NORTHERN COMMITTEE
TWELFTH REGULAR SESSION
Fukuoka, Japan
29 August – 2 September 2016

SC12 Summary Report to NC12
(Draft Executive Summary of SC12)

WCPFC-NC12-2016/IP-02

Secretariat

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

Twelfth Regular Session of the Scientific Committee
Bali, Indonesia
3-11 August 2016

SUMMARY REPORT

NOTE

According to Rule 33 of the Commission's Rules of Procedure, a Draft Executive Summary of the Draft SC12 Summary Report, including the text of all decisions adopted by SC12, is now posted. This will be finalized once SC12 Summary Report is adopted.

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

Scientific Committee
Twelfth Regular Session

Bali, Indonesia
3-11 August 2016

EXECUTIVE SUMMARY

AGENDA ITEM 1 – OPENING OF THE MEETING

1. The Twelfth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean took place from 3-11 August 2016 at the Stones Hotel in Bali, Indonesia.

2. The following WCPFC CCMs attended SC12: American Samoa, Australia, China, Cook Islands, European Union (EU), Federated States of Micronesia (FSM), Fiji, Indonesia, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Papua New Guinea (PNG), Philippines, Samoa, Solomon Islands, Chinese Taipei, Tokelau, Tonga, Tuvalu, United States of America (USA), Vanuatu, Vietnam and Wallis and Futuna.

3. The Commission Chair, Ms Rhea Moss-Christian, the SC Chair, Ms Berry Muller (RMI), the WCPFC Executive Director Mr Feleti Teo, and the Chairman of the Agency of Marine and Fisheries Research and Development of Indonesia, Mr Muhammad Zulficar Mochtar, delivered opening and welcome speeches.

4. The theme conveners and their assigned themes are:

Data and Statistics theme	B. Muller (RMI)
Stock Assessment theme	J. Brodziak (USA) and H. Nishida (Japan)
Management Issues theme	R. Campbell (Australia)
Ecosystem and Bycatch Mitigation theme	J. Annala (NZ) and A. Batibasaga (Fiji)

5. SC12 established five informal small groups (ISG) to facilitate the meeting process. The facilitators for the twelve ISGs were:

ISG-1	Development of SC Budget for 2017 – 2019	B. Muller
ISG-2	Project 57 – Scope of work for shark limit reference points	R. Campbell
ISG-3	A formal process for the independent review of stock assessment	K. Bigelow
ISG-4	Definition of public domain data and amendment of the *Scientific Data to be provided to the Commission*	L. Olsen
ISG-5	Designation of key shark species	S.Varsamos
ISG-6	Review of Shark Research Plan and future work plan	J. Larcombe
ISG-7	Ecosystem indicators and budget	Withdrawn
ISG-8	Development of *New guidelines for the survival of sharks (other than whale sharks) to be released from longline or purse-seine gear*	H. Kiyofuji
ISG-9	Review of Tissue Bank Protocol	N. Smith

ISG-10	Finalize Bycatch Data Exchange Protocol (BDEP) template	N. Smith
ISG-11	Guidelines for development and evaluation of shark management plan	S. Clarke
ISG-12	Future arrangements for the support of management strategy evaluation	R. Campbell

6. The SC12 provisional agenda WCPFC-SC12-2016-02_rev4 was adopted**.**

AGENDA ITEM 2 – REVIEW OF FISHERIES

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

7. The provisional total WCP–CA tuna catch for 2015 was estimated at 2,687,840 mt, the third highest on record and nearly 200,000 mt below the previous record catch in 2014 (2,882,511 mt); this catch represented 80% of the total Pacific Ocean catch of 3,379,789 mt, and 56% of the global tuna catch (the provisional estimate for 2015 is 4,799,697 mt, and when finalised is expected to be the second highest on record).

8. The 2015 WCP–CA catch of skipjack (1,827,750 mt – 68% of the total catch) was the third highest recorded, nearly 180,000 mt less than the record in 2014 (2,005,647 mt). The WCP–CA yellowfin catch for 2015 (605,963 mt – 23%) was the second highest recorded (less than 1,000 mt lower than the record catch of 2008 – 606,868 mt); the increase in yellowfin tuna catch from 2014 levels was mainly due to increased catches in the Indonesia and Philippines domestic fisheries. The WCP–CA bigeye catch for 2015 (134,084 mt – 5%) was the lowest since 1996 due to relatively low catches in the longline and purse seine fisheries. The 2015 WCP–CA albacore catch (120,043 mt - 4%) was the lowest since 2011 and nearly 28,000 mt lower than the record catch in 2002 at 147,793 mt. The WCP–CA albacore catch includes catches of north and south Pacific albacore in the WCP–CA, which comprised 81% of the total Pacific Ocean albacore catch of 149,289 mt in 2015. The south Pacific albacore catch in 2015 (68,594 mt) was about 12,000 mt lower than in 2014 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt.

