggles to adequately respond to scientific advice to limit fishing effort and reduce fishing mortality for bigeye. Given current levels of overfishing and overcapacity, some or all Commission members must necessarily compromise their interests and carry some share of the conservation burden. This paper analyzes WCPFC catch data, annual reports and market data, and presents an approximate graph of Commission member interests, and discusses the potential impact of proposed CMMs on these interests. The paper concludes with a proposal for a transparent framework for determining the distribution of the conservation burden.

Recommendations

350. SC8 recommended that TCC and the Commission note the following conclusions based on analyses presented in working papers SC8-MI-WP-04 and SC8-MI-WP-06, when reviewing the effectiveness of CMM 2008-01 (and its extension under CMM 2011-01) and in the development of a revised CMM for bigeye, yellowfin and skipjack tuna stocks.

- **a. The limits placed on purse-seine operations have not adequately constrained total purse-seine effort, with total effort in 2011 estimated to be 31% higher than effort in 2004, and 46% higher than 2001–2004 levels.**
- **b. The number of days reported with any activity related to a drifting FAD was 16.1% in 2009, 6.8% in 2010 and 8.2% in 2011 during the FAD closure periods. The observed incidence of vessels drifting at night with fish aggregation lights on increased from 2.3% in 2009 to 6.8% in 2010 and was 3.4% in 2011.**
- **c. Despite the FAD closure, the total estimated number of FAD sets made in 2011 was a record high, largely due to a high FAD set ratio outside of the FAD closure period and increased purse-seine effort overall. Nevertheless, several fleets (notably those from Japan, Philippines, New Zealand) have substantially changed their fishing operations, focusing more on unassociated set fishing in 2010 and 2011 than they had in the past, but others remain highly dependent on FADs.**

d. The catch of bigeye, small yellowfin and small skipjack tunas can be significantly reduced by purse-seine vessels switching from FAD sets to unassociated sets.

e. The total bigeye purse-seine catch during 2011 was the highest on record (77,095 mt) and only the second time that the purse-seine catch had exceeded the longline catch.

f. Available data indicate that the HSP closure since 1 January 2010 has largely been respected. Since January 2010, effort has been concentrated mainly in EEZs, with no apparent re-distribution of effort to the eastern high seas, although effort in this area could increase with the predicted return of El Niño-Southern Oscillation (ENSO)-neutral or El Niño conditions.

g. Closing areas and time entirely to purse-seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation, and will be less profitable to purse-seine operations as a whole.

h. The provisional bigeye longline catch in 2011 was 24% lower than 2001–2004 levels. However, in the core area of the tropical longline fishery, reduced catches have been paralleled by a decline in nominal CPUE and no apparent reduction in fishing effort, which indicate that the recent catch declines could be more the result of further declines in adult bigeye tuna abundance than reduced fishing mortality or a shift in target species.

i. The provisional longline catch of yellowfin tuna in 2011 is close to 2001–2004 average levels.

j. Stock projections undertaken using the reference case models for the 2011 assessments for bigeye tuna indicate that the maintenance of bigeye tuna catch and effort levels observed in the fishery in 2009 results in F/F_{MSY} remaining high, with a projected level of 1.40 in 2021. However, for the scenario best approximating the reported catch and effort in the fishery in 2010, F/F_{MSY} declines and is at a projected level of 0.96 in 2021. This is driven by several factors: lower than usual FAD use in 2010, lower longline catches, and a large (30%) reduction in reported catches from the domestic fisheries of Indonesia and the Philippines. For the scenario approximating 2011 fishery conditions, F/F_{MSY} stabilizes at a projected level of 1.29. The difference between 2010 and 2011 fishery outcomes is mainly due to the return to higher levels of FAD-based purse-seine effort in 2011.

k. For scenarios that mimic a total purse-seine closure (i.e. where FAD effort is not transferred to unassociated fishing), there is a small incremental reduction in F/F_{MSY} compared with that achieved by a FAD closure. However, this comes at a cost of substantial reductions in total catch, particularly of skipjack in the purse-seine fishery. This conclusion is robust to the use of base years from 2001 to 2009 to characterize the differences.

l. It is estimated that if the CMM was implemented without exemptions, approximately an additional half of the overfishing that is estimated to occur under the CMM as written could be removed (reduction of bigeye tuna F/F_{MSY} from 1.35 to 1.17).

m. Estimation of individual impacts on bigeye tuna F/F_{MSY} of observed levels of catch or effort for the longline, purse-seine and domestic Philippines and Indonesia fishery groups in 2009 and 2010 against a base of 2004 indicates that the reduction in purse-seine FAD effort in 2010 has the greatest effect in terms of removing overfishing (67.4% of overfishing removed) followed by the reduction in longline catch in 2010 (34.7% of the overfishing removed).

351. Based on the above observations and analyses, and noting that the fishing mortality for bigeye has not been reduced to the level intended under CMM-2008-01, SC8 supported the need for additional or alternative targeted measures to reduce fishing mortality on bigeye. In the

development of a revised CMM for bigeye, yellowfin and skipjack tuna stocks, SC8 recommended that the Commission consider:

a. **strengthening the control of FAD activities;**
b. **building on the apparent success of some fleets in reducing their dependence on FADs to achieve greater control of FAD activity outside the closures, including control of the number of FADs set throughout a year instead of FAD time-closures;**
c. **reducing the total number of FAD sets to levels no greater than those in the fishery in 2010;**
d. **clarifying the definition of limits on purse-seine effort that are applicable in different areas;**
e. **reducing fishing mortality on bigeye tuna from the longline fishery; and**
f. **adopting management measures that apply to all sectors of the fishery.**

352. SC8 recommended that the Commission take account of the information in working paper SC8-MI-WP-05, "Mapping the distribution of the conservation burden", in its consideration of new management measures for WCPFC.

353. SC8 recommended that the Management Objectives Workshop consider the issues raised in working paper SC8-MI-WP-05.

5.6 Management Objectives Workshop

354. The convener informed the meeting that WCPFC8 had reviewed the draft TOR for the Management Objectives Workshop adopted by SC7, and that the final set of TOR adopted by the Commission were available in SC8-MI-IP-02, together with a draft of the proposed meeting structure.

AGENDA ITEM 6 – ECOSYSTEM AND BYCATCH MITIGATION THEME

355. The Ecosystem and Bycatch Mitigation Theme was co-convened by D. Itano (USA) and A. Batibasaga (Fiji). Rapporteurs for the theme included A. Bloomquist (USA), V. Chan (USA) and K. Schaefer (IATTC).

6.1 Ecosystem effects of fishing

6.1.1 Review of research and information

356. S. Nicol (SPC) presented working paper SC8-EB-WP-01, which describes a multi-agency collaboration that will improve knowledge on the influence of environmental drivers on tuna fisheries to reduce the uncertainty in short, medium and longer term projections of tuna catches. The project includes research to better forecast ENSO patterns and seasonal and decadal trends and the influence of this variability on tuna fisheries and food webs. Outcomes of the project will have direct application for the spatial ecosystem and population dynamics model (SEAPODYM) and should enhance national and international policy advice and technical support for sustainable tuna fisheries in the WCPO under climate variation and longer term change. The project complements SC's work programme.

357. CCMs were also referred to information papers that discuss the progress with applying the SEAPODYM model to Pacific tunas and billfishes (SC8-EB-IP-06) and WCPO ecosystem indicator trends and results from Ecopath model simulations (SC8-EB-IP-11).

Discussion

358. FFA members expressed support for the ongoing development of ecosystem modeling efforts, particularly SEAPODYM, to better understand top-down and bottom-up impacts and ecosystem effects of fishing. It was also noted that ecosystem models are data intensive and will require high-quality logsheet data across taxa to better manage target and non-target fishing mortality.

359. SC8 was advised that the proposed project would seek external funding and thus would not impact Commission funds or personnel.

360. S. Nicol (SPC) also presented working paper SC8-EB-WP-02 on the activities of the Kobe joint tuna RFMO Technical Working Group for bycatch. Substantial progress has been achieved on the harmonization of purse-seine observer data, seabird identification guides, and the Bycatch Mitigation Information System. No progress was reported for harmonizing other tuna data between the tuna RFMOs or harmonizing identification guides for turtles, sharks and marine mammals. No activities on ecological risk assessment of sharks for the Indian Ocean Tuna Commission (IOTC) or the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) were reported.

Discussion

361. ACAP noted that its seabird identification guide is still in the draft phase, and requested that CCMs provide feedback because it would like to produce a guide that is useful and reliable for all tuna RFMOs.

362. SC8 noted that the Commission had previously allocated funds for work on a seabird identification guide, but the money had not been spent and it was suggested that SC consider the relative importance of implementing the initial Commission decision.

Recommendations

363. **SC8 reiterated the need to improve knowledge on the influence of environmental effects on tuna fisheries in order to reduce the uncertainty in short, medium and longer term projections of tuna abundance. SC8 recognizes that the outcomes of the project proposed in EB-WP-01 and its supportive linkages with the ongoing development of SEAPODYM will complement SC's work programme. SC8 recognizes that this project will not require direct contributions in funds or manpower from the Commission, and endorses the development and implementation of the project if external funding can be secured.**

364. **SC8 noted the progress of the Kobe Technical Working Group for bycatch, and provides the following advice: a) the participation of the WCPFC Secretariat (or its delegate) in the harmonization of longline observer data is desirable; b) encourages development of the Bycatch Mitigation Information System into a tuna RFMO-wide resource; and c) submission of the ACAP harmonized seabird identification guide to the WCPFC Secretariat to coordinate its review.**

6.2 Sharks

6.2.1 Shark Research Plan

a. Progress report on the Shark Research Plan

365. S. Harley (SPC) presented a summary of progress against the Shark Research Plan since SC7 and an outline of potential work over the next 12 months (SC8-EB-WP-03). Areas of progress include:

a. the adoption by the Commission of criteria for the determination of key shark species;
b. the adoption by the Commission of a CMM for oceanic whitetip sharks;
c. stock assessments for silky and oceanic whitetip sharks;
d. preparatory work on stock assessments for blue and mako sharks in collaboration with ISC (for northern populations) and Commonwealth Scientific and Industrial Research Organisation (CSIRO) and other Australasian researchers (for southern populations);
e. an analysis of whale shark against the recently adopted criteria for key shark species; and
f. collaboration with IATTC on the groundwork for a potential Pacific-wide silky shark assessment.

There are some new, emerging shark issues that may require analysis in addition to the previously scheduled (under the Shark Research Plan) stock assessments for blue and mako sharks (which are likely to be assessed separately as northern and southern hemisphere units). These are outlined in the paper and SC8 was invited to consider and provide guidance on the relative priorities to these. Further, there were some specific recommendations for SC to consider on ways to improve shark data quality.

Discussion

366. One CCM noted that the shark assessments completed this year suffered from data issues, and cautioned against rushing into updating the silky shark and oceanic whitetip stock assessments before further work could be done on collecting and refining data inputs.

367. Some CCMs suggested broadening the scope of proposed mitigation analysis to include all key shark species rather than focusing specifically on silky and oceanic whitetip sharks. However, other CCMs noted that some shark stocks may be in a healthy condition and are targeted, so work should be prioritized on a species-by-species basis. One CCM suggested that an SC7 working paper on potential mitigation techniques for key shark species (SC7-EB-WP-04) could be updated but that this should be of lesser priority than completing the stock assessments for blue and mako sharks.

368. SPC explained that the proposed analysis of mitigation methods involved examining observer data, estimating impacts that various factors (e.g. shark bait, shark lines) had on catch rates, and predicting what catch rates might be if certain mitigation methods were adopted.

369. FFA members reiterated that Articles 5(e) and 10.1(c) of the Convention provide guidance on the development of reference points for non-target species.

370. In response to a question on the recommended actions for improving fisher-collected data, SPC suggested that CCMs support the provision of shark identification guides to fishermen and also ensure that longline vessels are using logsheets that allow them to collect data on key shark species.

371. In response to a question on why a Pacific-wide assessment for silky sharks had not been completed, SPC explained that IATTC delayed its silky shark assessment due a large amount of data that still needs to be incorporated from their coastal fisheries. Once IATTC completes its silky shark assessment, work toward a Pacific-wide silky shark assessment may progress.

372. One CCM noted that the recommendation from the bigeye tuna stock assessment peer review, regarding the need for further work to refine the WCPO assessment before undertaking a Pacific-wide assessment, should also apply to the silky shark assessment process.

373. One CCM noted that a large amount of data are required to derive a standardized CPUE series for whale sharks, and suggested this might be a long-term rather than short-term goal. It was also noted that it might be possible to examine the data for any spatial or temporal trends in interactions.

374. SPC stated that some of the projects were selected because they seemed timely with regards to actions that the Commission was likely to take in the near future. It was suggested that those actions requiring simple analysis be done and passed directly to the Commission, whereas those actions requiring greater analysis be presented in future SC meetings.

375. The Secretariat noted that it is developing a proposal with IATTC to the Global Environmental Facility that would help fund some of the Commission's shark and bycatch work. The funding level has yet to be decided and there are several components that are still being considered, but the Secretariat hoped the proposal would be finalized towards the end of September.

b. Consideration of whale sharks as a key shark species

376. S. Harley (SPC) presented an evaluation of the whale shark (*Rhincodon typus*) against the criteria adopted at WCPFC8 for the determination of "key shark species" (SC8-EB-WP-04). A summary of known biological information and interactions in WCPFC tuna fisheries indicates that whale sharks meet the basic criteria for becoming a key shark species. There are some data gaps that might prohibit a formal stock assessment of whale sharks, most notably the absence of fisheries-related mortality from non-tuna fisheries in the region and other tuna fisheries besides the tropical purse-seine fishery. An evaluation of trends from tropical purse-seine fishery interactions may provide some information on trends for part of the stock.

377. CCMs were also referred to whale shark information contained in papers WCPFC8-2011-IP/01, WCPFC8-2011-DP/15a (Rev 1), and WCPFC8-2011-DP/17.

Discussion

378. Most CCMs agreed with SPC's analysis and supported the inclusion of whale sharks as a WCPFC key shark species.

379. One CCM disagreed with the analysis, stating that the number of fishery interactions per year is low and whale sharks may not be a species of ecological concern.

380. CCMs considered that if whale sharks are made a key shark species, SPC could consider conducting a CPUE analysis in a couple of years after a greater amount of observer data have been amassed.

381. Chinese Taipei mentioned that they banned the retention of whale sharks in their fisheries in 2008 and, thus, there are no data from a directed fishery available for analysis since that time.

382. The convenor noted that the Chinese Taipei coastal pound net fishery has bycatch of whale sharks and this could provide data for the analysis.

383. PNA members reminded SC8 that they have adopted a prohibition on setting purse seines on whale sharks in the waters of PNA members, and supported the inclusion of whale sharks as a WCPFC key shark species.

6.2.2 Review of CMMs for sharks

384. CCMs were referred to several information papers relevant to other shark issues of interest to the Commission, including a study on distribution and abundance trends for porbeagle sharks (SC8-EP-IP-03), a guide to practical mitigation measures for chondrichthyan bycatch (SC8-EP-IP-07), and two documents relating to Australia's National Plan of Action for Sharks (SC8-EB-IP-08 and SC8-EB-IP-09).

a. CMM 2010-07 (CMM for sharks)

385. Some CCMs noted that the 5% fins-to-carcass ratio does not specify how the ratio should be applied to different forms of fins and carcasses (frozen versus dried weight, whole versus dressed weight), and suggested that the CMM be amended to provide clearer guidance.

386. Some CCMs encouraged the use of the new longline logsheets formats to generate better species-specific data on shark catches.

b. CMM 2011-04 (CMM for oceanic whitetip shark)

387. There were no specific presentations on, or discussions of, this agenda item.

c. Development of CMMs on other shark species

388. One CCM commented that any new CMM should focus on reducing interactions and consider a suite of mitigation measures, including the use of circle hooks and a ban on the use of wire traces.

d. Guidelines for safe release of encircled animals

389. An informal small group (ISG3) met in the margins of SC8 to consider the issue of guidelines for the safe release of encircled animals. Guidelines were proposed for the consideration of SC8 and discussed and adopted, and are attached as Attachment G. These guidelines will be forwarded to TCC8 for further consideration.

6.2.3 International cooperation on shark issues

390. There were no specific presentations on, or discussions of, this agenda item.

Recommendations

391. SC8 noted the progress made in support of the Shark Research Plan while also noting that meaningful progress in some areas remains hindered by data availability and quality.

392. SC8 recommended that the Commission assist in providing or identifying funds to distribute existing shark identification guides, and promote the development of species identification guides harmonized, where appropriate, with other RFMOs in order to improve data reporting.

393. SC8, through the Commission, encouraged CCMs to adopt and promote the recording of data by their longline fleets on harmonized and sufficiently detailed longline logsheets that include key shark species.

394. SC8 recommended that the science services provider conduct a study on the spatial and temporal distribution of whale sharks in the WCPO based on observer data and other data sources as appropriate.

395. SC8 supported the finding of the science services provider that whale sharks meet the basic criteria for consideration as a key shark species, and recommended that the whale shark (*Rhincodon typus*) be defined as a key shark species of WCPFC.

6.3 Seabirds

396. D. Kirby (Australia) presented the two papers on behalf of the authors. The first was a study showing that new branchline weighting regimes could reduce the risk of seabird mortality without affecting fish catches (SC8-EB-WP-09). This study reported on trials of two new branchline weighting regimes involving custom-made lead weights, which were conducted to determine effects on catch rates of target and non-target fish species. There were no statistically detectible differences in the catch rates of the main target and non-target fish species between branchlines with 60-g lead weights at 3.5 m from hooks (the fishing industry standard) and those with either a 120-g lead weight at 2 m from the hook or a 40-g lead weight placed at the hook. Branchlines with 40-g weights at the hook, which have the greatest potential to be adopted by the fishery, sank immediately upon deployment and took, on average, 4.5 seconds (0.43 m/s) to reach 2 m depth, 33% less time than 60 g at 3.5 m from the hook, the industry standard. The 40-g leads placed at the hook also improved crew safety, reduced the amount of time spent in gear construction and facilitated gear inspection for compliance purposes. The findings provide the fishing industry with new line weighting options that have the potential to reduce seabird bycatch without affecting target fish catches.