9. The provisional 2015 purse-seine catch of 1,766,070 mt was the fifth highest catch on record and more than 280,000 mt lower than the record in 2014 (2,051,970 mt); the main reason for this decline in catch appears to be reduced effort more than any other factor. The 2015 purse-seine skipjack catch (1,416,453 mt; 80% of total catch) was about 210,000 mt lower than the record in 2014. The 2015 purse-seine catch estimate for yellowfin tuna (298,847 mt) contributed only 17% of the total catch, continuing the recent trend of a diminishing contribution in the overall catch and amongst the lowest for the past decade. The provisional catch estimate for bigeye tuna for 2015 (48,772 mt) was the lowest catch since 2007 and appears to be related to a combination of lower effort, and possibly environmental conditions which resulted in bigeye tuna being less available to the purse seine gear.

10. The 2015 pole-and-line catch (228,129 mt) was a slight increase on the 2014 catch but remains amongst the lowest annual catch since the late-1960s. Japanese distant-water and offshore fleets (110,433 mt in 2015), and the Indonesian fleets (116,179 mt in 2015), account for nearly all of the WCP–CA pole-and-line catch (99% in 2015).

11. The provisional WCP–CA longline catch (243,547 mt) for 2015 was lower than the average for the past five years. The WCP–CA albacore longline catch (80,596 mt – 33%) for 2015 was the lowest for three years, 21,000 mt. lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (63,986 mt – 26%) for 2015 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery. The yellowfin catch for 2015 (97,289 mt – 40%) was amongst the highest over the past decade ten years.

12. The 2015 South Pacific troll albacore catch (2,576 mt) was around the average over the past decade. The New Zealand troll fleet (131 vessels catching 2,425 mt in 2015) and the United States troll fleet (6 vessels catching 151 mt in 2015) accounted for all of the 2015 albacore troll catch.

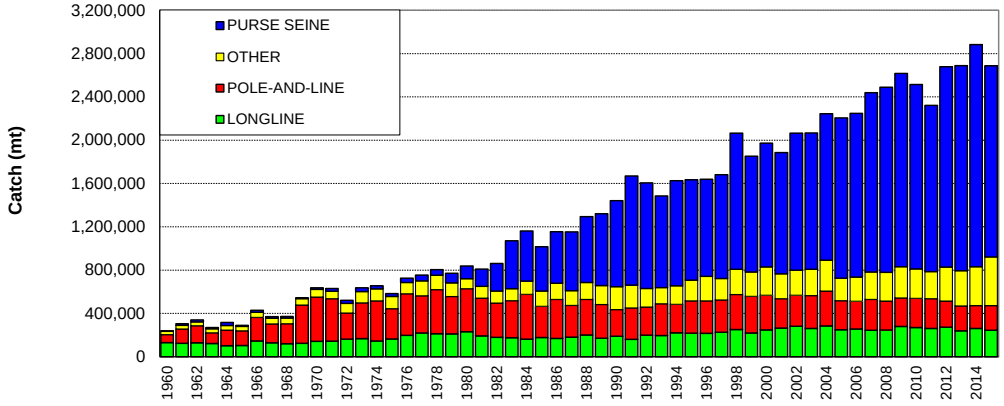


Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA, by longline, pole-and-line, purse seine and other gear types