397. The second paper examined various branchline weighting options for their effectiveness in reducing seabird bycatches based on key findings from several different experiments (SC8-EB-WG-10). Initial sink rates (0–2 m deep) and overall sink rates of a range of line weighting options — each comprising a different combination of weight and leader length (distance between hook and weight) — were compared and several options identified that offer faster sink rates and, hence, pose reduced risk of seabird bycatch. The effect on catch rates (of target and non-target species) by placing weights adjacent to the hook was also tested and a new design of lead weight ("sliding hook leads") was developed that offers significant economic and safety advantages over traditional leaded swivels. Key findings include that: a) the fastest initial and overall sink rates were achieved with weights at the hook — these sank significantly faster than the same weight with any length of leader; b) 60-g weight with 1 m leader also performed well, with a significantly faster sink rate than 60 g at 3.5 m from the hook; c) all weights with longer leaders had the slowest initial sink rates and, thus, pose higher risks of seabird bycatch; and d) placing the weight at the hook had no effect on catch rates of tuna-like species or sharks. Based on this research, the authors recommended that consideration be given to revising the line weighting options of CMM 2007-04 to: a) require all fishers to use weighted branchlines and preferably encourage them to use a faster sinking weight option, such as 40 g or 60 g at the hook, or 60 g at 1 m; b) allow the use of 40 g at no more than 0.5 m from the hook; c) require 60-g weights to be used at no more than 1 m from the hook; d) delete the options of 60–98 g within 3.5 m of the hook and greater than 98 g at 4 m from the hook; and e) strongly encourage use of the new "sliding" weights (including "safe leads" or other proven safer methods of line weighting).

398. CCMs' attention was drawn to Annex D of SC8-EB-WP-10, where sink rate profiles for a range of line weighting regimes are presented.

399. W. Papworth (ACAP) provided a presentation on the outcomes of a review of research conducted on seabird bycatch mitigation measures for pelagic longline fisheries undertaken by ACAP's Seabird Bycatch Working Group (SBWG) at its meeting in Guayaquil, Ecuador, held from 29 August–2 September 2011 (SC8-EB-WP-06). The review of recent research confirmed the advice provided to SC6, that the use of appropriate configurations of weights on branchlines 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.

400. These measures should be applied in high risk areas, where there is an overlap of longline fishing effort with albatrosses and petrels, to reduce seabird incidental mortality to the lowest possible levels. Other factors such as safety, practicality and fishery characteristics should also be recognized. Currently, no single mitigation measure can reliably prevent the incidental mortality of seabirds in most pelagic longline fisheries. The most effective approach is to use the above measures in combination with one another.

401. Branchlines should be weighted to sink the baited hooks rapidly out of the diving range of feeding seabirds. Weighted lines sink faster and more consistently, resulting in dramatic reductions in seabird attacks on baited hooks and seabird mortality; no negative effect has been demonstrated on the catch rate of fishes. Continued refinement of line weighting configurations (mass, number and position of weights and materials) through controlled research and application in fisheries, was encouraged to find configurations that are the most safe, practical and effective. Scientific studies have demonstrated that branchline weighting configurations with more weight close to the hook sink the hooks most rapidly and consequently are most effective at reducing seabird interactions and mortalities. Working papers SC8-WP-EB-09 and SC8-WP-EB-10 provide outcomes of further research on branchline weighting that were not available at the time of ACAP's SBWG meeting.

402. A significant amount of research has been conducted on bird scaring lines (tori lines) since SC6 last reviewed this issue. This research has shown that properly designed and deployed bird scaring lines deter birds from sinking baits, thus dramatically reducing seabird attacks and related mortalities. Due to practical considerations associated with the use of tori lines on different sized vessels, ACAP has provided two sets of recommended specifications, one for vessels >35m in total length, and a second specification for vessels <35m. Detailed specifications for the construction of tori lines are provided in the BirdLife International/ACAP mitigation fact sheets (SC8-EB-IP-05).

403. Simultaneous use of two bird scaring lines, one on each side of the sinking longline, provide maximum protection from bird attacks under a variety of wind conditions, and are recommended as best practice for larger vessels. The bird scaring lines should be deployed to maximize the aerial extent, where aerial extent is a function of vessel speed, height of the attachment point to the vessel, drag, and weight of bird scaring line materials. Vessels should deploy bird scaring lines with the purpose of achieving a minimum aerial extent of 100 m.

404. For smaller vessels (<35m), a single bird scaring line using either long and short streamers, or short streamers only, has been found to be effective. Streamers should be brightly coloured. Short streamers (>1 m) should be placed at 1-m intervals along the length of the aerial extent. Two designs have been shown to be effective: a mixed design that includes long streamers placed at 5-m intervals over the first 55 m of the bird scaring line, and a design that does not include long streamers. Vessels should deploy bird scaring lines with a minimum aerial extent of 75 m.

405. W. Papworth (ACAP) also reported that at the last meeting of ACAP's Seabird Bycatch Working Group (SBWG), held in August 2011, an assessment was undertaken of the minimum data requirements necessary to monitor fisheries performance with respect to seabird bycatch and the effectiveness of the mitigation measures being used (SC8-EB-WP-07). It was noted that the lack of this information at previous SC meetings had hindered an informed discussion on many of the issues related to the management of seabird bycatch in the Convention Area.

406. The SBWG noted that the main objectives of collecting seabird bycatch data are to:

- characterize and quantify seabird bycatch within a fishery;
- understand the nature of seabird bycatch, and the importance of various factors that contribute to the observed level of bycatch (important for identifying specific mitigation solutions for the particular fishery); and
- assess and monitor the effectiveness of seabird bycatch mitigation measures in reducing mortality.

407. The WCPFC Regional Observer Programme Minimum Standard Data Fields and Instructions already identifies most of the data that are considered by ACAP to be a minimum for monitoring seabird bycatch; however, there are a small number of data fields that have not been identified that are considered by ACAP to be essential for evaluating the effectiveness of mitigation measures being used.

408. Specific data fields that are recommended for further inclusion in the WCPFC ROP include the following.

- Amount of additional weight attached to branchlines. Line weighting is considered a critical mitigation measure for longline fisheries, and it is hoped that most RFMOs will require the mandatory use of line weighting in the near future.
- Distance between weight and hook, in metres. This is an important component of the line weighting regime and should be recorded to assist in evaluating the effectiveness of the mitigation measure.
- The fate (dead, alive, injured) and number of birds (for each species) in each of these categories should be recorded for all observed seabird interactions. The WCPFC ROP currently only requires this information for individuals that are landed on deck.

The following data would also ideally be recorded.

- Regular seabird abundance estimates (presently only the number of animals sighted during an interaction is recorded).
- Environmental data such as sea state, wind speed and direction relative to a vessel's course, cloud cover, visibility and moon phase (for night fishing operations).

409. CCMs' attention was also drawn to a number of information papers relevant to seabird issues, including a progress report on the development and testing of the underwater bait setter for pelagic longline fisheries by Australia (SC8-EB-IP-02), and the development of tuna RFMO seabird identification guides by ACAP and the National Research Institute of Far Seas Fisheries (NRIFSF) (SC8-EB-IP-04).

Discussion

410. One CCM asked why line shooters, which are used in Hawaii's longline fishery, are not recommended as a mitigation measure within ACAP documents. It was noted that shallow setting has five times more seabird interaction rates than deep sets (using line shooters) in Hawaii's fishery. ACAP was encouraged to reconsider the use of line shooters in the development of best practices guidelines.

411. ACAP responded that the intent of the documents was to put forth the most robust mitigation measures to be used in a range of circumstances, and those for which there is a large body of evidence of their effectiveness.

412. One CCM noted that although diving seabirds dominate in the seabird bycatch hotspot area of ICCAT and IOTC waters, there is a particular area where diving seabird bycatch is not observed in WCPFC waters.

413. In response, another CCM noted that the reason seabird mitigation is so difficult in the WCPFC is that the mid- to high-latitude areas of the South Pacific have high densities of deep-diving and other seabirds.

414. Some CCMs asked for clarification about the effectiveness of night setting in mitigating seabird interactions.

415. ACAP and some CCMs explained that the most important factor in seabird mitigation is line weighting, in combination with correct leader lengths between weight and hook, in order to achieve the fastest possible hook sinking rates.

416. CCMs generally agreed with the mitigation measures proposed in the documents.

417. One CCM also noted that given the result and variety of longline operation styles among countries, a variety of effective specifications for weighted branchlines should be considered.

Recommendations

418. Following the review of papers presented, SC determined that currently, there is no single mitigation measure that can reliably prevent the incidental mortality of seabirds in most pelagic longline fisheries.

419. SC8 recognized the advice from ACAP that the following seabird bycatch mitigation measures are the most effective: weighted branchlines, night setting and bird scaring lines.

420. SC8 recommended that a combination of techniques should be used, especially weighted branchlines, bird scaring lines, and night setting, which have proven most effective for reducing seabird bycatch of seabird fauna prevalent in a particular region of concern. Other factors such as safety, practicality and fishery characteristics should also be recognized.

421. SC8 recognized that different longline fleets have obtained lower interaction rates with different mitigation methods. SC8 also notes that a combination of longline deployment techniques and other gear attributes used in the Hawaii-based longline fisheries effectively reduce incidental seabird capture.

422. SC8 reiterated advice that a spatial management approach be employed for seabird mitigation and recommended that the Commission consider the following advice when it revises the seabird CMM 2007-04:

a. Southern Hemisphere

SC8 recommended that fisheries south of 30°S are required to use at least two of these three measures: weighted branchlines, night setting and bird scaring lines. When using bird scaring lines, the descriptions outlined in SC8-EB-WP-06 should be used.

b. **Northern Hemisphere**
SC8 recommended that the table in CMM 2007-04 be revised to eliminate redundancy by removing weighted branchlines and underwater setting chute in column B.

c. **Branchline weighting**
With regard to branchline weighting, SC8 recognized that research in Australia (SC8-EB-WP-09 and SC8-EB-WP-10) has demonstrated that the use of at least one weight of 40 g within 50 cm of the hook, or of 45-60 g within 1 m of the hook, is more effective in quickly sinking baited hooks beyond the depths at which they may be available to seabirds. Other options using weights at greater distances from the hook are not as effective.

d. **Vessel length**
SC8 recommended that the potential impacts of the North Pacific vessel size exemption be addressed. Nations conducting longline fishing in the North Pacific to the north of 23°N should provide vessels numbers for those <24 m and ≥24 m for recent years. Annual Reports-Part 1 have statistics on vessel size by gross registered tons, however statistics on vessel length should be presented to SC9.

e. **Spatial management**
SC8 reiterated advice that a spatial management approach should be employed for seabird mitigation. In clearly defined areas south of 30°S and north of 23°N, exemption from the following requirements could be considered if seabird interaction rates can be scientifically demonstrated to be minimal, with observer coverage rates that are sufficient to quantify rare events in these areas. SC should determine appropriate (minimal) levels of interaction rates when representative observer data are available.

f. **ROP data fields**
SC8 recommended that TCC give consideration to the inclusion of data fields on: amount of additional weight attached to branchlines, distance between weight and hook (in meters), and the fate (dead, alive or injured) and number of seabirds for each species in each of these categories and whether the seabirds were released alive or discarded dead.

6.4 Sea turtles

423. There were no specific presentations on, or discussions of, this agenda item.

6.5 Other species and issues

6.5.1 FAD bycatch and mitigation

424. D. Itano (USA) presented a summary (SC8-EB-WP-11) of a research cruise conducted on a USA-flagged purse-seine vessel as part of ISSF's Bycatch Project that facilitates industry collaboration in the development and scientific testing of technical options to minimize undesirable catches in tuna fisheries. The cruise concentrated on bycatch and catch estimation issues related to fishery impacts on sea turtles, oceanic sharks, whale sharks, miscellaneous finfish (e.g. mahi mahi, wahoo, rainbow runner) and market tunas of undesirable size, particularly bigeye tuna that aggregate to floating objects. Research activities included: studies on the FAD-associated ecosystem; the ability of fishermen to estimate size and species on FADs before setting (with potential for avoidance of bycatch); the vertical and horizontal behavior of tuna and other species aggregated to floating objects; the behavior of tuna and bycatch in the net; best practices for the safe release of whale sharks and manta rays from purse-seine gear; and a range of studies

on oceanic sharks centered on their condition during different phases of the fishing operation and post-release survival. Different sampling protocols for estimating size frequency and species composition of target catches were also compared along with video monitoring systems for comparison at the set level. The latter half of the cruise concentrated on the selective release of non-target species, particularly silky sharks from the net.

425. M. Hutchinson (USA) presented the preliminary findings of post-release survival rates of silky sharks caught during the ISSF Bycatch Project research cruise in the WCPO on a commercial tuna purse-seine vessel (SC8-EB-WP-12). Initial results show animals landed and released early in the fishing operations (while still free swimming or entangled in the net) had higher post-release survival rates than animals landed during the brailing stages. Post-release survival of sharks is compromised once they are confined in the sack. Release conditions were correlated to landing stage, and animals released in "good" or "excellent" condition had high survival rates. Preliminary blood chemistry analysis shows that pH and lactate levels correlate to release condition and survival. Satellite tag data showed 100% mortality in blood-sampled animals when blood pH levels were ≤ 6.5 and lactate levels were higher than 15. All 295 silky sharks caught during the cruise were juveniles. Pop-up satellite archival tag (PSAT) data show diel periodicity to the vertical behavior of juvenile silky sharks: they are deeper at night (30–100 m) and shallow during the day (0–30 m). Initial PSAT depth data suggest the vertical range of juvenile silky sharks is restricted to the upper 100 m of the water column. Although whale sharks were not caught during this cruise, there was ample opportunity to communicate with the captain and crew regarding the best practices for their safe handling and release. The recommended bridle was made and ready to tow whale sharks out of the net. In addition, tagging poles were rigged and ready for deployment on encircled whale sharks.

426. J. Muir summarized work (SC8-EB-WP-13) pertaining to acoustic tagging of several finfish species aggregated on drifting FADs, as well as observations of behavior displayed by finfish and sharks once encircled by purse-seine gear. These experiments were conducted on a dedicated research cruise supported by ISSF (SC8-EB-WP-11). Skipjack, yellowfin, and bigeye tunas and silky sharks (*Carcharhinus falciformis*) were implanted with pressure sensing acoustic transmitters and monitored on drifting FADs. Assumptions relating to natural behavior of encircled fish in purse-seine gear were clarified: divers repeatedly observed clear separation of target species by species as well as size, with smaller-sized, species-specific schools occupying shallower depths in the net, and larger-sized bigeye and yellowfin occupying deeper regions in the net. Additionally, non-target species consistently separated themselves from target species and remained shallow. This species- and size-specific segregation was consistently observed during all sets and lasted for the duration of the haul until the beginning of sacking was reached, at which point individuals and schools were forced to intermingle. Predation attempts also began to occur at this point. These observations provide much needed insight to behavioral patterns of non-target and unwanted species, which may inform further research and development of options to selectively release or sort them from the net before these animals sustain mortal injuries.

427. D. Itano summarized work on the development and testing of an experimental method (SC8-EB-WP-14) to selectively release non-target finfish and sharks from purse-seine gear. This was one of several experiments conducted on a dedicated research cruise on bycatch mitigation supported by ISSF (SC8-EB-WP-14). The concept was developed during the cruise after repeated visual observations confirmed a clear segregation (vertically and horizontally) between tuna and non-target species inside the pursed net. Non-target species were observed to generally remain in the upper 10 m of the water column with tuna generally restricted to greater depths. In particular, silky sharks (*Carcharhinus falciformis*) were observed during several sets to collect in a small pocket of net that forms on the vessel port side during the latter stages of net retrieval. Items on the surface naturally collect in this area due to the nature of the fishing operation that slowly shifts the fishing vessel to starboard. An experimental release panel approximately 5.5 m x 11 m deep was installed at this location and could be opened and closed by crewmen from a 6-m

auxiliary towboat. After installation of the panel the conditions observed during the earlier part of the cruise were not experienced and only a small number of sharks exited the panel. However, larger numbers of silky shark, wahoo and mahi mahi were observed in close proximity to the opening, suggesting that they may be induced to exit the net if a better location or different stimuli were introduced. Further refinement of the concept through experimental trials was suggested.

Discussion

428. FFA members thanked ISSF for the opportunity to involve Pacific Island scientists, crews and observers in the research cruises. FFA members welcomed the research results and supported: a) avoidance or selective removal of non-target species from the net; b) avoidance of exposing sharks to the brailing process given the very low post-release survival after brailing; c) the use of PSATs to verify post-release condition of sharks released from purse-seine fishing operations; and d) the development of practices to maximize the survival of released bycatch species. Support was also stated for increasing the ratio of free school to associated purse-seine sets.

429. One CCM asked for clarification on the research module of the cruise related to the targeting of skipjack after dawn to avoid bigeye on FAD sets.

430. D. Itano noted that both species are tagged with sonic transmitters, allowing them to be identified when they are near the FAD or actively tracked when they depart. This technology can determine if there is separation of the species at particular times of day that may help to develop ways to avoid bigeye catches by purse-seine vessels. It was acknowledged that this is still a theory and needs a great deal of additional work.

431. In response to question about on how survival PSATs can distinguish between a mortality and a tag that has been shed from a live shark, M. Hutchinson (USA) explained that if a shark dies, it will sink and the tag tether will automatically sever at 1,800 m depth. This depth is beyond the depth a live epipelagic shark can survive, so it is a presumed mortality. Also, the tag manufacturer can confirm the depth at which the tag reports, and can supply this information to the tag owner for further interpretation.

432. H. Okamoto (Japan) presented Japanese approaches to mitigate bycatches of juvenile bigeye tuna by purse seine on FADs in the WCPO in recent years (SC8-EB-WP-15). These attempts represent collaborative research between the Japanese fishery industry, the Fishery Research Agency of Japan, and the Japanese government, and corresponding to CMM 2008-01, paras 25 and 26 (juvenile tuna catch mitigation research). Almost all of the research was intended to reduce bigeye bycatches on FADs by improving fishing methods and equipment. We applied new fishing methods to FAD operations, such as various depths of underwater structures of FADs, multiple FADs in one operation, acoustic signals or illumination to control movement of tuna foraging relative to FADs. Purse seines with large mesh sizes have been used in the fishing ground because it is supposed that the large mesh allows the escape of small fish. Recently developed broad spectrum sonar was also tested, which was intended to identify tuna species and estimate fish size before a fishing operation begins. The effects in terms of reducing bigeye tuna of these experiments were tested using statistical analysis, through field examinations using net pens, and by field research in the fishing grounds conducted by commercial fishing vessels and research vessels. We also investigated the relationship between bigeye tuna catches and oceanographic conditions, and studied the relationship between school type and juvenile tuna catches. These studies are summarized in this document to provide an overview of the results.

433. T. Oshima (Japan) presented a study on methods to reduce the bycatch of juvenile bigeye tuna in purse-seine FAD operations (SC8-EB-WP-16). Three joint research cruises were conducted during 2009–2012 with the intention of developing methods to mitigate bycatch of bigeye in purse-seine FAD

operations. The fishery research vessel *Shoyo-maru* of the Japan Fishery Agency, and a tuna seiner *Nippon-maru* chartered by the Japan Fisheries Research Agency, participated in the research cruises. Light stimuli were applied in attempts to move bigeye schools and let them escape through the mesh or underneath the net. Movements of fish were observed with coded pingers, scanning sonar, a wide-band quantitative echo sounder, and an underwater camera. Introducing new micro-coded pingers (Fusion Inc.) in 2011 resulted in longer survival and/or retention of tagged fish. As a consequence, large datasets on the movement of bigeye and skipjack tunas around FADs with or without light stimuli were obtained.

434. T. Kawamoto (Japan) presented the results of a study to mitigate bigeye tuna fishing mortality by using two separate FADs with underwater light stimulus (double FADs) (SC8-EB-WP-17). This document reported a decreasing bigeye tuna catch with the use of double FADs as compared with normal FADs. The total number of operations was 48, including 6 double FADs, 8 normal FADs and 34 free school operations. These were conducted by a commercial vessel *Wakaba-Maru No.3* in November–December 2011 in the EEZs of PNG and Solomon Islands under funding from the Fisheries Agency of Japan. Based on onboard sampling data, the number of fish 3.0 kg or more caught by double FADs was larger than that of normal FADs in all species, including skipjack, yellowfin and bigeye tunas. The bycatch ratio of bigeye tuna to the total number of bigeye, yellowfin and bigeye tunas with double FADs and normal FADs was 6.1% and 8.9% in number, and 7.2% and 14.2% in weight, respectively. The number of bigeye tuna in the catch of 1 mt was estimated as 24 in double FADs and 45 in normal FADs. Although sample size and quality is insufficient to draw a conclusion based on statistically testing, these results suggest that double FADs have some effect on reducing bigeye tuna bycatch as compared with normal FADs.

Discussion

435. The convener, on behalf of SC8, thanked the speakers for the large body of work related to bigeye tuna bycatch mitigation efforts conducted by Japan.

436. In response to a question about whether the study considered setting on double FADs equipped with flashing lights that were towed away from the FAD with continuous light, T. Kawamoto responded this was not done but may be tried in the future.

437. In response to a request to outline their future research plan, T. Kawamoto explained that more experiments need to be done in order to draw firm conclusions, and encouraged all CCMs to explore other approaches to testing double FADs with flashing lights.

438. One CCM suggested that the research should also look at the effect of light on other species, and asked if total tuna catch was impacted by the use of double FADs.

439. T. Kawamoto responded that generally the total catch quantities were not strongly affected and the amount of time required for fishing was more or less the same as usual.

440. FFA members noted that investigating technical solutions was one of two ways of reducing fishing mortality on bigeye tuna, the other being reducing the number of FAD sets and a higher reliance on free school fishing. FFA members encouraged Japan in seeking other technical solutions to reducing fishing mortality on bigeye. FFA also encouraged other CCMs to investigate ways of reducing bigeye mortality on associated sets.

441. CCMs noted that experimental sets using double FADs had all been conducted together in one location while all experimental sets using normal FADs had been conducted at another time and location. Researchers were invited to comment on whether the experimental design could be improved by

alternating the different types of sets at the same location and time instead of conducting them at different locations and times. Researchers were also asked about the possibility of testing the effect of light on FADs with nets hanging below them at different depths, rather than just the lights.

442. T. Kawamoto explained that the research was designed to test the effects of double FADs with lights only and so deployed nets at a consistent depth (50 m). It was acknowledged that if the research was adjusted as suggested, perhaps it would yield a different result.

Recommendations

443. SC8 supported the research objectives of the ISSF bycatch research cruises, and encouraged further work by ISSF and all CCMs to develop and test purse-seine mitigation efforts that prioritize avoidance or selective release of bycatch from the net; that maximize the condition factor of released animals; and that scientifically verify their post-release condition using PSATs and other technology.

6.5.2 Food security issues with bycatch

444. S. Nicol (SPC) presented a summary of the preliminary analysis of tropical purse-seine edible bycatch (SC8-EB-WP-1) that begins to address the request made at SC7 in the Ecosystem and Bycatch Theme on this subject. The analysis uses ROP observer data and delta-lognormal modeling approaches to estimate the potential level of key finfish (non-tuna) bycatch over the period 2000–2011, along with the potential fate of that bycatch. It should be noted that the estimates presented are preliminary, and a number of areas for improvement in modeling approaches are noted. Purse-seine sets associated with FADs and other floating objects result in an on average higher catch rate of non-billfish species, in particular rainbow runner and dolphinfish, and a slightly higher bycatch catch rate overall. By comparison, catch rates of billfish, in particular blue and black marlins, were higher in unassociated sets. The greatest total bycatch of the species examined was estimated in 2011; mean bycatch estimates across the species examined totaled 996 mt. Over 50% of the catches of each species were discarded from both set types, the exceptions being sailfish and wahoo, where the majority of catches were retained, and this discard rate was not found to vary between set types. Areas for consideration within a food security-focused research plan were suggested. These include: improving our understanding of the practical reasons behind the pattern of discarding by purse-seine vessels, and an understanding of the finer spatial pattern of bycatch, relative to the location of unloading ports.

Discussion

445. Regarding the estimates of non-target catch by year (Table 3), one CCM queried whether SPC compared these estimates with other data sources. A CCM's own comparison using observer data from its fleet indicated a range from 30% to 135% of the totals provided in the paper.

446. SPC agreed to examine the data sources and figures further.

447. A CCM noted support for the continuation of Project 60 while suggesting it should also collect detailed data on non-target species and discards.

448. The convenor suggested that it would also be helpful to see information by fleet, including comparisons between fleets and information on the fate of discards.

449. FFA members requested regularly updated estimates of food fish discarded in tuna fisheries to better inform management decisions on food security issues. These members also considered the possibility of under-estimation of foodfish discards in purse-seine fisheries. They supported further work as outlined in the paper, including extension to the longline fishery and reporting of non-target species in unloadings data.

Management recommendations

450. SC8 requested that the Commission's science services provider continue to produce and update the type of analysis presented in "Estimation of catches and fate of edible bycatch species taken in the equatorial purse-seine fishery" (SC8-EB-WP-18) for presentation to SC, with analyses to include the WCPO longline fishery and to address some of the issues raised in the Next Steps section of the paper.

AGENDA ITEM 7 – OTHER RESEARCH PROJECTS

7.1 West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFM Project)

451. T. Lewis (Chair of WPEAOFM Project Steering Committee, PSC) provided a brief presentation on the outcomes of the WPEAOFM PSC meeting, which was held on Saturday, 11 August 2012 in the margins of SC8. The WPEAOFM Project is in its final year. The main aim of the project is to support the Philippines, and Cooperating Non-members Indonesia and Vietnam in the areas of data and statistics, as well as tuna fisheries management and governance. It was noted that excellent progress has been made by all three recipient countries towards achieving project objectives. It is anticipated that some of the key activities, such as data collection and port sampling, will be able to continue using co-financing funding, which will bridge any gaps before a new project can be finalized and initiated. Plans for terminal evaluation of the WPEAOFM Project and continuity of 2013 project activities under the auspice of WCPFC were discussed and endorsed by PSC.

Discussion

452. SC8 welcomed the report of progress of the WPEAOFMP PSC, and noted the success of the WPEAOFM Project.

Recommendation

453. SC8 agreed that the WPEAOFM Project has contributed significantly to the Commission's data holdings for these important fisheries.

454. SC8 recommended that the WCPFC Secretariat work with the Global Environment Facility (GEF)/United Nations Development Program (UNDP) to develop a further project to continue the improvement of data collection, fisheries management and governance for tuna species in the Southeast Asian region.

7.2 Pacific Tuna Tagging Project

455. J. Hampton made a brief presentation on the Pacific Tuna Tagging Programme (PTTP) Steering Committee, which held its sixth meeting on Friday, 10 August 2012 in the margins of SC8. Project activities and future work plans are outlined in meeting paper SC8-RP-PTTP-02. The report of Steering Committee is contained in SC8-RP-PTTP-01.

Recommendation

456. SC8 adopted SC8-RP-PTTP-01, the Summary Report of the Sixth Steering Committee Meeting for PTTP, and noted the importance of tagging data for stock assessments of tropical tunas in the WCPFC Convention Area.

AGENDA ITEM 8 – COOPERATION WITH OTHER ORGANIZATIONS

8.1 The status of cooperation and relations

457. SC8 noted SC8-GN-IP-01, and SC had no comments on this agenda item.

AGENDA ITEM 9 – SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

9.1 Consideration of the special requirements of developing States pursuant to Part VIII of the Convention

458. The Assistant Science Manager, T. Beeching, who is responsible for administering the Japanese Trust Fund (JTF), noted that JTF is in its second five-year phase, which is focused more on monitoring, control and surveillance, and compliance issues. In 2012, approximately US D400,000 was available under JTF, which was fully allocated to 15 projects. He noted that a call for 2013 projects is likely to be made at TCC, but the amount of funding for next year is still to be confirmed.

459. Japan clarified that the main aim of JTF is to cooperate in developing the capacity of Pacific Island countries, and it strives to improve the implementation of measures in the WCPO that will lead to long-term benefits to Japanese fishers. Every year, the overall budget for JTF is subject to internal negotiations and approvals, thus it cannot be fixed in advance. Japan encouraged all developing island States to take advantage of the funding while it is available.

Discussion

460. Cook Islands, on behalf FFA members, expressed thanks to Japan for the generous contribution of a second phase of JTF. It also expressed its appreciation to those CCMs who have contributed to the Special Requirements Fund, and urged other CCMs who have yet to contribute, to do so. It was noted that in 2012, a lack of specific selection criteria hindered the approval and consideration of project proposals to JTF. FFA members asked that Japan consider providing guidelines for the development of future proposals.

461. FSM, on behalf of FFA members, noted that SPC stock assessment training could not be held in 2012 due to a reduction in donor funding. FFA members requested that donors consider funding future workshops, in recognition of the importance of these stock assessment workshops in developing the capacity of small island developing States.

AGENDA ITEM 10 – FUTURE WORK PROGRAMME AND BUDGET

10.1 Review of SC Work Programme

a. Review of 2011–2012 activities

462. T. Beeching detailed science projects conducted by the science services provider (SPC) outside of their core activities related to ongoing data management, stock assessment and other advisory services. Seventeen papers were listed as specific outputs for work requested by SC7 and WCPFC8.

b. Review of SC List of Work Programme items

463. S. Brouwer (New Zealand), provided a report on the work of an ISG tasked with reviewing and providing advice to SC on the list of agreed work for SC (SC8-GN-WP-05 [rev. 2], Attachment I). The ISG made recommendations and identified new projects as follows:

- The Secretariat should create a database to manage this process. The list of fields should include at least project number, title, status, research provider, completion date, budget and budget origin.
- Projects listed in the SC List of Work Programme should include work done for SC but funded externally to the Commission.
- If a project is classified as inactive, the Secretariat should include a reason for the inactivity.
- Active projects should have detailed project descriptions that should be publicly accessible.

464. New projects proposed for inclusion in the SC List of Work Programme include:

- Post-release survival of key shark species from purse-seine and longline gear (budget to be provided by the Shark Research Plan and likely to be conducted by either SPC, country scientists and/or ISSF; priority is high).
- Desktop analysis of shark mitigation effects (budget to be provided by the Shark Research Plan; priority is high).
- Collection of catch information on edible species (e.g. mahi mahi, rainbow runner) in purse-seine and longline fisheries and presentation of data already held by SPC (budget to be provided by routine funding; priority is on annual updates to SC8-EB-WP-18).

Recommendation

465. SC8 tasked the Secretariat with updating the SC List of Work Programme (SC8-GN-WP-05 [rev. 2]), in accordance with the recommendations of the ISG as specified above.

10.2 Development of 2013 work programme and budget, and projection of 2014–2015 provisional work programme and indicative budget

a. Schedule of stock assessments to be conducted

466. The SC Vice-Chair reported on the results of ISG6, which he convened in order to discuss SC work programme and budget issues. A list of stock assessments to be conducted by SPC was created for prioritization purposes, and CCMs were invited to comment.

467. SC8 discussed the regularity of stock assessments from both biological and funding perspectives. SC8 considered that the stock assessments for the major tuna species should be conducted every three years, swordfish should be conducted every four years (i.e. next assessed in 2017), and other billfish

species should be conducted every five years. An ongoing programme of shark assessments should be implemented once a decision is taken regarding whether to extend the Shark Research Programme.

468. The outcome of discussions on the prioritization and timing of stock assessments is shown in Table 2.

Table 2: Stock assessments to be conducted by the science services provider 2013–2017.

Species	Stock	Last assessment	2013	2014	2015	2016[a]	2017[a]
Bigeye tuna	WCPO	2011		X			
	Pacific-wide				X		
Skipjack tuna	WCPO	2011		X			
Yellowfin tuna	WCPO	2011		X			
Albacore	South Pacific	2012			X		
Striped marlin	SW-Pacific	2012					X
	NW-Pacific	2012					X
Swordfish	SW-Pacific	2008	X				X
Silky shark	WCPO	2012	X				
	Pacific-wide						
Oceanic whitetip shark	WCPO	2012			X		
Blue shark	Pacific-wide		X				
Mako shark	South Pacific			X[b]			
	North Pacific			X[b]			

a = Indicates stock assessments currently agreed to be conducted.
b = Contingent on funding approval for the Shark Research Plan beyond December 2013 being agreed on at WCPFC9.

b. Work programme and budget

469. The SC Vice-Chair introduced the proposed 2012–2013 SC work programme and budget, and 2013–2015 SC provisional work programme and budget (SC8-GN-WP-05). He noted that the budget includes additional costs for the following functions:

- USD 75,000 for Project 60 (purse-seine species composition);
- USD 40,000 for bigeye MFCL improvements (recommended by the bigeye peer review); and
- USD 160,000 for additional resourcing for SPC for stock assessment tasks and improvements as recommended by the bigeye peer review.

470. In addition, it was noted that there was a proposal to carry over USD 30,000 over from 2012 unallocated funds to apply to Project 57 (limit reference points) in 2012–2013.

471. SPC noted that, as a general rule, under the current Service Agreement for Scientific Services, it can conduct two tuna stock assessments and one shark stock assessment. Any additional work would require additional funding.

Recommendation

472. **SC8 tasked the science services provider with undertaking a review of data holdings for sailfish in order to inform discussions at SC9 regarding the necessary budget for undertaking further analyses.**

473. SC8 recommended that the Commission consider the proposed 2013 Scientific Committee Work Programme and Budget and the Provisional 2014–2015 Scientific Committee Work Programme and Indicative Budget (SC8-GN-WP-09). SC8 also considered SPC's indicative science services for 2013–2015 (SC8-GN-WP-10). Both documents are appended as Attachment I.

474. SC8 recommended that the Commission consider extending the Shark Research Programme conducted by the science services provider beyond December 2013 when current funding from the Commission expires.

475. SC8 recommended that the Management Objectives Workshop consider continued research and associated budgets (using funds available in the unobligated budget) for Project 58 (Evaluation of Reference Points and Decision Rules) and Project 66 (Identification and Evaluation of Target Reference Points) and recommended that the Commission consider the inclusion of this research within the SC work programme and budget.

AGENDA ITEM 11 – ADMINISTRATIVE MATTERS

11.1 Rules of procedure

476. No proposals were received, and SC8 had no comments on this agenda item.

11.2 Peer review of stock assessments

477. CCMs were referred to the recommendations of the ISG on Peer Review (see Agenda Item 4.1.1a) and Attachment F.

478. Some CCMs expressed support for adequate resourcing being provided to SPC for implementing all peer review recommendations.

479. Some CCMs suggested using the bigeye peer review assessment experience to develop a TOR and select a review panel for future peer review of stock assessments, and to set a format for future peer reviews of WCPFC stock assessments.

480. Some CCMs considered that the bigeye peer review could be used to increase transparency and accountability in other WCPFC stock assessment work. Stock assessments for Pacific bluefin and North Pacific albacore tunas were considered by some to be candidates for a similar peer review.

481. In contrast, other CCMs believed that peer review of northern stock assessments are best dealt with by ISC and the Northern Committee.

482. In response to the proposal for a peer review of the North Pacific albacore stock assessment, USA noted that a CIE review had already been conducted and that this desktop review, currently held by USA, would be released in due course.

483. In order to allow time for the benefits of the bigeye stock assessment to flow through to other stock assessments, some CCMs suggested that the next tuna stock assessment peer review should occur in several years' time.

Recommendations

484. SC8 recommended that:

- **the TOR (Attachment J, SC7 Summary Report) be adopted for future stock assessment reviews, noting that minor revision may be required to address assessment-specific issues;**
- **the selection procedure of a review panel developed at SC7 (paras. 580 and 581, SC7 Summary Report) be used for future peer review of stock assessments; and**
- **the Commission request NC to conduct a scientific peer review of the Pacific bluefin tuna stock assessment once it is completed.**

11.3 Future operation of SC

11.3.1 Future structure of SC

485. The SC Chair asked CCMs to consider whether the scope of SC9 should be expanded to include theme sessions on fish biology, fishing technology and methods.

486. FFA members, noting that they already consider the workload of the Commission too onerous, did not support the inclusion of these additional theme sessions at future SC meetings. In addition, FFA members urged convenors to be more selective in their screening of working and information papers, highlighted the ongoing need for funding support to fully participate in the work of the Commission, and looked forward to receiving the Secretariat's paper on rationalization of meetings and streamlining of agendas.

487. USA concurred with FFA members but cautioned that SC had already been reduced from 11 to 8 days and should not be further shortened.

Recommendation

488. SC8 agreed that future SC meeting agendas would include Data and Statistics, Stock Assessment, Management Issues and Ecosystem and Bycatch themes only.

11.3.2 Review of the SC agenda

489. SC8 had no comments on this agenda item.

11.3.3 Guidelines for the SC Chair and theme convenors

490. R. Campbell (Australia) presented draft guidelines for the SC Chair and theme convenors.

491. Some CCMs requested that specific guidance be included on the procedures to be used by convenors when formulating recommendations; for example, the need for initial discussion about the nature of the recommendation to be drafted, and the amount of time before clearance that the recommendation should be circulated, and the method of circulation.

492. An Observer made the point that recommendations should also be drawn from working papers even if these points were not discussed across the floor.

493. These comments were considered and incorporated into the guidelines, along with additional guidance on the timeline for submission of theme working and information papers.

494. SC8 adopted the guidelines for the SC Chair and theme convenors contained in SC8-GN-WP-06 (Attachment J).

11.4 Election of the SC Chair and theme convenors

495. Nominations to fill the position of SC Chair were requested, given that N. Miyabe (Japan) will step down as Chair at the end of 2012.

496. Because no nominations were forthcoming, nominations for a new Chair were encouraged to be submitted at WCPFC9 in order to confirm a new SC Chair.

497. L. Kumoru (PNG) was nominated to replace P. Maru (Cook Islands) as the Data and Statistics Theme convenor.

498. SC8 approved L. Kumoru as the new Data and Statistics Theme convenor.

499. A. Batibasaga (Fiji) was nominated to replace D. Itano (USA) as one of the Ecosystem and Bycatch Theme co-convenors.