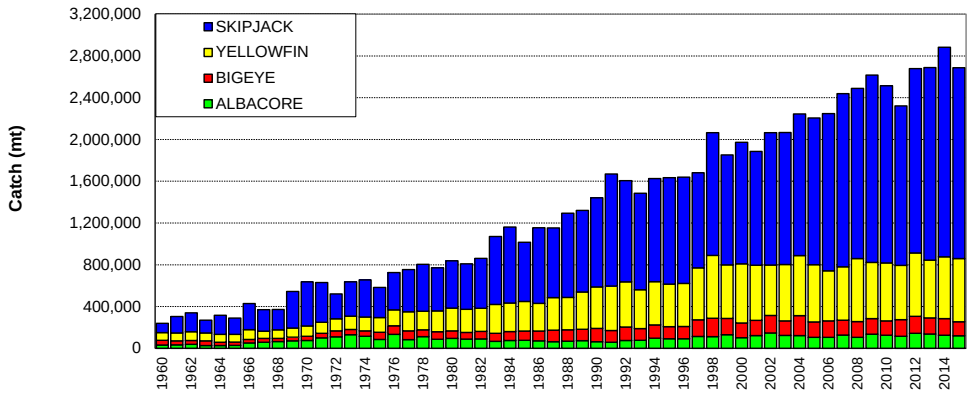


Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA.

AGENDA ITEM 3 – DATA AND STATISTICS THEME

3.1 Data gaps

13. SC12 recommended that:

a) The paper SC12-ST-IP-02 (Status of observer data management) is forwarded to TCC12, highlighting the gaps in ROP longline coverage.

b) The Scientific Services Provider calculate annual coefficients of variation (CVs) for various taxa collected from longline observer data for 2013, 2014 and 2015, and present this information to SC13.

14. SC12 recommended that the Scientific Services Provider proceed with the proposed work plan for Project 60 (Collection and evaluation of purse seine species composition data) as endorsed by SC12.

15. SC12 recommended that WCPFC continue the work which would include exploring mechanisms for obtaining complete cannery receipt or equivalent data for validating the purse seine catch and evaluating the usefulness of these data.

3.2 Electronic monitoring and electronic reporting

16. The Scientific Committee endorsed the recommendations as outlined in SC12-ST-WP-07 (Agreed recommendations from ERandEM-WG2).

17. SC12 supported outcomes and recommendations from the second meeting of the WCPFC E-Reporting and E-monitoring Working Group (ERandEM WG-2, August 2016) and that they are taken forward to TCC12.

18. SC12 noted that CCMs agreed to provide comments on the draft WCPFC E-Reporting standard data fields for logsheet and observer data prior to 10th September 2016, so that the WCPFC Secretariat and Science Services Provider can compile comments for presentation to TCC12.

3.3 WCPFC-funded Port Coordinators

19. SC12 recommended that the the WCPFC Secretariat consider the requests of several CCMs to expand the support of the Port Coordinators initiative and report a proposal at TCC12.

3.4 Review of Scientific Data to be Provided to the Commission

20. SC12 noted the work of the SC12 informal small working group on data (ISG-4) and that the recommendations in the report of ISG-4 (available as SC12-ST-WP-09_rev2) are taken forward.

a) With respect to "the proposal to modify the definition of the WCPFC public domain data to align to the IATTC definition", the changes proposed by ISG-4 are to be forwarded to TCC12 for consideration.

b) With respect to the review of the elements proposed in SC12-ST-WP-05: EU European Union proposal for an amendment of the "Scientific data to be provided to the Commission", the revised document by ISG-4 are to be forwarded to TCC12 for further work.

3.5 FAD Management Options Intersessional Working Group

21. SC12 endorsed the work and the FADMgmtOptions-IWG work plan.

3.6 Economic data

22. SC12 recommended that:

a) An annual update of "Analyses and projections of economic conditions in WCPO fisheries", in a similar manner to SC12-ST-WP-04, continue to be provided at SC meetings.

b) These economic analyses be made available to, and be used by, the Commission in the development of harvest strategies and management measures.

c) SC13 considers guidelines for the voluntary submission of economic data to the Commission by CCMs, recognizing the value of economic data to the work of the Commission.

AGENDA ITEM 4 – STOCK ASSESSMENT THEME

4.1 WCPO tunas

4.1.1 WCPO bigeye tuna (*Thunnus obesus*)

Stock status and trends

23. SC12 noted that no stock assessment was conducted for WCPO bigeye tuna in 2016. Therefore, the stock status description from SC10 is still current. For further information on the stock status and trends from SC10, please see http://www.wcpfc.int/node/19472

24. SC12 noted that the total bigeye catch in 2015 was 134,084 mt, which was a 16% decrease over 2014 and a 13% decrease over the average for 2010-14.

25. Purse seine bigeye catch in 2015 was 26% lower than that in 2014 and effort was 21% lower. Longline catch in 2015 was 13% lower than that in 2014, and tropical longline effort (20N-10S) was 4% lower.