500. SC8 approved A. Batibasaga as one of the Ecosystem and Bycatch Theme co-convenors.

11.5 Next meeting

501. The Executive Director noted that, as a general principle, the cost of holding SC meetings in Pohnpei is less than if they are held elsewhere. Therefore, nominations for other venues will need to be considered in light of the cost differential between the proposed location and Pohnpei.

502. SC9 is provisionally scheduled for 6–14 August 2013, with a venue to be determined intersessionally and agreed on at WCPFC9.

AGENDA ITEM 12 – OTHER MATTERS

503. Some CCMs questioned the need for support rapporteurs to be provided by national delegations, given the presence of a lead rapporteur and several members of the Secretariat's staff at SC. It was noted that other subsidiary bodies of the Commission do not make use of support rapporteurs.

504. One CCM suggested that better use could be made of the meeting website, rather than email, as a clearinghouse for meeting documents, proposed recommendation text, and other information.

505. The Secretariat agreed to further consider these issues and to provide options to CCMs for consideration prior to SC9.

AGENDA ITEM 13 – ADOPTION OF THE REPORT OF THE EIGHTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

506. The Report of the Eighth Regular Session of the Scientific Committee was adopted.

AGENDA ITEM 14 – CLOSE OF THE MEETING

507. The Executive Director thanked the four convenors for their diligent efforts during the theme sessions and in preparing the Summary Report, in particular P. Maru and D. Itano, who stepped down as of this meeting. He also thanked the lead rapporteur, S. Clarke, and the SC Chair N. Miyabe, who will step down at the end of this year.

508. The Executive Director also expressed WCPFC's sincere appreciation for the meeting organizers and support staff who ably handled local administrative and logistical arrangements for SC8.

509. The local organizers presented the Executive Director with a token of their appreciation.

510. The SC Chair thanked SC for its efforts over the past years while he was Chair, and expressed his interest in continuing to work with SC in the future.

511. Korea thanked all attendees for their participation in an excellent meeting and wished all a safe return home.

512. The meeting closed at 15:30 on 15 August 2012.

Attachment A

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

KEYNOTE ADDRESS

by Dr Jae-Hak Son, President of the National Fisheries Research and Development Institute, Ministry for Food, Agriculture, Forestry and Fisheries

The Chair of the Scientific Committee, Dr Naozumi Miyabe, The Executive Director of WCPFC, Professor Glenn Hurry, The Distinguished scientific representatives of Members, Cooperating Non-members and Participating Territories of the Commission, Observers, Ladies and Gentlemen.

"Annyeong Haseyo!" On behalf of the Government of the Republic of Korea, I would like to cordially welcome you all to Busan, Korea and I am honored to make "Key note Address" before you on this occasion of the opening session of the Eight Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission.

For Korea as one of top seafood consumers in the world, WCPFC fisheries are the most important now, accounting for over 90% of the total catch of tuna and tuna-like species by Korean Distant Waters Tuna Fisheries in the world oceans.

Korean longline fishery took the first step in 1958 and tuna purse-seine fishery in 1971, into the high-seas and within the coastal States in the South Pacific of the WCPO which have been their main fishing grounds since 1980s.

"The Review of the Status of World Marine Fishery Resource" published by FAO in 2011, reported that, though dealing with 70 % of 584 world fish stocks, 57.4 percent were estimated fully exploited, 29.9 % over-exploited and 12.7 % non-fully exploited as of 2009.

It also pointed out that tuna fisheries compared favorably with the global average. I assume that tuna fisheries have been managed with the dedicated effort of research and management by regional fisheries management organizations (RFMOs) in close collaboration with members and co-operating non-members.

Referring to the your last year's Scientific Committee Report, a set of stock status indicators and Kobe plots clearly showed us where we are now and to go. What should be done for the stock status to be drawn to the "Green Zone".

To make it realize, among other things to be addressed, data issues are put in the first place. We know well that it is a commonly shared view that timely, complete and accurate fisheries data should be available for carrying out the reliable stock assessment. It seems to me that the importance of data is reflected in your agenda for this meeting by arranging it sitting at the beginning of substantial issues of the agenda.

According to your document regarding the overview of WCPO in 2011, I found that the provisional estimated tuna catch in 2011 was 2,244,776 mt and is corresponding to 55% of world's tuna catch.

Interesting to me, the catch figures in 2011 are the lowest catch since 2005 and 300,000 mt lower than the record in 2009. This decline occurred in all major species. I would like to look forward that you together would work out what happened in the stock status and in the WCPO.

Together with the Stock Assessment, Management Issues, and Ecosystem and Bycatch themes are other important issues to be addressed in this meeting. Those issues are listed in your agenda and the importance of which are noted in the report of performance review of the WCPFC.

Distinguished scientists from the member countries, cooperating non-member countries and from the Commission's scientific consultants, I would like to warmly thank you for your hard work every year and this year again, to enhance our understanding and make available the best scientific information for conserving and managing the fish stocks, related species and ecosystem in the WCPFC area of competence.

I sincerely hope that you would have a pleasant stay here in Busan, Korea, enjoying the culture, the tourist attractions and of course, the food that this region of Korea has to offer. Again, I whole-heartedly welcome all of you to the Eight Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission and to Busan, Korea.

Attachment B

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

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Attachment C

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

AGENDA

AGENDA ITEM 1 OPENING OF THE MEETING

1.1 Welcome address
1.2 Meeting arrangements
1.3 Issues arising from the Commission
1.4 Adoption of agenda
1.5 Reporting arrangements
1.6 Intersessional activities of the Scientific Committee

AGENDA ITEM 2 REVIEW OF FISHERIES

2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries*
2.2 Overview of Eastern Pacific Ocean (EPO) fisheries
2.3 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 DATA AND STATISTICS THEME

3.1 Data gaps
3.1.1 Data gaps of the Commission
3.1.2 Species composition of purse-seine catches
3.1.3 Data issues with the ISC
3.2 Requests from CMM 2008-01
3.2.1 Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries*
3.3 Regional Observer Programme

AGENDA ITEM 4 STOCK ASSESSMENT THEME

4.1 WCPO bigeye tuna
4.1.1 Review of research and information
- a. Peer review of 2011 bigeye tuna stock assessment
- b. Indicator analysis
- c. Progress report on Project 35 (Refinement of bigeye parameters Pacific-wide)

4.1.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.2 WCPO yellowfin tuna

4.2.1 Review of research and information

4.2.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.3 WCPO skipjack tuna

4.3.1 Review of research and information

4.3.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.4 South Pacific albacore tuna

4.4.1 Review of research and information
   a. Review of Project 39 (Stock structure and life-history characteristics of SP albacore)
   b. Review of 2012 stock assessment
   c. Review of CMM 2010-05

4.4.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.5 South Pacific swordfish

4.5.1 Review of research and information

4.5.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.6 Southwest Pacific striped marlin

4.6.1 Review of research and information
   a. Review of Project 64 (Collation of SP striped marlin)
   b. Review of 2012 stock assessment

4.6.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.7 North Pacific striped marlin

4.7.1 Review of research and information
   a. Review of 2012 stock assessment

4.7.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.8 Northern stocks

4.8.1 North Pacific albacore tuna

4.8.1.1 Review of research and information

4.8.1.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.8.2 Pacific bluefin tuna

4.8.2.1 Review of research and information
   a. Review of 2012 stock assessment

4.8.2.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.8.3 North Pacific swordfish

4.8.3.1 Review of research and information

4.8.3.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.9 WCPO sharks

4.9.1 Oceanic whitetip shark

4.9.1.1 Review of research and information
   a. Review of 2012 stock assessment

4.9.1.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.9.2 Silky shark

4.9.2.1 Review of research and information
   a. Review of 2012 stock assessment

4.9.2.2 Provision of scientific information
   a. Status and trends*
   b. Management advice and implications*

4.10 Stock Assessment Methods

4.10.1 Review of research and information

AGENDA ITEM 5 MANAGEMENT ISSUES THEME*

5.1 Terms of Reference

5.2 Reference Points for the WCPFC

5.2.1 Limit reference points

5.2.2 Target reference points

5.2.3 Harvest Control Rules

5.3 Requests from CMM 2008-01

5.3.1 Review of the effectiveness of CMM 2008-01*

5.4 Management Objectives Workshop

AGENDA ITEM 6 ECOSYSTEM AND BYCATCH MITIGATION THEME

6.1 Ecosystem effects of fishing

6.1.1 Review of Research and Information

6.2 Sharks*

6.2.1 Shark Research Plan
   a) Assessment of whale sharks against the key shark species criteria

6.2.2 Review of CMM for Sharks
   a) CMM 2010-07 (CMM for Sharks)
   b) CMM 2011-04 (CMM for oceanic whitetip shark)
   c) Development of CMMs on other shark species
   d) Guidelines for safe release of encircled animals

6.2.3 International cooperation on shark issues

6.3 Seabirds*

6.3.1 Review of Research and Information

6.4 Sea turtles*

6.5 Other species and issues

6.5.1 FAD bycatch mitigation

6.5.2 Food security issues with bycatch

a) Management advice and implications*

AGENDA ITEM 7 OTHER RESEARCH PROJECTS

7.1 West Pacific East Asia Oceanic Fisheries Management Project*

7.2 Pacific Tuna Tagging Project*

AGENDA ITEM 8 COOPERATION WITH OTHER ORGANISATIONS

8.1 The status of cooperation and relations

AGENDA ITEM 9 SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

9.1 Consideration of the special requirements of developing States pursuant to Part VIII of the Convention

AGENDA ITEM 10 FUTURE WORK PROGRAM AND BUDGET

10.1 Review of the Scientific Committee Work Programme

10.2 Development of the 2013 Work Programme and budget, and projection of 2014-2015 provisional Work Programme and indicative budget*

AGENDA ITEM 11 ADMINISTRATIVE MATTERS

11.1 Rules of Procedure

11.2 Peer review of stock assessments*

11.3 Future operation of the Scientific Committee

11.3.1 Future structure of the SC

11.3.2 Review of SC agenda

11.3.3 Guidelines for the SC Chair and theme conveners

11.4 Election of the Chairman of the Scientific Committee*

11.5 Next meeting*

AGENDA ITEM 12 OTHER MATTERS

AGENDA ITEM 13 ADOPTION OF THE SUMMARY REPORT OF THE EIGHTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

AGENDA ITEM 14 CLOSE OF MEETING

Attachment D

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

ACRONYMS AND ABBREVIATIONS USED BY WCPFC

ACAP	Agreement for the Conservation of Albatross and Petrels
ALB	albacore (*Thunnus alalunga*)
$B_{current}$	average biomass over the period 2006–2009
BET	bigeye tuna (*Thunnus obesus*)
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
B_{MSY}	biomass that will support the maximum sustainable yield
CCM	Members, Cooperating Non-members and participating Territories
CMM	Conservation and management measure
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 effort
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DFLL	deep frozen tuna longline
EB-theme	Ecosystem and Bycatch Mitigation theme
EEZ	exclusive economic zone
ENSO	El Niño-Southern Oscillation
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/aggregation device
FAO	Food and Agriculture Organization of the United Nations
$F_{current}$	average fishing mortality rate over the period xxxx–xxxx

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)
GEF	Global Environment Facility
GLM	general linear model
GT	gross registered tonnage
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IFLL	ice fresh (tuna) longline
IOTC	Indian Ocean Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISG	Informal Small Group
ISSF	International Sustainable Seafood Foundation
IWG	Intersessional working group
JPY	Japanese yen
JTF	Japan Trust Fund
LL	longline
LRP	limit reference point
m	meters
MCMC	Markov chain Monte Carlo (a random sampling method)
MFCL	MULTIFAN-CL (a stock assessment modeling approach)
M_{FMT}	maximum fishing mortality threshold
MOU	memorandum of understanding
MSE	management strategy evaluation
M_{SST}	minimum stock size threshold
MSY	maximum sustainable yield
mt	metric tonnes
NPAFC	North Pacific Anadromous Fisheries Commission
PFRP	Pelagic Fisheries Research Program (Hawaii, USA)
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PTTP	Pacific Tuna Tagging Programme
ROP	Regional Observer Programme
RFMO	regional fisheries management organization
RMI	Republic of the Marshall Islands
SB	spawning biomass
SC	Scientific Committee of the WCPFC
SEAFDEC	Southeast Asian Fisheries Development Center

SEAPODYM	spatial ecosystem and population dynamics model
SIDS	small island developing state
SKJ	skipjack tuna (*Katsuwonus pelamis*)
SPC-OFP	Secretariat of the Pacific Community-Oceanic Fisheries Programme
SPR	spawning potential per recruit
SSB	spawning stock biomass
the Statistical Area	the WCPFC Statistical Area defined in para. 8 of the document "Scientific data to be provided to the Commission"
TCC	Technical and Compliance Committee of the WCPFC
TOR	terms of reference
USA	United States of America
USD	US dollars
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	western and central Pacific Ocean
WG	working group
WPEAOFM	Western Pacific East Asia Oceanic Fisheries Management Project

Attachment E

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

LIST OF DOCUMENTS

MEETING INFORMATION

WCPFC-SC8-2012-01	Meeting notice and information
WCPFC-SC8-2012-02	Provisional agenda
WCPFC-SC8-2012-03	Provisional annotated agenda
WCPFC-SC8-2012-04	Indicative schedule Rev 1 (4 August 2012)
WCPFC-SC8-2012-05	Registration form
WCPFC-SC8-2012-06	Guidelines for submitting meeting papers
WCPFC-SC8-2012-07	List of Documents Rev 3 (15 August 2012)
WCPFC-SC8-2012-08	Provisional agenda for head of delegation (HOD) meeting (1600-1700, 6 August 2012)
WCPFC-SC8-2012-09	Provisional Agenda of the JTF Steering Committee Meeting
WCPFC-SC8-2012-10	Provisional Agenda of the PTTP Steering Committee Meeting
WCPFC-SC8-2012-11	Provisional Agenda of the WPEA OFM Project Steering Committee
WCPFC-SC8-2012-12	Notes on Reorganisation of the SC Documents List
WCPFC-SC8-2012-13	Theme Agendas Annotated with Associated Papers

GENERAL PAPERS

GENERAL PAPERS – Working Papers	
GN-WP-01	Williams, P and P. Terawasi. . Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions – 2011.
GN-WP-02	IATTC. Summary of the fishery and assessments of the major stocks of tuna exploited in the eastern Pacific Ocean.
GN-WP-03	Secretariat. Issues arising from the Commission
GN-WP-04	Secretariat. Intersessional activities of the Scientific Committee
GN-WP-05	SC8 ISG5 List of Work Programme of the Scientific Committee Rev 2
GN-WP-06	SC8 ISG4 Guidelines for the SC Chair and Theme Conveners Rev 1
GN-WP-07	Secretariat. Recommended Requirements for Hosting the Scientific Committee Meeting of the WCPFC.
GN-WP-08	Secretariat. Recommendations from the Review of the WCPFC.
GN-WP-09	SC8 ISG6 List of Scientific Committee work programme titles and budget for 2012, and indicative budget for 2013–2014
GN-WP-10	SC8 Indicative plan of the SPC-OFP Science Services for 2013-2015

GENERAL PAPERS – Information Papers	
GN-IP-01	Secretariat. Cooperation with other organizations
GN-IP-02	ISC (Chair). Report of the 12th Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean.
GN-IP-03	Harley, S. A proposal to investigate range contraction for tropical tunas in the WCPO

SCIENCE-RELATED DOCUMENTS PRESENTED AT WCPFC8

SC8-WCPFC8-01	SPC-OFP. Review of Implementation of Effectiveness of CMM 2008-01 (WCPFC8-2011/43 Rev1)
SC8-WCPFC8-02	SPC-OFP. Projections recent av-recruitment (WCPFC8-2011/43 A)
SC8-WCPFC8-03	SPC-OFP. Projections srr recruitment (WCPFC8-2011/43 B)
SC8-WCPFC8-04	SPC-OFP. Summary Information on Whale Shark and Cetacean Interactions in the Tropical WCPFC Purse Seine Fishery (WCPFC8-2011-IP/01 Rev 1)
SC8-WCPFC8-05	SPC-OFP. WCP Tuna Fishery: 2010 Overview and Status of Stocks (WCPFC8-2011-IP-02)
SC8-WCPFC8-06	Secretariat. South Pacific Albacore Fishery (WCPFC8-2011-IP/04 Rev 1)
SC8-WCPFC8-07	SPC-OFP. WCPFC CMM 2008-01 Background Stats (Rev 1) (WCPFC8-2011-IP-11 (Rev 1))
SC8-WCPFC8-08	SPC-OFP. WCPFC-2011-IP06. Plan for Improvement of the Availability and Use of Purse Seine Catch Composition Data (Project 60)
SC8-WCPFC8-09	Australia Proposals to Address the Impact of Purse Seine Fishing Activity on Whale Sharks (WCPFC8-2011-DP/15a (Rev 1))
SC8-WCPFC8-10	Japan. A Guideline for safe and live release of encircled whale sharks during purse seine fishing operation (WCPFC8-2011-DP/17)

DATA AND STATISTICS THEME

ST THEME – Working Papers	
ST-WP-01	Williams, P. Scientific data available to the Western and Central Pacific Fisheries Commission. Rev 1 (30 July 2012)
ST-WP-02	Lawson, T. and F. Lasi. Report on Project 60: Collection and Evaluation of Purse-Seine Species Composition Data.
ST-WP-03	Lawson, T. Estimation of the species composition of the catch by purse seiners in the Western and Central Pacific Ocean using grab samples and spill samples collected by observers Rev 1 (27 July 2012)
THEME – Information Papers	
ST-IP-01	Williams, P. Estimates of annual catches in the WCPFC Statistical Area. SPC-OFP
ST-IP-02	Williams P. and C. Cole. Status of Observer Data Management
ST-IP-03	Secretariat. Summary of Regional Observer Programme Audits
ST-IP-04	Dickson et al. Analysis of Purse Seine/Ring Net Fishing Operations in Philippine EEZ
ST-IP-05	Piasente et al. Electronic onboard monitoring pilot project for the Eastern Tuna and Billfish Fishery (Australia)
ST-IP-06	Kumasi, B. Determination of age-classes from length-frequency data collected from port sampling in Papua New Guinea
ST-IP-07	Usu, T. Assessment of Independent fishery data collected from the PNG Purse Seine Fishery between 2008 and 2011.

STOCK ASSESSMENT THEME

SA THEME – Working Papers	
SA-WP-01	Ianelli, J., M. Maunder, and A. E. Punt. Independent Review of 2011 WCPO Bigeye Tuna Assessment.
SA-WP-02	Harley S., P. Williams and J. Hampton. A compendium of fisheries indicators for bigeye, skipjack, yellowfin, and south Pacific albacore tunas and south Pacific swordfish
SA-WP-03	Nicol, S. Project 35: Bigeye tuna age and reproductive biology progress report
SA-WP-04	Hoyle, S. Stock Assessment of Albacore in the south Pacific Ocean Rev 1 (29 July 2012)
SA-WP-05	Davies, N. et al. Stock Assessment of Striped Marlin (Kajikia audax) in the Southwest Pacific Ocean.
SA-WP-06	Rice, J. and S. Harley. Stock Assessment of Oceanic Whitetip Sharks in the Western and Central Pacific Ocean
SA-WP-07	Rice, J. Stock Assessment of Silky Sharks in the Western and Central Pacific Ocean
SA-WP-08	Kleiber, P. and S. Harley. An update on progress towards a stock assessment for swordfish in the southern WCPO including standardized CPUE for Spanish swordfish fleet.
SA-WP-09	Lee, S., Z. Kim, M. Lee, J. Ku, S. Yoon, and D. Lee. Yellowfin tuna CPUE standardization of the Korean tuna longline fisheries in the Western and Central Pacific Ocean. Rev 1 (6 August 2012)
SA-WP-10	ISC. Stock Assessment for North Pacific Striped Marlin
SA-WP-11	SC8 ISG1 Implications and priorities from the Peer Review of Bigeye 2011 Stock Assessment
SA THEME – Information Papers	
SA-IP-01	Davies, N. et al. Recent developments in the MULTIFAN-CL stock assessment software
SA-IP-02	Hampton, J. et al. SPC-OF response to the Independent Review of the 2011 bigeye tuna stock assessment
SA-IP-03	Servidad-Bacordo, R., A. Dickson, L. Nepomuceno and R. Ramiscal. Composition, Distribution and Abundance of Fish Eggs and Larvae in the Philippine Pacific Seaboard and Celebes Sea with Focus on Scombrids Larvae (Tuna and Tuna-like Species).
SA-IP-04	Holdsworth, J. Yellowfin Tuna Fisheries in New Zealand and the Southwest Pacific Ocean.
SA-IP-05	Evans, K., D. Kolody, F. Abascal, J. Holdsworth, P. Maru and T. Sippel. Spatial dynamics of swordfish in the south Pacific Ocean inferred from tagging experiments.
SA-IP-06	Not Provided
SA-IP-07	Ghosn, D., D. Collins, C. Baiada and A. Steffe. Catch per unit effort and size composition of striped marlin caught by recreational fisheries in southeast Australian waters. NSW Department of Primary Industries. Rev 1 (11 July 2012)
SA-IP-08	Holdsworth, J., and T. Kendrick. Characterization and catch per unit effort of striped marlin in New Zealand.
SA-IP-09	Hoyle, S. et al. CPUE Standardization for Striped Marlin in the Western and Central Pacific Ocean
SA-IP-10	Rice, J. Catch per unit effort of oceanic white tip sharks in the Western and Central Pacific Ocean.
SA-IP-11	Rice, J. Catch per unit effort of silky sharks in the Western Central Pacific Ocean (Rev 1).
SA-IP-12	Rice, J. Alternative catch estimates for silky and oceanic whitetip sharks in the WCPO
SA-IP-13	Campbell, R. Abundance indices for striped marlin and broadbill swordfish in the south-

	west Pacific based on standardised CPUE from the Australian longline fleet.
SA-IP-14	Bigelow, K. and S. Hoyle. Standardized CPUE for South Pacific albacore
SA-IP-15	Farley, J. et al. Population Biology of Albacore Tuna in the Australian Region
SA-IP-16	ISC. Annex 7 Report of the Billfish Working Group ISC 2-9 April 2012

MANAGEMENT ISSUES THEME

MI THEME – Working Papers	
MI-WP-01	Harley, S. et al. Evaluation of stock status of south Pacific albacore, bigeye, skipjack, and yellowfin tunas and southwest Pacific striped marlin against potential limit reference points Rev 1 (24 July 2012)
MI-WP-02	Pilling, G. et al. Consideration of target reference points for WCPO stocks with an emphasis on skipjack tuna
MI-WP-03	Berger, A. et al. An introduction to the use of harvest control rules for WCPO tuna fisheries
MI-WP-04	Satoh, K., H. Okamoto and M. Ogura. Relationship between bigeye tuna catch and school type of Japanese purse seine operated in tropical area of the western and central Pacific Ocean
MI-WP-05	Hanich, Q. Mapping the Conservation Burden in the Western and Central Pacific Tuna Fisheries
MI-WP-06	Hampton, J. et al. Review of the Implementation and Effectiveness of Key Management Measures for Tropical Tuna.
MI THEME – Information Papers	
MI-IP-01	WCPFC8. Terms of Reference for MI Theme Attachment J, WCPFC8 Summary Report
MI-IP-02	WCPFC8. Terms of Reference for the Management Objectives Workshop, WCPFC8 Summary Report

ECOSYSTEM AND BYCATCH MITIGATION THEME

EB THEME – Working Papers	
EB-WP-01	Evans, K. et al. Progressing adaptation to climate variability and change in Western and Central Pacific Ocean tuna fisheries.
EB-WP-02	Nicol, S. Progress on Kobe III bycatch technical working group.
EB-WP-03	Rice, J. and S. Harley. A Progress Report on the Shark Research Plan Rev 1
EB-WP-04	Rice, J. and S. Harley. Assessment of the whale shark as a key shark species
EB-WP-05	Withdrawn (2 August 2012) Kirby, D. and P. Ward. Review of bycatch mitigation and management measures for highly migratory (oceanic) shark species.
EB-WP-06	ACAP. Review of Seabird Bycatch Mitigation Measures for Pelagic Longline Fisheries.
EB-WP-07	ACAP. Minimum Data Requirements for Monitoring Seabird Bycatch
EB-WP-08	Withdrawn (2 August 2012) Kirby, D. and I. Hay. Review of bycatch mitigation and management measures for seabirds.
EB-WP-09	Robertson, G. et al. New branchline weighting regimes reduce risk of seabird mortality in the Australian pelagic longline fishery without affecting fish catch'.
EB-WP-10	Robertson, G. et al. Branchline weighting options that reduce the risk of seabird bycatch'.
EB-WP-11	Itano, D. et al. Overview of the ISSF Bycatch Mitigation Research Cruise in the WCPO

EB-WP-12	Hutchinson, M. et al. The post-release condition of FAD associated silky sharks (Carcharhinus falciformis) caught in tuna purse seine gear Rev 1
EB-WP-13	Muir, J. et al. Behavior of target and non-target species on drifting FADs and when encircled by purse seine gear.
EB-WP-14	Itano, D. et al. Development and testing of a release panel for sharks and non-target finfish in purse seine gear.
EB-WP-15	Satoh, S. et al. Review of Japan's approaches to reduce bycatch of juvenile bigeye tuna by purse seine on FADs in tropical area of the western and central Pacific Ocean.
EB-WP-16	Oshima, T. et al. Study on the methods to reduce the by-catch of juvenile Bigeye tuna in purse seine FADs operations. Rev 1
EB-WP-17	Kawamoto, T. et al. Study on the methods to mitigate the bycatch of juvenile bigeye tuna by introducing Double FADs with light stimulus for tuna purse seine fishery in the Western and Central Pacific Ocean.
EB-WP-18	Pilling, G. et al. Estimation of catches and fate of edible bycatch species taken in the equatorial purse seine fishery. Rev 1 (25 July 2012)
EB-WP-19	ISG 3 Guidelines for the Safe Release of Encircled Animals, including Whale Sharks
EB THEME – Information Papers	
EB-IP-01	Fitzsimmons, L. Bycatch Mitigaation Information System
EB-IP-02	Graham Robertson and Ian Hay. Progress report on the development and testing of the underwater bait setter for pelagic longline fisheries'
EB-IP-03	Semba, Y., K. Yokawa and H. Matsunaga. Distribution and trend of abundance for porbeagle (Lamna nasus) in the Southern Hemisphere.
EB-IP-04	Beck, N., Y. Inoue and W. Papworth. Progress Report on the Development of a Seabird Identification Guide for use by tRFMOs. Rev 2 (31 July 2012).
EB-IP-05	Birdlife International and ACAP. Seabird Bycatch Mitigation Fact Sheets.
EB-IP-06	Lehody, P. et al. SEAPODYM applications in WCPO – progress report.
EB-IP-07	Patterson, H. M. and M. J. Tudman. Chondrichthyan Guide for Fisheries Managers
EB-IP-08	Australia. National Plan of Action for the Conservation and Management of Sharks 2012 – Shark Plan 2
EB-IP-09	Australia. Operational Strategy: National Plan of Action for the Conservation and Management of Sharks 2012 - Shark-Plan 2
EB-IP-10	Mitsunaga, Y. et al. Association of early juvenile yellowfin tuna Thunnus albacares with a network of payaos in the Philippines
EB-IP-11	Allain et al. WCPO ecosystem indicator trends and results from ecopath simulations.
EB-IP-12	Poisson F. et al Good practices to reduce the mortality of sharks and rays caught incidentally by the tropical tuna purse seiners.

RESEARCH PROJECTS

JAPAN TRUST FUND	
RP-JTF-01	Secretariat. Japan Trust Fund Status Report (2012)
RP-JTF-02	Secretariat. Japan Trust Fund Steering Committee Report
PACIFIC TUNA TAGGING PROJECT	
RP-PTTP-01	PTTP-SC. Report of the PTTP Steering Committee
RP-PTTP-02	Hampton, J. et al. PTTP progress report and work plan for 2012-2013
WEST PACIFIC EAST ASIA OCEANIC FISHERIES MANAGEMENT PROJECT	
RP-WPEA-01	Secretariat. Information on WPEA OFM Project Steering Committee
RP-WPEA-02	Secretariat. Summary Report on 2011-2012 WPEA OFM Project Activities
RP-WPEA-03	Secretariat. WPEA OFM Project Financial Statement
RP-WPEA-04	Indonesia. WPEA OFM Project: Progress Report – Indonesia Rev 1

RP-WPEA-05	Philippines. WPEA OFM Project: Progress Report – Philippines Rev 1
RP-WPEA-06	Vietnam. WPEA OFM Project: Progress Report – Vietnam Rev 1
RP-WPEA-07	Secretariat. Report of the fourth session of the WPEA OFP Project Steering Committee. August 2012
RP-WPEA-08	Key Notes Reported to UNDP for 2012 APR/PIR for PIMS 4084: West Pacific East Asia Oceanic Fisheries Management Project

ANNUAL REPORT – PART 1[9]

Symbol	CCMs
AR-CCM-01	**Australia**
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**
Covered by its territories	***France***
AR-CCM-08	**French Polynesia**
AR-CCM-09	**Japan**
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-16	**Niue – Not Provided**
AR-CCM-17	**Palau**
AR-CCM-18	**Papua New Guinea**
AR-CCM-19	**Philippines Rev 1 (7 August 2012)**
AR-CCM-20	**Samoa**
AR-CCM-21	**Solomon Islands**
AR-CCM-22	**Chinese Taipei**
AR-CCM-23	**Tokelau**
AR-CCM-24	**Tonga Rev 1**
AR-CCM-25	**Tuvalu**
AR-CCM-26	**United States of America**
AR-CCM-27	**Vanuatu**
AR-CCM-28	**Wallis and Futuna**
Covered by USA Annual Report	***American Samoa***
	Guam
	Northern Mariana Islands

[9]Part 1 Annual Reports not posted on the WCPFC SC8 website have not been received.

AR-CNM-29	**Belize**
AR-CNM-30	**Democratic People's Republic of Korea**
AR-CNM-31	**Ecuador**
AR-CNM-32	**El Salvador Rev 1**
AR-CNM-33	**Indonesia Rev 1 (6 August 2012)**
AR-CNM-34	**Mexico**
AR-CNM-35	**Panama**
AR-CNM-36	**St. Kitts and Nevis**
AR-CNM-37	**Senegal**
AR-CNM-38	**Thailand**
AR-CNM-39	**Vietnam**

NGO and Others

Pew Statement to SC8
Greenpeace Statement to SC8
SEAFDEC Statement to SC8
Letter to SC8 on behalf of and in coordination with Shark Advocates International

Attachment F

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

IMPLICATIONS AND RECOMMENDATIONS TAKEN FROM THE PEER REVIEW OF THE BIGEYE 2011 STOCK ASSESSMENT

Timing	Priority/Importance
1 = ongoing, 2 = next assessment, 3 = longer term	1 = highest, 2–4 = moderate, 5 = lowest

Review recommendation	SPC-OFP response	Implications for SC to consider	Timing	Priority	Responsibility	Applicability to other species
1) When moving from one reference model to a modified one, care should be taken to change only one factor at a time to ensure the impact of changes can be fully understood.	Agree		1	2	SPC	skipjack, yellowfin
2) The way the fisheries are linked should be more fully documented in the assessment report, and the implications of such linkage should be more fully evaluated.	Agree and will include a table like Table E1 in future assessment reports.		2	3	SPC	skipjack, yellowfin
3) A Pacific-wide assessment should be conducted soon to evaluate whether the past conclusion that the results from a WCPO-only assessment are consistent with expectations	Agree	This represents another stock assessment and, therefore, needs to be prioritized with other assessment requests. It will require collaboration and	3	1	SPC	None

from a Pacific-wide assessment remains true.		travel resources to work with IATTC.				
4) Pacific-wide assessments should be conducted regularly (i.e. ~ every five years) to confirm the assumption that a WCPO-only assessment will provide robust estimates of stock status.	Agree	See above		2	SPC	None
5) Continue tagging programmes to allow estimates of movement rates to be obtained for a wide range of environmental conditions	Agree, and emphasize that this is also of importance to yellowfin and skipjack tuna, which are predominantly taken in surface fisheries. It has been shown that assessments using integrated statistical models for WCPO skipjack, in particular, are at best unreliable and at worst impossible without good quality and high volume tagging data.	This will have considerable budgetary implications. The costs (including tag recovery, database and analytical support) of an annual three-month pole-and-line-based tagging cruise in the western WCPO and an annual four to six week tagging cruise in the central Pacific (targeting bigeye) are around USD 1.5 million.	3	2	Commission, CCMs, SPC	skipjack, yellowfin
6a) High volume, small fish fisheries (e.g. Philippines and Indonesia) should be retained in the model to ensure their catches are removed from the population correctly with respect to length. However, the model should be formulated so that the data for such fisheries do not have a large impact on estimates of population trend and size.	Agree, although we note that data from these areas continue to improve and become more informative, and stock assessments should respond to this evolution over time.		1	2	Commission, CCMs, SPC	skipjack, yellowfin, bigeye
6b) Spatial variation in biological parameters should form a focus for future model development	Agree		3	2	SPC	skipjack, yellowfin
7) To better address the assumption of homogeneity in tag-recapture data, split Region 3	Agree		2	1	SPC	skipjack, yellowfin

into two regions and examine whether Region 5 should be split into two regions for tagging off eastern Australia.						
8) Further explore methods for weighting purse-seine length frequencies by catch.	Agree		2	3	SPC	skipjack, yellowfin
9) Further explore methods for the calculating longline size-composition data by weighting spatial data by long-term average catches.	Agree		2	3	SPC	skipjack, yellowfin
10) Length-frequency data for the Japanese longline fishery should be omitted from the reference model until these data are better understood and can be shown to be compatible with the associated weight-frequency data.	Agree	A request will be needed from SC/WCPFC to Japan to seek access to these data. If access to these data requires travel to Japan, then additional funds will be required. Also, availability of such data to be explored beforehand.	2	2	SPC and NRIFSF[a]	None at this time
11) Separate the training vessel length-frequency data from the commercial data and create a "survey" length composition series to be included in the model. Analysts should gain access to how training vessel trips and any other sampling programmes are undertaken, and analyze the available data at the set-by-set level before these length-frequency data are considered for re-inclusion in the assessment.	Agree, this is a good idea. It is an approach adopted in the skipjack assessment to utilize longline training vessel data.	See above	2	2	SPC and NRIFSF	Possibly yellowfin
12) A more appropriate method should be used to calculate the coefficients of variation for the Japanese catch per unit effort indices (e.g. Francis' canonical	Agree		2	3	SPC	Apply to all longline fisheries

method or prediction-based methods)						
13) Drop the Region 5 tagging data unless the model can be re-structured to make the area where the Australian tagging took place in Region 5 a separate region.	Agree. Drop or consider spatial restructuring instead. We also plan to carefully examine tagging data and model fits for both recent and historical tagging to determine if other issues exist. This will be complimented with analyses of mixing rates to determine the best way to model tagging data.		2	1	SPC	yellowfin
14) Available data on tag shedding should be examined and be used to provide a value for use in the assessment, noting that this may be challenging given the possibility of correlation between tag loss for each tag for double-tagged animals.	Agree. To date, modeling of double tagging data has not indicated continuous longer-term shedding to be an issue. Tag shedding is currently included (along with non-reporting) in a general instantaneous tag loss component.		3	5	SPC	skipjack, yellowfin
15) Tag loss and tagging-induced mortality should be modeled separately	Agree, although we note that specific estimates of tagging-induced mortality are not available.		3	5	SPC	skipjack, yellowfin
16a) Future analysis of operational catch per unit effort data should focus on how to identify targeting and investigate year-area interactions and the implications of increasing numbers of year-area cells without data.	Agree, and also note the additional point made in the main body of the report regarding the development of models to interpolate catch rates for cells with no data.	Analyses of Japanese operational data have been undertaken in collaboration with NRIFSF. Further discussion with NRIFSF in September 2012	2	1	CCMs, SPC	yellowfin
16b) Removing these unidentified vessels from the latter period is advised (Japanese longline operational data)		These trips to Japan are expensive and do not provide the best environment to analyze these important data (i.e. the	2	2	NRIFSF, SPC	yellowfin

		trips are short and we cannot retain the data for follow-up analysis).				
16c) Further developments of this very useful tool. MFCl The additional outputs provided in R (e.g. graphs of mean and variation in length and weight composition over time) were also very useful.		If access to these data requires travel to Japan then additional funds will be required.	1	3		Not applicable
17) Use methods that simultaneously use both age-length and growth increment data, ideally within MFCL.	Agree, and note that this is important for other assessments, notably South Pacific albacore.		3	3	SPC	skipjack, yellowfin, South Pacific albacore
18) Continue seeding experiments due to the impact that reporting rates have on the present model configuration and estimation.	Agree, and this is being done with the cooperation of national observer programmes across the region.	These costs will be included within existing tagging programmes while funds are available.	1	3	SPC	skipjack, yellowfin
19) Sensitivity analyses should continue to be shown to the assumed value for steepness and an appropriate means (e.g. a decision table) used to summarize the management implications of uncertainty regarding steepness.	Agree		Clarify with Panel		SPC and Secretariat	skipjack, yellowfin, South Pacific albacore
20) The size of the stock recruitment penalty should be selected which allows the asymptote of the stock-recruitment relationship to be estimated, but is otherwise uninformative about stock size.	Agree		Done		SPC	skipjack, yellowfin, South Pacific albacore
21) Moved to MFCL. Consider fitting the stock recruitment relationship to annual rather than seasonal recruitments.	Agree, and note that this capability currently exists in MFCL.				SPC	
22) The statistical weights for each data component (e.g. size	Agree		2	3	SPC	skipjack, yellowfin,

composition, tagging, effort deviations) should be re-evaluated and revisited with each subsequent assessment.						South Pacific albacore
23) Future assessments should include both standard and historical retrospective analyses.	Agree		2	2	SPC	skipjack, yellowfin, South Pacific albacore
24) Methods should be developed to provide output which accounts for uncertainty regarding the values for the factors considered in the structural analysis.	Agree, and this is been developed in the context of the 2012 oceanic whitetip and silky shark assessments.		2	2	SPC	skipjack, yellowfin, South Pacific albacore
25) Stochastic yield functions should be presented because they may not indicate the same values for management reference points such as F_{MSY} and B_{MSY}.	This can be done, and we are currently finalizing coding for stochastic projections, which could be used to generate stochastic yield functions.		3	4	SPC	skipjack, yellowfin, South Pacific albacore
26) Projections considering MSY estimates should account for fishery-specific changes (i.e. likely proportional catches by fishery).	Agree, and note that this is currently done as a matter of course in projections, and fishery selectivity can be re-computed for each time step of the projection.		1	3	SPC	skipjack, yellowfin, South Pacific albacore