26. SC12 noted that the results of the updated short-term projections using actual catch and effort levels in 2013-2015 and which assumed that recent above-average recruitments continued, indicated that the median spawning biomass depletion (SB/SBF=0) of bigeye has been relatively stable since the 2012 assessment.

27. SC12 also noted the importance of retrospective analyses as a diagnostic tool for WCPFC stock assessments. Further, retrospective forecasting of the 2014 WCPO bigeye tuna stock assessment found that the 2014 bigeye tuna stock assessment model is not subject to substantial retrospective bias.

28. In addition, SC12 noted that short-term projections conducted using the results of the 2014 bigeye tuna reference case assessment model provide consistent and relatively accurate indications of stock status in the short-term.

29. SC12 notes that the projected median spawning biomass depletion of bigeye in 2016 was SB2015/SBF=0 = 0.17. It was also noted that short-term stochastic projections using only the reference case model are likely to underestimate uncertainty in projected stock status.

Management advice and implications

30. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see http://www.wcpfc.int/node/19472

4.1.2 WCPO yellowfin tuna (*Thunnus albacares*)

Stock status and trends

31. SC12 noted that no stock assessment was conducted for WCPO yellowfin tuna in 2016. Therefore, the stock status description from SC10 is still current. For further information on the stock status and trends from SC10, please see http://www.wcpfc.int/node/19472

32. SC12 noted that the total yellowfin catch in 2015 was 605,963 mt, a 2% increase over 2014 and a 7% increase over the average for 2010-14.

33. Purse seine yellowfin catch in 2015 was 15% lower than that in 2014 and effort was 21% lower. Longline catch in 2015 was 2% lower than that in 2014, and tropical longline effort (20N-10S) was 4% lower. Catches of other gears increased by 47% from 2014 to 2015.

34. SC12 noted that the results of the updated short-term projections using actual catch and effort levels in 2013¬¬-2015 indicated that the projected median spawning biomass depletion (SB/SBF=0) of yellowfin showed an increasing trend since 2012. SC12 also noted that the projected median spawning biomass depletion of yellowfin in 2016 was SB2015/SBF=0 = 0.49.

Management advice and implications

35. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see http://www.wcpfc.int/node/19472

4.1.3 WCPO skipjack tuna (*Katsuwonus pelamis*)

Stock status and trends

36. SC12 noted that the skipjack catch in 2015 was 1,827,750 mt, was a 9% decrease over 2014 and a 3% increase over the average for 2010-14.

37. Purse seine skipjack catch in 2015 was 13% lower than that in 2014 and effort 21% lower.

38. The SC12 was unable to reach consensus on the description of stock status based on the 2016 stock assessment.

39. SC12 notes that the majority of member countries agreed on the following description of WCPO skipjack tuna status and trends.

Majority view of stock status and trends

40. A majority of SC12 CCMs selected the reference case model as the base case to represent the stock status of skipjack tuna. To characterize uncertainty, those CCMs chose the structural uncertainty grid. Summaries of important model quantities for these models are shown in Table SKJ1.

Table SKJ1. Description of the structural sensitivity grid used to characterise uncertainty in the assessment. The reference case option is denoted in bold face.

Axis	Levels	Option
Steepness	3	0.65, **0.80**, or 0.95
Mixing period	2	**1 quarter mixing**, 2 quarters mixing
Length composition weighting	3	sample sizes divided by 10, **20** or 50
Tagging overdispersion	3	**Default level**, Estimated, or Fixed (moderate) level

Table SKJ2: Estimates of management quantities for the selected stock assessment models. For the purpose of this assessment, "recent" is the average over the period 2011–2014 and "latest" is 2015.