[a] NRIFSF = National Research Institute of Far Seas Fisheries

Recommendations that specifically refer to MFCL

Definitions: Timing	Definitions: Priority/Importance
1 = immediate, 2 = 2013, 3 = 2014+	1 = highest, 2–4 = moderate, 5 = lowest

Review comment	SPC-OFP response	Timing	Priority	Responsibility
a. Test the options for time-varying selectivity. Allowing for time-varying selectivity may address some of the issues related to the sometimes poor fits to the length- and weight-frequency data.	This is currently possible by specifying time breaks in fisheries, but we agree a more elegant solution using time blocks as in Stock Synthesis would be better.	2	2	SPC
b. Allow the length bins to be of different widths. One might, for example, want many narrow length bins for the smaller lengths, but fewer but wider length bins for the larger lengths. Allowing for a more flexible length bin structure should also reduce computational times as well as better reflect the available data.	Agree this would be useful.	3	3	SPC
c. Allow for long-term and initial tag loss. Currently, initial tag loss is implemented by reducing the number of animals tagged when inputting data to the model and no account can be taken of long-term tag loss.	Initial tag loss is also allowed through the reporting rate parameter. But agree that the addition of long-term tag loss, while it is not seen to be significant in the double tagging data available, would be useful.	3	4	SPC
d. Include an option that allows tagging data to inform movement only rather than movement and mortality.	A tag likelihood conditional on-tag recapture exists in MFCL but has not been used for WCPO tuna assessments.	2	3	SPC
e. Allow conditional age-at-length data to be included in the likelihood function. This will allow ageing data from current sampling (e.g. WCPFC-SC6-2010/GN IP-04) to be formally included in the assessment.	Agree that this is a priority. Likewise for tag length-increment data.	2	2	SPC
f. Extend MFCL to allow gender to be explicitly represented. This will allow the impacts of differences in growth and natural mortality between the sexes to be represented. The current approach to modeling, for example, length-specific natural mortality (e.g. WCPFC-SC4-2008/ ME-WP-1) seems unnecessarily complicated given the lack of gender-structure in the model.	This development is close to completion in MFCL.	1	1	National scientists and SPC
g. Create an output table that lists all of the likelihood components by fleet and automates the process of computing effective samples sizes (and other summary statistics related to model fit).	Agree	2	1	SPC
h. Allow for more general selectivity options, including selectivity patterns where the first age for which selectivity is non-zero is pre-specified. This should help to avoid selectivity being non-zero owing to	Agree	3	3	SPC

the functional form for selectivity rather than data.				
i. Include a "tail compression" option, which would pool all length- and weight-data for large and small sizes based on a specified percentage (e.g. all lengths would be pooled so that the "plus" length-class contained 0.1% of the length-frequency).	We probably need to discuss the merits of this further with the reviewers.	3	5	
j. Add an option that allows the analyst to assume a multinomial likelihood for the compositional data in the first phases and only transition to the robust normal likelihood in the later phases.	Agree	2	2	SPC
k. When maturity data are based on length, converting to ages should be done within the model. Presently, maturity-at-age is based on a fixed age-length relationship.	Agree	3	3	SPC
l. An option to add a likelihood weight to the tagging data component should be added.	Agree, although to an extent this exists through the over-dispersion parameter of the negative binomial.	2	3	SPC
m) Moved from general recommendation #21. Consider fitting the stock-recruitment relationship to annual rather than seasonal recruitments.	Agree, and note that this capability currently exists in MFCL.	2	3	SPC

Attachment G

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

GUIDELINES FOR THE SAFE RELEASE OF ENCIRCLED ANIMALS, INCLUDING WHALE SHARKS

Summary

An Informal Small Group 3 (ISG3) meeting was held during the WCPFC SC8 in Busan, Korea on 8 August 2012. Fourteen (14) SC8 participants took part in the meeting and discussed the development of guideline for the safe release of encircled animals, including whale sharks. ISG3 reached the conclusion that it is currently not possible to determine the "best" practical method for the safe release of encircled animals. Additionally, there have been no scientific investigations as to the survival of whale sharks that have been caught or entangled in purse seines. Therefore, ISC3 recommended further research primarily to investigate the survival of encircled animals associated with various release techniques.

General principles

- Safety of the crew is a paramount consideration.
- When releasing encircled whale sharks, the stress the animal receives should be minimized to the extent possible.
- The following possible release methods should be used as general guidelines.
- The effectiveness of the following possible release methods has not been fully evaluated. Further scientific research is necessary in order to investigate survival after the release by various release methods. Therefore, CCMs are encouraged to conduct analysis on methods used by their purse seine vessels. In addition, the WCPFC could initiate a program of satellite tag deployments by experienced observers to assess survival of encircles animals associated with various release techniques.
- The appropriate release method should be chosen in a flexible manner depending on the circumstances and condition of the particular purse seine set, e.g. the size and orientation of the encircled animal, amount of fish in the purse seine set, weather conditions and brailing operation style.

Possible release methods

1. Cutting net
   - Experience indicates that cutting the net vertically (about 3-5 meters) is quick and efficient.
   - Caveat: Possible uncontrolled ripping of the net if under load from catch or currents, loss of entire catches and time to repair the net.

2. Passive removal or letting sharks go over corkline (ref. Japan proposal in WCPFC8-2011-DP-17, see Appendix 1)
    - Would be easy particularly for vessels sacking up with a skiff.
    - The manipulation of cork line is possible only if the vessel concentrates and loads catch using a brailing boom.
    - Very situation dependent and based on size and orientation of the animal.
    - Caveat: If it takes a long time to roll a shark out of the net which may expose the sharks to excessive stress, Some loss of catch is possible during the operation.

3. Horizontally pulling sharks by the tail or a Sling Method, see Appendix 2)
    - Encircling the caudal peduncle of the shark with a smooth sling (non-abrasive material) that is attached to a heavy line and towboat. A second line is run from the skiff through the sling and back to the skiff. The skiff slowly moves the shark's tail/body next to the cork line and is gently led over the cork line. Lowering corks from brailing boom or releasing some corks from attachment to net skiff. Slowly towing shark horizontally by the tail until clear of corks when rope is released and sling falls away.
    - Caveat: This procedure could be traumatic although likely less traumatic for small and medium sharks (5-6 m maximum). Probably inappropriate for fish >6 m.

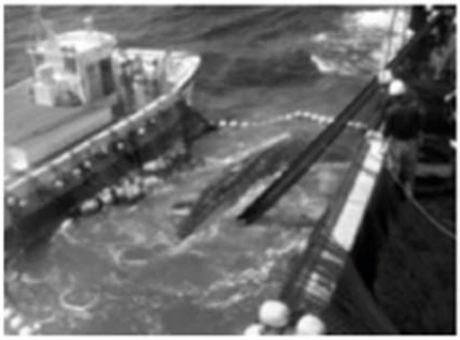
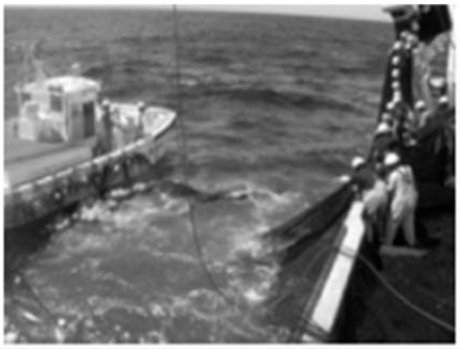
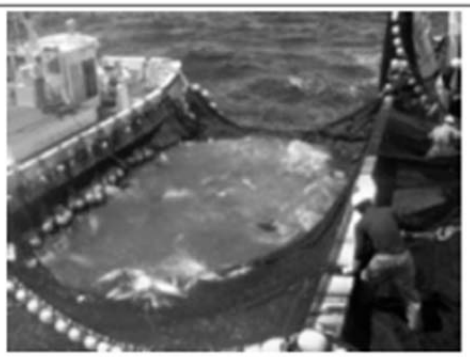
Note, animals should be kept in water at all times when using release methods 1-3.

- Brailing sharks
    - Could be very easy and quick. Appropriate length is probably less than 3 m.
    - Exposure time out of the water should be minimised
    - Caveat: sharks must be small enough to be scooped by brailing without stress

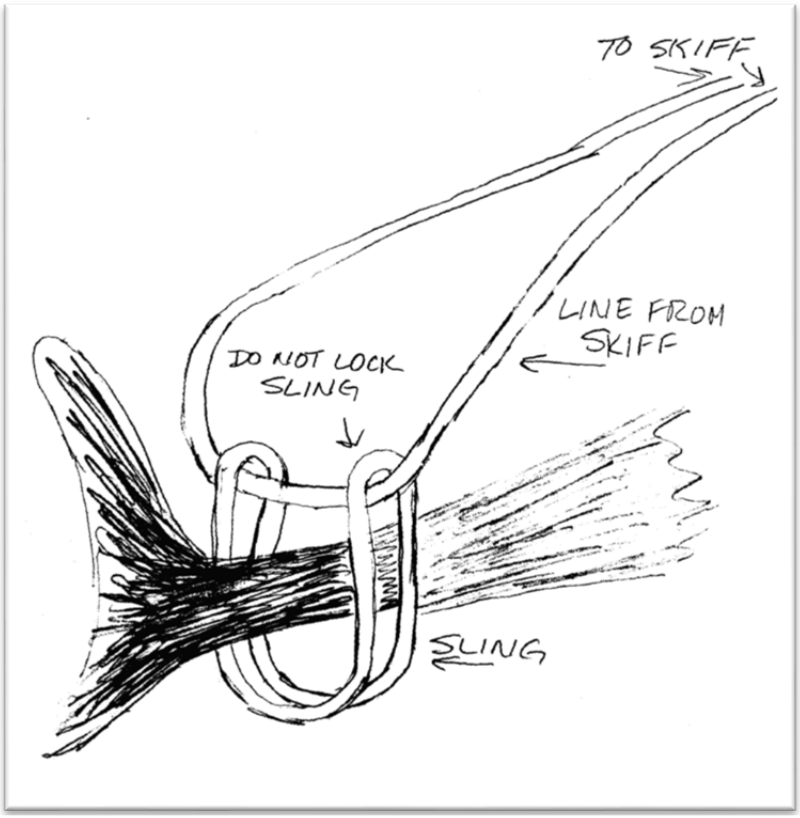
Release methods not recommended:

- Vertically lifting sharks by tail because internal organs may be damaged.
- Pulling sharks by a loop hooked around its gill or holes bored into a fin.

[Appendix 1] Proposed by Japan at SC7 (Guidelines for safe and live release of encircled non-target animals during purse-seine fishing operations)

a). lead the head to approach nearest cork rope by rolling up the net under the ventral and tail side.	
b). Release cork rope from their head side. c). Roll up the net of the tail side to run the head on the cork line d). Control the net carefully to keep whale shark calm down because if they wriggle, their body could be entangled in the net	 
e). Wait for escaping from the net themselves (whale shark swim away from the net)	

[Appendix 2]
Design and deployment of a release mechanism for mid- to small-sized whale sharks



Attachment H

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
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LIST OF WORK PROGRAMMES OF THE SCIENTIFIC COMMITTEE

An Informal Small Group (ISG) will meet to update the List of SC Work Programme. The purpose of this List is to allocate a unique number to individual SC projects for future reference, to describe explicit terms of reference for any project contract, and compile historical project activities. This will be a standing document for an annual update if needed. The ISG will meet in the margin of SC8 to review the priority, TOR and any further background descriptions, and consider the budget implications for review and recommendation to the Commission for high priority projects.

DRAFT WORK PROGRAMME OF THE SCIENTIFIC COMMITTEE FOR 2008–2010

(Indicative budget in USD)

Project items (priority)	Description	Status
Project 28. (Priority = Medium)	**Development of procedures and decision rules (harvest control rules) to assist the interpretation of stock assessment results and the formulation of management recommendations.** Tasks/TOR History • SA-SWG priority. • 2012: SPC conducted a project "development of a simple harvest control rules for the WCPO fisheries".	**Active** (Due for completion 2012)
Project 38. (Priority = Low)	**Feasibility study to determine the effectiveness of otolith microchemistry to estimate stock mixing and large-scale tuna movement.** Tasks/TOR • Recent advances in extraction of microchemistry samples from fish otoliths provide the potential for observing regional water chemistry differentiation in the otoliths of pelagic species; hence a natural tag for estimating stock mixing and large-scale tuna movement. History • **Budget level: USD** 60,000 over one year (SPC and University of Hawaii proposal). Comments: 1. Not sure about this. Independent of WCPFC funding, I (Itano) have been involved in an otolith microchemistry project for stock discrimination of yellowfin and bigeye tuna in the central Pacific. That project is complete and a publication is in press. 2. This may refer to ongoing work between SPC and CSIRO Hobart. 3. Recommend: Consult with SPC for their opinion. SPC comment (Nicol) SPC has some ongoing otolith microchemistry with CSIRO for albacore. I always assumed that this project though was the Itano yellowfin but we could capture our work under this project if that is desired. Maybe this could be determined after consideration of the South Pacific albacore assessment report.	**Active** (Due for completion 2012)
Project 55. (Priority = Medium)	**Undertake 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, with a view to identifying their impact in relation to mitigation measures to reduce catches of juvenile tuna and non-target species by purse-seine gear.** Tasks/TOR History • FT-SWG priority. • Includes seeking collaboration with industry to design of industry-associated studies related to selectivity and avoidance of small tunas and bycatch on floating objects. Assistance of the commission in promoting industry cooperation with in-kind contribution of vessel time is requested.	**Active** (Due for completion 2012)

	• PNG supported USD 25,000 for FAD Bycatch Mitigation Research and Itano working with ISSF conducted this research (contracted in January 2011). Comments: 1. Funds have been used as per the project proposal to support established FAD bycatch mitigation programmes as the funds were insufficient to mount a stand-alone project of effective scope. Funds to date have been used to support bycatch mitigation research sponsored by ISSF. This project will be fully reported to SC8 as funds will be fully expended to close the project in 2012.	
Project 57. (Priority = High)	**Identifying provisional limit reference points for the key target species in the WCPFC Convention Area.** Tasks/TOR • Identify candidate indicators (e.g. $B_{current}/B_o$, SB/SB_{MSY}) and related limit reference points (e.g. $B_{current}/B_o$,=X, SB/SB_{MSY}=Y), the specific information needs they meet, the data and information required to estimate them, the associated uncertainty of these estimates, and the relative strengths and weaknesses of using each type within a management framework. • Using past assessments, evaluate the probabilities that related performance indictors exceed the values associated with candidate reference points. • Evaluate the consequences of adopting particular limit reference points based on stochastic projections using the stock assessment models. • 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). • Include the consideration of multi-specific effects on harvest control rules. History • Several researches on reference points have been conducted by SC.	**Active** (Due for completion 2012)
Project 58. (Priority = Medium)	**Evaluation of reference points and decision rules (harvest control rules).** Tasks/TOR • Undertake a formal evaluation (e.g. Management Strategy Evaluation and robustness of stock assessments) of reference points and decision rules to guide the long-term management of key target species in the WCPFC. History • The work programme recommended in the second consultancy report and at SC4 would provide some guidance on progressing this task. • As of SC8, WCPFC-SC considered limit reference points, target reference points, and harvest control rules.	**Active** (Due for completion 2012)
Project 60. (Priority = High)	**Collection and evaluation of purse-seine species composition data.** Tasks/TOR • Collection of fish weight data onboard longline and purse-seine vessels using "at sea" scales. • Continued study into sampling regimes for size and species composition of purse-seine catches. • Port sampling programmes to determine the accuracy of cannery receipts in Noro, Solomon Islands and possibly other ports. • Collaboration with other tuna RFMOs to examine factors affecting the sampling of purse-seine species composition. Tasks/TOR for 2013 • Collect paired grab and spill samples from the WCPO purse-seine fishery and	**Active** (Due for completion 2013)

	quantify the bias in species and size compositions determined from grab samples. • Compare species compositions determined from i) logsheets, ii) grab samples, iii) spill samples, iv) cannery receipts, and v) port sampling of landing categories of catches delivered to the cannery at Noro, Solomon Islands and possibly other ports. • Document spill sampling protocol. • Develop procedures to correct historical catch and size data covering the WCPO purse-seine fishery for biases. History • In April 2009 (to be presented at SC5 in 2009), USD 54,500 was contracted to fund the "Collection and Evaluation of Purse-Seine Species Composition Data". In December 2009, USD 54,500 was budgeted and in 2010, USD 90,000 was endorsed to support this project. • In December 2011, no further budget was allocated to this project but requested to submit a "Plan for Improvement of the Availability and Use of Purse Seine Catch Composition Data" (WCPFC8-2011-IP/06). SC8 will consider budgetary implications of this Plan. • 2013 = USD 75,000.	
Project 37. (Priority = High)	**Analysis of FAD impacts on trophic dynamics.** Tasks/TOR • **This work is required for a better understanding of the biological impacts of FADs.** History • Budget level: USD 70,000 over two years (SPC and University of Hawaii proposal). SPC comment (Nicol) – The only progress on this is the collection of samples for isotope analyses and fatmeter for condition. Lab analyses have not been undertaken. SPC will host a PhD student from the University of South Hampton in 2013 who will address hypotheses on this topic but we will not have results from this work until the 2014 SC. We might want to grant an extension to this project.	**Active** (Due for completion 2014)
Project 42. (Priority = High)	**Pacific-wide tagging project.** Tasks/TOR • Main objectives are to obtain information on movement, stock structure, growth, mortality, behavior, habitat utilization, and vulnerability for use in stock assessments for yellowfin, bigeye and skipjack tunas. • Undertake a preliminary analysis of the vertical distribution of skipjack, yellowfin and bigeye tunas associated with FADs, as indicated by acoustic tagging data. This item is related to the analysis of data from the PNG Tagging Project and scientists from other CCMs will participate in this project. Future work will be in the context of Phase 2 tagging. • Ongoing and newly funded research with sonic and archival tags in Hawaii, PNG and other areas. Ongoing. **(**Currently funded SPC-OFP and University of Hawaii projects). History • Refer to GN WP-10 for the Phase 2 proposal of regional tuna tagging. • Funding is a limiting factor for Pacific Ocean tuna tagging experiments and should be sought from a broad range of sources, including member and non-member countries with substantial financial interests in these fisheries, Global Environment Facility, and non-governmental organizations, particularly foundations interested in supporting scientifically based tuna conservation efforts.	**Active** (Due for completion 2015)

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- The budget required for a two-year pan-Pacific tagging project would be at least USD 9 million for conducting a wide coverage project in the WCPFC Convention Area alone. Approximately USD 2.4 million has been identified through SPC projects. To provide some additional perspective, the Indian Ocean Tuna Commission tagging project over three years in a much smaller area than the Pacific (or even the Convention Area) cost USD 19 million.

</td><td></td></tr>
<tr><td>Project 67. (Priority = High)</td><td>

Range contraction of tropical tunas, sharks, and billfish.

<u>Tasks/TOR</u>
• Recognizing that biomass for most WCPO stocks is estimated to be at historical lows and concerns have been raised by non-tropical coastal states about declines in the abundance of tropical tuna species, this project seeks to:
a) examine existing data to examine the spatial distribution of tropical tunas and related species is changing through time and with change is abundance;
b) develop models that allow the simulation testing of alternative hypotheses about spatial distribution patterns including range contraction; and
c) provide advice on the how the preservation of the spatial distribution of tropical species may impact on target and limit reference points.

<u>History</u>
• This is a newly proposed project in 2012 and no funding is sought from WCPFC at this time.

</td><td>Active (Due for completion 2015)</td></tr>
<tr><td>Project 35. (Priority = High)</td><td>

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

<u>Tasks/TOR</u>
a) Objective: To obtain accurate scientific information on maturity, spawning locations, sex ratios, and fecundity for inclusion in stock assessments of bigeye tuna in the Pacific Ocean.

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

<u>History</u>
• Original proposal
<table>
<tr><th colspan="2">Pilot study</th><th colspan="4">Pacific-wide study</th></tr>
<tr><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td></tr>
<tr><td>30,000</td><td>29,000</td><td>62,000</td><td>236,000</td><td>350,000</td><td>129,000</td></tr>
</table>
• Adjusted proposal, as of July 2012
<table>
<tr><th>Planning stage</th><th colspan="3">Pilot study?</th><th colspan="4">Pacific-wide study?</th></tr>
<tr><td>2008</td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td></tr>
<tr><td>15,000</td><td>30,000</td><td>30,000</td><td>31,000</td><td>55,000</td><td></td><td></td><td></td></tr>
</table>
• It is important to address some of the outstanding issues related to the biological parameters for bigeye, but we also need to ensure work is done on other species for which much less data are available. Hopefully, the priority species will

</td><td>Active (Due for completion 2016)</td></tr>
</table>

	identify themselves through the ecological risk assessment process. In the WCPO, we have a range of similar or even more critical issues related to yellowfin and albacore.	
Project 36. (Priority = High)	**Age and growth of the target tuna species.** Tasks/TOR • An initial project within this category is regional differences in growth from length-frequency data for yellowfin and bigeye. History •	**Active** (Part of project 35)
Project 65. (Priority = High)	**Peer review of stock assessment.** Tasks/TOR History • In 2012, a peer review was conducted on the 2011 bigeye stock assessment. • Include any others (e.g. Yellowfin Center of Independent Experts review).	**Active ongoing**
Project 1. (Priority = High) SPC-OFP services	**Incorporate data provided by Members, Cooperating Non-Members and Participating Territories (CCMs) under the Commission's data provision policy into existing databases and facilitate access of Commission Secretariat staff to those data as appropriate.** Tasks/TOR History	**Active ongoing**
Project 11. (Priority = High) SPC-OFP services	**Identify known data/information gaps in the current stock assessment, particularly in relation to operational level CPUE data.** Tasks/TOR History • A number of potential explanations for different data gaps were identified, including the time and resources required to access and collate historical records, the long voyage times for some distant-water longline fleets and the large and dispersed nature of small boat fleets in Indonesia and the Philippines. • A number of members cited specific issues with the summary of data gaps presented in the paper and SPC-OFP undertook to revise the information accordingly in consultation with the relevant members.	**Active ongoing**
Project 14. (Priority = High) Consolidate with Project 8	**Indonesia and Philippines Data Collection Project (IPDCP)** **West Pacific East Asia Oceanic Fisheries Management Project** Tasks/TOR • IPDCP: Data collection from port sampling in Indonesia and the Philippines. • WPEAOFM: i) monitoring, data enhancement and fishery assessment; and ii) policy, institutional strengthening and fishery management. History • Refer to SC3-GN-WP-07 Report of the Steering Committee on IPDCP. • 2004-2009: IPDCP activities in Indonesia and the Philippines. • 2010-2012: WPEAOFM Project activities • WCPFC Secretariat and UNDP is working on Phase 2 of WPEAOFM	**Active ongoing**

Project 15. (Priority = High)	**Rescue of historical commercial catch data from countries in the western Pacific Ocean, including Vietnam.** Tasks/TOR History • Highest priority to minimize data gaps in stock assessments and has been implemented as part of the WPEAOFM Project.	**Active ongoing** (Refer to Project 14)
Project 2. (Priority = High) SPC-OFP services	**Compile estimates of annual catches by species, gear type and flag, as specified in the procedures for Scientific Data to be Provided to the Commission.** Tasks/TOR History	**Active ongoing**
Project 22. (Priority = High) SPC-OFP services	**Undertake stock assessment for target and non-target species as requested by the Commission.** Tasks/TOR • Refinement of data and data structure used for stock assessment. • Quantification of changes in fishing efficiency due to changes in fishing gears and fish finding technologies – Medium Priority. (Used to model changes in selectivity over time required in MFCL assessment models - Cross-reference with Project 27 for non-OFP project work) • Quantification of changes in longline selectivity due to changes in gear types and patterns of deployment – Medium Priority. (Used to model changes in selectivity over time required in MFCL assessment models. SPC-OFP services as time allows.) History • Annual commitment.	**Active ongoing**
Project 23. (Priority = High) SPC-OFP services	**Undertake standardization of longline catch and effort data, including where appropriate operational-level data, and the construction of indices of stock abundance for species of interest to the Commission.** Tasks/TOR • There are many issues to explore relating to CPUE standardization. Need to develop a specific work programme on this with funding support. History	**Active ongoing**
Project 24. (Priority = Medium) SPC-OFP services	**Development and reporting of stock indicators for those key species not formally assessed.** Tasks/TOR • Formulate most-up-to-date management advice to Commission if full assessment not undertaken. History • SA-SWG priority.	**Active ongoing**
Project 25. (Priority = High) SPC-OFP services	**Continued exploration of sensitivity of stock assessment outcomes to structural assumptions in models and data issues, including the comparison of various stock assessment models.** Tasks/TOR • This work also includes the development of better diagnostics to more objectively determine plausible model structure. • Work programme for 2008 includes a comparison of MFCL, SS-2 and other	**Active ongoing**

	stock assessment models for yellowfin or bigeye tuna. • This will be more routinely incorporated into the assessments if it is felt to be informative. <u>History</u> • ME-SWG priority.	
Project 26. (Priority = High)	**Stock assessment on southern swordfish.** <u>Tasks/TOR</u> <u>History</u> • SA-SWG priority. • 2006: Full stock assessment of swordfish in the southwest Pacific. • 2008: Full stock assessment. • 2011: Data collection and CPUE analysis. • In March 2012, WCPFC8 agreed to conduct swordfish stock assessment as requested by the European Union. SPC-OFP is undertaking this work.	**Active ongoing (periodic)**
Project 29. (Priority = High) SPC-OFP services	**Further refinement of the stock assessment model, MFCL, including simulation testing of new developments as appropriate and refinement of models for CPUE standardization.** <u>Tasks/TOR</u> • Work programme for 2008 included designing a more efficient recruitment parameterization (High priority) and incorporation of length-based selectivity (Medium priority). • There are a number of other matters that need to be addressed, including a long-term project to re-write the software to make it more transparent, better documented, and include new features (multi-sex, species, and stock options). <u>History</u> • ME-SWG and SA-SWG priority.	**Active ongoing**
Project 3. (Priority = High) SPC-OFP services	**For catches for which estimates are not otherwise available, conduct statistical analyses to estimate catches, particularly in regard to a) purse-seine catches of bigeye tuna and yellowfin tuna, b) discards of target tuna species, and c) catches of non-target species.** <u>Tasks/TOR</u> <u>History</u> • Related with (c) above, refer to WCPFC-SC8-2012/EB-WP-18.	**Active ongoing**
Project 32. (Priority = Medium)	**Further consideration of how to reflect uncertainty in projections.** <u>Tasks/TOR</u> <u>History</u> • ME-SWG priority.	**Active ongoing** (now Project 28)
Project 41. (Priority = Medium)	**Development of a biological database for inclusion on the WCPFC website.** <u>Tasks/TOR</u> <u>History</u> • BI-SWG priority. • The Commission contracted with SPC for the development of "Bycatch Mitigation	**Active ongoing (now as B MIS?)**

	Information System" (BMIS), which is annually updated with TCC's budget.	
Project 5. (Priority = Medium) SPC-OFP services	**Produce and publish on the Commission's website the Tuna Fishery Yearbook, containing annual catch estimates by gear type, flag and species.** Tasks/TOR History	**Active ongoing**
Project 50. (Priority = Low)	**Offal discards and haul-back mitigation studies.** Tasks/TOR History • Development of bycatch and bycatch mitigation database (currently BMIS is developed and managed by SPC, funded by TCC budget). • If any use is to be made of this database, there would be considerable ongoing work required to populate the various database tables. Some of this, but not all, could be done under other OFP service items (bycatch estimation). • There is also a concern that the additional components added on (e.g. ERA attributes, non-target catch estimates and species utilisation) probably weren't envisaged at the start and the work involved will go beyond the time/funds originally envisaged in the contract. • Some funding would need to be allocated in future budgets if this work is to be ongoing.	**Active ongoing** (TCC funded BMIS; Remainder Inactive)
Project 52. (Priority = High) SPC-OFP services	**Shark Research Programme.** Tasks/TOR • Refer to the Shark Research Plan. History • EB-SWG priority. • Shark Research Plan was proposed at SC6 and adopted at WCPFC7. • CMM 2006-05 (replaced by 2010-07) requested that shark stock assessments be undertaken for key shark species. • Shark research plan was approved by WCPFC7.	**Active ongoing**
Project 6. (Priority = High) SPC-OFP services	**Compile estimates of catch and effort in support of the functions of the Commission and its subsidiary bodies, such as a) estimates of annual catches by vessel flag, EEZ, and archipelagic waters, for use in determining the catch component of the Commission's assessed contributions; and b) estimates of catch and effort in support of conservation and management measures.** Tasks/TOR History	**Active on going**
Project 7. (Priority = High) SPC-OFP services	**Disseminate public domain catch, effort and size data on the Commission's website at agreed level of resolution.** Tasks/TOR History	**Active ongoing**

Project 8. (Priority = High) SPC-OFP services	**Participate in data collection project in the West Pacific East Asian waters.** Tasks/TOR • Participate in the Indonesia and Philippines Data Collection Project (Projects 15 and 16) and the compilation of information on the tuna fisheries of Vietnam. • Participate in the WPEAOFM Project. History	**Active ongoing** (The 1st phase of WPEA OFM finishes in 2012)
Project 46. (Priority = Medium)	**Development/review of models, such as full development of an EcoSim model, for evaluation of fishery and environmental impacts on an ecosystem, including development of reference points.** Tasks/TOR History • Required modeling and assessing fishery impacts on ecosystems. • This is separate from the ERA work. SPC-OFP will be undertaking work under SciFish project on continued development of SEAPODYM model and application to WCPO pelagic ecosystems.	**Active ongoing** (SEAPODYM – long term)
Project 62. (Priority = Medium)	**SEAPODYM simulation modeling.** Tasks/TOR • Collaboration between Collecte Localisation Satellites, Space Oceanography Division and SPC-OFP. • Development of a Pacific swordfish application. • Simulation experiments to improve the model calibration for tuna species, using higher resolutions of fishing data and oceanic environmental data. • Model calibration for albacore with a basin-scale application, including both north and south populations. • Incorporation of conventional and archival tagging data in the model calibration. • Projection of impact of global climate change on distribution and abundance of tuna stocks. History	**Active ongoing see Project 46**
Project 16. (Priority = Medium)	**Publication and distribution of Commission's training and educational materials.** Tasks/TOR • Development of training materials and the production of material to facilitate the identification of target and non-target species by fishermen, observers, and port samplers with the objective of improving data quality. History • During 2007, additional guides were developed by the FT-SWG on longline and purse-seine bycatch species. **Comments:** 1. Work included the production of three identification guides for distinguishing yellowfin from bigeye tuna in three condition states (fresh, brine frozen, damaged) useful for the training of observers and port samplers. The guides were produced in English and have since been translated into seven languages for use by all tuna RFMOs. Additional photographic guides were produced to assist the identification of longline and purse seine non-target species. Expenditures under this Project were mainly used to fund the reproduction and	**Completed**

	distribution of these guides to various agencies and organizations for training purposes. 2. These guides are still available on the Commission website at no cost but funds for their printing and distribution in hard copy may be desirable in the future. 3. Recommend that this project be moved to a list of inactive but potentially useful projects.	
Project 17. (Priority = High)	**Draft list of minimum data fields for the Regional Observer Programme be annotated with explanations of what each field is and why it is needed and detail describing the format (e.g. units of measure, codes) to be used when collecting each field.** Tasks/TOR • As shown in the title above. History • ST-SWG priority. • Undertaken by WCPFC Secretariat during 2008.	**Completed**
Project 34. (Priority = High) SPC-OFP services	**Further review of spatio-temporal aspects of catches of juvenile bigeye and yellowfin tuna caught in association with FADs by updating the analysis presented in WCPFC 3-2006-16. Refine the assessment of management options presented in the paper on the basis of the latest available fishery information.** Tasks/TOR • Research items to be considered over the three-year planning horizon: a) With new skipjack and bigeye tuna assessments and the 2007 yellowfin assessment, conduct multi-species management options analyses, including economic outcomes of options on each sector. b) Purse-seine fishery characterization – as a first step in developing an operational model of the fishery and more formal management strategy evaluation work. c) More spatial analysis – perhaps adopting the statistical approach of estimating latitude, longitude and seasonal effects on associated set (small juvenile) yellowfin and bigeye tuna catches. History	**Completed**
Project 39. (Priority = High)	**Regional study of the stock structure and life-history characteristics of South Pacific albacore.** Tasks/TOR History • BI-SWG Priority. • A proposal to undertake this work is being developed by Australia and conjunction with New Zealand, SPC-OFP and other CCMs (e.g. New Caledonia, French Polynesia, FFA countries). • Total Budget: AUD 820,000 over three years, and the Commission supported USD 25,000 for 2008, 2009, and 2010 to CSIRO (Jessica Farley). • This project was successfully finished and the final report was submitted to the Secretariat in July 2012, and posted on SC8's website.	**Completed**
Project 43. (Priority = High)	**Ecological risk analysis, including productivity-susceptibility analysis.** Tasks/TOR	**Completed** (ERA complete in 2009

	History • Ongoing ERA work programme submitted to SC3 and endorsed (cf. EB-WP-3). • Includes USD 30,000 for identifying areas of spatial and temporal overlap of seabird and sea turtle interactions with tuna fisheries in the WCPO (ACAP). • ERA budget of USD 130,000 was included in SPC-OFP science services budget in 2009 (SC5). • WCPFC7 switched ERA to shark research: WCPFC7 144. WCPFC7 approved the shark research plan and the reallocation of existing funds within the science services budget (USD 792,000 in 2012) to support shark assessments during 2011 and 2012. WCPFC7 agreed to add porbeagle and four species of hammerhead sharks to the Commission's key shark species in CMM 2009-04 (Attachment DD). This amendment raises the number of key shark species to be reported to the Commission to 13 but maintains the original 8 key species as the focus of the Shark Research Plan until further funding is made available.	Shark Research Plan ongoing)
Project 56. (Priority = Medium)	**Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects.** Tasks/TOR History • FT-SWG priority • The unit used in the EPO by IATTC cost approximately USD 3,000. On advice from IATTC, it will likely be necessary that gear be suitable to depths of at least 100 m due to deeper thermocline and mixed layer depth in the WCPO. This will require greater pressure ratings and length of cables. • This project was conducted by D. Itano for two years and project outputs were presented at SC meetings.	**Completed**
Project 9. (Priority = Medium) SPC-OFP services	**Develop data standards for port sampling and observer programmes in association with WCPFC Secretariat.** Tasks/TOR History	**Completed**
Project 10. (Priority = High) SPC-OFP services	**Advise the Executive Director regarding the development of a) Rules and Procedures for the Access to and Dissemination of Data, and b) the Information Security Policy.** Tasks/TOR • Will require ongoing periodic monitoring as the information and data management policies and procedures of the Commission evolve. • This has been in each annual work plan for many years. There has not been much year-to-year progress. It would be better to engage in this process only periodically (e.g. once every three years). Also need legal advice beyond the expertise of SPC. History	**Completed** (retain as required for periodic inputs)
Project 12. (Priority = High)	**Within the next 12 months, deploy on WCPFC website a prototype computer programme that will allow gaps in data to be easily identified.** Tasks/TOR	**Completed 2008**

SPC-OFP services	History • ST-SWG priority. • Undertaken in 2008 jointly with WCPFC Secretariat.	
Project 13. (Priority = High) SPC-OFP services	**Review current unloadings data forms used in the region, and the proposed WCPFC transhipment reporting form, to determine their adequacy for scientific purposes.** Tasks/TOR History • ST-SWG priority.	**Completed 2008**
Project 40. (Priority = Medium)	**Life-history characteristics of non-target species identified by the ERA as high risk.** Tasks/TOR History • BI-SWG priority.	**Completed** 2009
Project 51. (Priority = High)	**Extension services to member countries for within EEZ ERA.** Tasks/TOR History • ERA methods can value add to ecosystem approach to fisheries management approaches being adopted by WCPFC member countries for fisheries planning and management at the EEZ scale. • The extension services will be capacity building of ERA skills within these countries.	**Completed 2009**
Project 61. (Priority = High)	**North Pacific striped marlin mitigation methods.** Tasks/TOR • Analyze catch rates with regard to gear and operational modifications, spatio-temporal and oceanographic considerations. • Modeling to incorporate gear and spatio-temporal effects to identify potential factors contributing to striped marlin catch reductions in North Pacific longline fisheries. History	**Completed 2010**
Project 44. (Priority = High)	**Seabird and turtle education and extension of fishers (Promotion of mitigation methods to fishers).** Tasks/TOR History	**Completed 2012**
Project 45. (Priority = High)	**Education and dissemination of information relating to turtle de-hooking devices.** Tasks/TOR History	**Completed 2012**

Project 64. (Priority = High)	**Revised stock assessment of southwest Pacific striped marlin** Tasks/TOR • A project to undertake this work is being developed by Australia in conjunction with New Zealand, SPC-OFP and other CCMs. • This species is not one of the principal target species assessed by SPC-OFP but is an important target species for a number of CCMs. Australian and New Zealand scientists are proposing to undertake this work, and are seeking the Commission's endorsement because the research will have broader regional benefits. Support from the Commission would help secure funds from funding sources from Australia and New Zealand. History • 2011: Collation of South Pacific striped marlin data for a planned stock assessment in 2012 (USD 30,000), which is coordinated by S. Brower (New Zealand) – SC6 Report, para. 514 • 2012: SPC-OFP will conduct stock assessment	**Completed 2012**
Project 66. (Priority = High)	**Identification and evaluation of target reference points.** Tasks/TOR History • SPC-OFP conducted the Commission's consultancy in 2012 to identify and evaluate candidate target reference points for skipjack, including empirical reference points such as those based on CPUE as well possible target reference points derived from stock assessment models.	**Completed 2012**
Project 63. (Priority = High)	**Identifying provisional decision rules.** Tasks/TOR • For the key target species in the WCPFC, develop candidate harvest strategies (decision rules) based on present stock status. • Define and/or quantify assessment uncertainty and articulate how this is to be incorporated within decision rules. History • SC8 will review the concept of harvest control rules and the Commission will have a workshop on management objective WS, 28–29 December 2012.	**Completed 2012 possible extension**
Project 30. (Priority = Medium) SPC-OFP services	**Development of recruitment indices independent of the MFCL model, including the investigation of recruitment and oceanographic trends.** Tasks/TOR • Required to index recruitment in stock assessment models. Major advances made in 2007 need to be followed up and formally incorporated into assessments. History • SA-SWG and ME-SWG priority.	**Deleted as requested by the SC4**
Project 4. (Priority = Medium) SPC-OFP services	**Produce and publish on the Commission's website two issues of the Regional Tuna Bulletin, containing estimates of monthly catch rates for WCPO fleets, based on the most recent data available.** Tasks/TOR History	**Dis-continue**

Project 18. (Priority = High)	**Determine appropriate sample sizes for length-frequency sampling strategies.** Tasks/TOR • Relates to all target species but yellowfin was identified as priority species. History • SA-SWG priority Comments: 1. Incorporated into Project 60. 2. Recommend deleting this item.	**Inactive Delete**
Project 19. (Priority = High)	**Identification and description of operational characteristics of the major WCPO fleets and identification of important technical parameters for data collection.** Tasks/TOR • Includes characterization of operational features at both vessel and set or operational levels useful for effort standardization and the evaluation of fishing efficiency, targeting and bycatch mitigation. • Includes use of simple proxies and other means as tangible indicators of increasing fishing power (i.e. individual or fleet landings per annum, and/or estimates of the number of FADs deployed each year). • Includes monitoring of operational features related to depths fished by longline hooks and depths of purse-seine nets. • Includes monitoring and reporting on new developments in fishing gear and practices, fishing modes and related shore side developments as they relate to changes in fishing power. • Supply time-depth recorders and hook timers to regional observer programs undertaken by SPC-OFP. History • FT-SWG priority. Comments: 1. FT-SWG no longer exists so no progress. ~~2. Recommend that this Project be moved to a list of inactive but potentially useful projects.~~	**Inactive**
Project 20. (Priority = Low)	**Examine and review the technical aspects of capacity measurement and monitoring of fisheries within the WCPFC Convention Area.** Tasks/TOR • This project may be undertaken by the TCC, but the FT-SWG TOR were modified in 2006 to accommodate capacity work. History • FT-SWG priority. Comments: 1. FT-SWG no longer exists so no progress. ~~2. Recommend that this Project be moved to a list of inactive but potentially useful projects.~~	**Inactive**
Project 21. (Priority = Low)	**Investigate and promote studies on socioeconomic influences on fishing strategies, spatio-temporal fishing patterns, and influences on effective fishing effort.** Tasks/TOR History	**Inactive**

	• FT-SWG priority. Comments: 1. FT-SWG no longer exists so no progress. ~~2. Recommend that this Project be moved to a list of inactive but potentially useful projects.~~	
Project 27. (Priority = Medium)	**Investigation and quantification of changes in catchability of target and non-target species, including bycatch and incidental species, over time not included in the CPUE standardization.** Tasks/TOR • Many factors, not reported in logbooks, influence catchability. The comparison of catch rates obtained by individual research projects where details of gear and fishing practices have been extensively documented may allow changes in catchability to be investigated and possibly quantified. History • SA-SWG priority (cross-reference Project 23/22).	**Inactive** (links with other projects)
Project 31. (Priority = High)	**Improve existing, and explore alternative, models for standardization of effort and the construction of indices of stock abundance.** Tasks/TOR • Includes tasks identified by the ME-SWG at SC3: the continued identification of factors that influence CPUE, understanding and quantification of the changes in catchability over time not included in the CPUE standardization models, and identification of alternative catchability trends for inclusion in stock assessment models, and the calculation of regional weighting factors. History • SA-SWG and ME-SWG priority.	**Inactive**
Project 33. (Priority = ~~Medium~~) Low	**Development of new stock assessment models and associated software.** Tasks/TOR History • ME-SWG priority.	**Inactive** (links to project 60)
Project 47. (Priority = Medium) Low until enough observer coverage	**Turtle population assessments.** Tasks/TOR • Three-year project to continue into 2009, involving collation of data eventually leading to quantitative assessments. History	**Inactive**
Project 48. (Priority = Medium)	**Survival of hooked and released seabirds.** Tasks/TOR History • Will require sourcing external funding for satellite or archival tags.	**Inactive**
Project 49. (Priority	**Turtle tagging and associated materials.** Tasks/TOR	**Inactive**

= Medium)	History • Will require sourcing external funding for satellite or archival tags. Conventional tags can probably be obtained at little or no cost from SPREP.	
Project 53. (Priority = Medium)	**Investigation into fishing activities and catch composition of small vessels (e.g. longline vessels <24m)** Tasks/TOR • To create a better understanding of the catch and effort and operational activities of small high seas vessels so that appropriate management measures (e.g. sharks and seabirds) can be considered for these vessels. History • EB-SWG priority.	**Inactive**
Project 54. (Priority = Medium)	**Review scientific data to assess the inter-relationship between the effects of bycatch management measures using different longline gear types and mitigation measures on catches of turtle, shark and other target and non-target longline species.** Tasks/TOR • Assess the impact of circle hooks, line weighting and other mitigation methods on the capture of target species, sea turtles, seabirds and sharks. History • EB-SWG priority. • Some work has been done in the Atlantic and we could assess that.	**Inactive**
Project 59. (Priority = Medium)	**Management strategy evaluation for non-target and protected species using semi-quantitative models.** Tasks/TOR • ERA will identify species at risk from to the effects of fishing. For some of these species, the information available will be insufficient for a robust statistical stock assessment approach. However, a need to evaluate management options for these species will remain. History	**Inactive**
Project 68. (Priority = High - once there is sufficient observer coverage)	**Estimation of seabird interaction, bycatch and mortality.** Tasks/TOR • EB-SWG priority? • Subject to the requests by CMM 2007-04 History	Inactive

Abbreviations used in the table
ACAP = Agreement on the Conservation of Albatrosses and Petrels
BI-SWG = Biology Special Working Group
BMIS = Bycatch Mitigation Information System
CCM = Members, Cooperating Non-members and participating Territories
CMM = conservation and management measure
CPUE = catch per unit effort

CSIRO = Commonwealth Scientific and Industrial Research Organisation
EB-SWG = Ecosystems and Bycatch Mitigation Special Working Group
EEZ = exclusive economic zone
EPO = eastern Pacific Ocean
ERA = ecological risk assessment
FAD = fish aggregation device
FT-SWG = Fishing Technology Special Working Group
IATTC = Inter-American Tropical Tuna Commission
IPDCP = Indonesia and Philippines Data Collection Project
ISSF = International Sustainable Seafood Foundation
ME-SWG = Methods Special Working Group
MFCL = MULTIFAN-CL (a stock assessment modeling approach)
PNG = Papua New Guinea
RFMO = regional fisheries management organization
SA-SWG = Stock Assessment Special Working Group
SC = Scientific Committee of the Western and Central Pacific Fisheries Commission
SEAPODYM = spatial ecosystem and population dynamics model
SPC = Secretariat of the Pacific Community
SPC-OFP = Oceanic Fisheries Programme of the Secretariat of the Pacific Community
SPREP = Pacific Regional Environment Programme
ST-SWG = Data and Statistics Special Working Group
TCC = Technical and Compliance Committee of the Western and Central Pacific Fisheries Commission
TOR= terms of reference
USD = United States dollars
WCPFC = Western and Central Pacific Fisheries Commission
WCPO = western and central Pacific Ocean
WPEAOFM = West Pacific East Asia Oceanic Fisheries Management Project

Attachment I

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

WORK PROGRAMME AND BUDGET FOR 2012, PROVISIONAL WORK PROGRAMME AND INDICATIVE BUDGET FOR 2013–2014, AND INDICATIVE SCIENCE SERVICES FOR 2-13-2015

List of Scientific Committee work programme titles and budget for 2013, and indicative budget for 2014–2015, which require funding from the Commission's core budget (in USD).

Research Activity / Project with priority	2013	2014	2015
Project 14. WPEAOFM	25,000	25,000	25,000
Project 35. Refinement of bigeye parameters	70,000	75,000	75,000
Project 42. Pacific-wide tagging project	10,000	10,000	10,000
Project 57. Limit reference points	30,000		
Project 66. Target reference points			
Project 63. Harvest control rules			
Project 60. Purse-seine species composition	75,000		
Sail Fish (Data analysis)			
Peer review of Pacific bluefin tuna			
Bigeye MFCL	40,000		
Additional resourcing SPC	160,000	160,000	160,000
SUBTOTAL	410,000	270,000	270,000
UNOBLIGATED BUDGET	83,000	83,000	83,000
SPC-OFP BUDGET[10]	871,200	871,200	871,200
GRAND TOTAL	**1,364,200**	**1,224,200**	**1,224,200**

[10] Details of the SPC-OFP science services for 2013–2015 are tabulated below.

Indicative plan of the SPC-OFP science services for 2013–2015

Species	Stock	Last assessment	Comments	Proposed assessment		
				2013	2014	2015
Bigeye tuna	WCPO	2011	Review recommendations to implement with priority on analysis of tagging and longline catch per unit effort data. Not all recommendations will be complete by 2013. Good to do tropical tunas together for the purpose of examining management options.	Analysis of tagging data and longline catch per unit effort data and complete the model Within the services budget	Stock assessment 2014	No
	Pacific-wide		Suggested that this not be conducted until the WCPO stock assessment updated.	N/A	N/A	2015 following completion of changes and conduct of WCPO assessment
Skipjack tuna	WCPO	2011	Will benefit most from PTTP data for which more data is now available. Good to do tropical tunas together for the purpose of examining management options.	1) Analysis of tagging data and complete the model.	Stock assessment 2014 but start earlier in 2013	No
Yellowfin tuna	WCPO	2011	Many bigeye tuna recommendations will also benefit yellowfin tuna. Good to do tropical tunas together for the purpose of examining management options.	Analysis of tagging data and longline CPUE data and complete the model	Stock assessment 2014	No
Albacore	South Pacific	2012	Next assessment would benefit from the implementation of sex-structure in MFCL. Recent fishery developments suggest closer monitoring.			Stock assessment 2015

Striped marlin	South-west Pacific	2012	Just updated after several years. Next assessment 2017			
	North-west Pacific	2011–2012	Just updated after several years. Next assessment 2017			
Blue marlin	Pacific-wide	2002	Would appropriately be conducted collaboratively; SC noted this is a pacific wide stock and request ISC to present assessment to SC in advance. SC requested assurance that ISC assessment would be submitted to WCPFC	ISC 2013		
Swordfish	SW-Pacific	2012/13	Update underway	SA be finish by SC9 2013		
Silky shark	WCPO	2012	SC8 request for an updated assessment to address some input data issues	Stock Assessment 2013		
	Pacific-wide		Collaboration with IATTC. Not to be conducted until after the revised assessment for the WCPO stock.	Following WCPO Assessment		
Oceanic whitetip shark	WCPO	2012	First assessment conducted this year			Next assessment 2015
Blue shark	South Pacific		Currently scheduled for 2012/2013	2013 Pacific wide assessment		
	North Pacific		Currently scheduled for 2012/2o13. ISC has initiated some work on this stock. It is not an official northern stock.			
Mako shark	South Pacific		Currently scheduled under the Shark Research Plan for 2012/2013	No decision pending agreement on future funding		
	North Pacific		Currently scheduled under the Shark Research Plan for 2012/2013.			

Attachment J

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

Scientific Committee
Eighth Regular Session

Busan, Republic of Korea
7–15 August 2012

GUIDELINES FOR THE SC CHAIR AND THEME CONVENORS

In the document circulated after SC5 outlining potential benefits to moving to a Theme based meeting structure (now adopted), several additional comments were noted that in the past each Chair/Convener had run their session according to their own rules and that this had caused some confusion and delays. Whilst set in stone rules can cause problems, there has been general agreement that the running of the Scientific Committee (SC) could be improved if the Chairs and Convenors could agree on some basic guidelines for running the meeting and ensuring consistency throughout the meeting.

According to the decision made by the SC7 (paragraph 584.f), the Secretariat prepared a draft guidelines for the review of SC8 officers.

General guidelines for the SC Chair and Theme Convenors

1. The SC Chair and Convenors will be involved with the Commission's Secretariat in developing the provisional annotated agenda for the approval of Heads of Delegation.

2. The SC Chair will convene an SC Officer's Meeting prior to Heads of Delegation meeting. The Meeting will consider SC meeting procedures, including reviewing the indicative schedule according to the volume of theme papers to be covered.

3. The SC Chair and Convenors will direct discussions at the plenary, subject to the approval of Heads of Delegation.

4. The SC Chair and Convenors will make sure that all presentations and discussions should stay focused on the science and the relevant agenda item. Furthermore, while discussion on agenda items to be encouraged the SC Chair and Convenors are to remind the plenary to keep specific questions and commentary concise.

5. The SC Chair and Convenors will ensure observance of the Commission's Rules of Procedure, mutatis mutandis, to accord the right to speak, announce the list of speakers and, with the consent of the Scientific Committee, declare the list of speakers closed.

6. The SC Chair and Convenors should be mindful of non-English speaking delegations, particularly when text is edited on screen. Draft text will be circulated prior to being submitted for the approval of the SC. Appropriate time should then be given for plenary to consider the text prior to approval.

7. The SC Chair and Convenors, in consultation with the Secretariat, may formulate Informal Small Group (ISG) meetings that will be held, as needed, in the margin of the plenary to formulate a conceptual framework and/or develop consensus views, and submit a summary paper of the ISG meeting to the plenary for consideration. The plenary will try to make every effort to avoid duplicating discussions that were made at the ISGs. The SC Chair and Theme Convenors will consult with the facilitators of ISGs to coordinate meeting schedules.

8. SC Chair and convenors should help develop consensus by briefly summarising discussions across the floor. They should not indulge in monologues and should remain alert to CCMs wishing to make interventions across the floor of the meeting.

9. SC Chairs and convenors should not directly or indirectly advocate their own views or the positions of their own delegations when chairing the plenary or theme sessions.

10. The SC Chair and Convenors will consult on how non-consensus is to be handled and accommodated into the provision of advice to the Commission. The use of break-out groups may help to achieve a consensus view.

Guidelines for the SC Chair

1. The rules and powers of the SC Chair are explained in Rule 9 of the Commission's Rules of Procedure, which is annexed below.

Rule 9 (Function of the Chairman)

1. In addition to exercising the powers conferred upon him or her elsewhere in these rules or by the Convention, the Chairman shall declare the opening and closing of each plenary meeting of the Commission, direct the discussions in plenary meeting, ensure observance of these rules, accord the right to speak, announce the list of speakers and, with the consent of the Commission, declare the list of speakers closed, put questions and announce decisions. He or she shall rule on points of order and, subject to these rules, shall have complete control of the proceedings at any meeting and over the maintenance of order thereat. The Chairman may, in the course of discussion of an item, propose to the Commission the limitation of the time to be allowed to speakers, the limitation of the number of times each representative may speak, the closure of the list of speakers or the closure of the debate. He or she may also propose the suspension or the adjournment of the meeting or the adjournment of the debate on the item under discussion.
2. The Chairman, in the exercise of his or her functions, remains under the authority of the Commission.
3. The Vice-Chairman acting as Chairman shall have the same powers and duties as the Chairman.

Guidelines for the Theme Convenors

1. Convenors will provide draft agendas for their Theme session. This will be done in consultation with the Commission's Secretariat to take account of specific requests from the Commission and with the scientists who are providing a paper to the Theme. Based on this process, Convenors will also decide which papers will be presented as Working Papers and which will be provided as Information Papers. Papers that are not relevant to agenda items should not be accepted. Information papers are not normally presented verbally but may be referred to by the SC in discussion and in formulating recommendations to the Commission.

2. The submission of papers for sessions of the Scientific Committee should be in accordance with the specified timeline. Convenors in consultation with the Secretariat should give consideration towards deadlines for submission of papers, recognizing that CCMs need time to consider the papers in consultations domestically and with other CCMs.

3. Convenors will provide guidance to each presenter on the time allowed for the presentation and discussion of their paper in order to facilitate staying within the time allocated to the Theme session.

4. Convenors will enlist support rapporteurs to take notes on the discussion for each agenda item. Convenors will also work with the Head Rapporteur on the production of the final summary report for each Theme session.

5. During the sessions at the SC, Convenors should identify Information Papers that support and are relevant to Working Papers in line with Theme Session Agenda. Other information papers should be separated by posting directly beneath Agenda related papers.

6. After the completion of presentations and the discussion of agenda items and possible management advice Convenors will draft recommendations and circulate these to the meeting seeking comments and feedback. Each Theme will then reconvene during a time provided for in the Meeting Agenda to undertake the final review and adoption of recommendations for their Theme. For this final review changes made to the initial draft recommendations are to be presented in track changes format. The Head Rapporteur will assist in the finalization of the recommendations for each Theme.

7. Convenors should assist the plenary reach consensus in adopting recommendations.

8. Convenors should be mindful of the time allocated to their session and where possible take advantage of any time saving opportunities.