Quantity	RefCase	h0.65	h0.95	mix2qtr	Lgth10	Lgth50	EstVB	EstVBSD	EstOD	ODmiddle	InvMov	SRRqtrly	TermRec4
C_{latest}	1,679,528	1,679,517	1,679,522	1,679,609	1,679,535	1,679,467	1,679,194	1,679,283	1,679,169	1,679,313	1,679,538	1,679,520	1,679,698
MSY	1,891,600	2,026,400	1,832,800	2,076,800	1,84,8000	1,934,400	1,902,800	1,760,800	1,641,200	1,762,000	1,856,400	1,591,600	1,874,000
$Y_{F_{recent}}$	1,594,800	1,766,000	1,504,000	1,659,200	1,585,200	1,603,200	1,591,600	1,531,600	1,545,600	1,589,200	1,580,000	1,445,200	1,595,200
f_{mult}	2.23	1.96	2.48	2.47	2.14	2.31	2.23	2.04	1.61	1.88	2.17	1.69	2.17
F_{MSY}	0.24	0.22	0.27	0.24	0.26	0.23	0.25	0.27	0.24	0.25	0.24	0.19	0.24
$F_{recent}/F_{\mathrm{MSY}}$	0.45	0.51	0.40	0.41	0.47	0.43	0.45	0.49	0.62	0.53	0.46	0.59	0.46
SB_{MSY}	1,626,000	1,972,000	1,423,000	1,858,000	1,496,000	1,761,000	1,560,000	1,346,000	1,470,000	1,509,000	1,597,000	1,813,000	1,622,000
SB_0	6,764,000	7,637,000	6,284,000	7,463,000	6,256,000	7,420,000	6,996,000	5,453,000	5,858,000	6,055,000	6,618,000	6,469,000	6,767,000
$SB_{F=0}$	7,221,135	7,802,299	6,877,143	7,751,452	6,744,980	7,825,861	7,449,414	5,981,232	6,436,206	6,539,112	7,086,859	7,205,705	7,212,830
SB_{latest}/SB_0	0.62	0.55	0.66	0.68	0.64	0.59	0.59	0.59	0.45	0.51	0.63	0.65	0.66
$SB_{latest}/SB_{F=0}$	0.58	0.53	0.61	0.65	0.60	0.56	0.56	0.54	0.41	0.47	0.59	0.58	0.62
$SB_{latest}/SB_{\mathrm{MSY}}$	2.56	2.11	2.93	2.73	2.69	2.49	2.66	2.38	1.81	2.03	2.60	2.30	2.76
$SB_{recent}/SB_{F=0}$	0.52	0.48	0.54	0.56	0.52	0.51	0.50	0.50	0.41	0.46	0.52	0.52	0.51
$SB_{recent}/SB_{\mathrm{MSY}}$	2.31	1.90	2.63	2.32	2.36	2.28	2.41	2.21	1.80	1.98	2.29	2.07	2.28

41. Trends in estimated recruitment, spawning biomass, fishing mortality and depletion are shown in Figures SKJ 1-4.

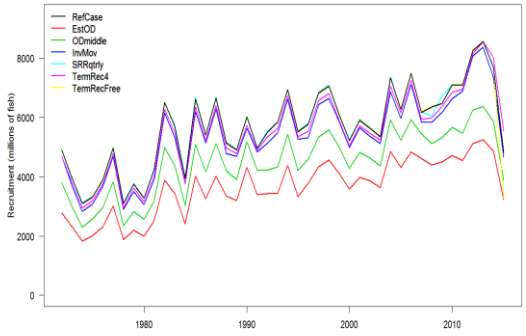


Figure SKJ1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference case model and six additional runs.

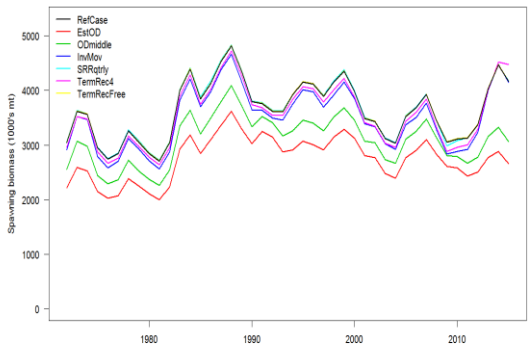


Figure SKJ2: Estimated annual average spawning potential for the WCPO obtained from the reference case model and six additional runs.

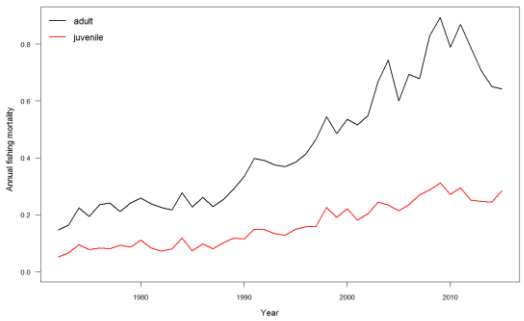


Figure SKJ3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model.

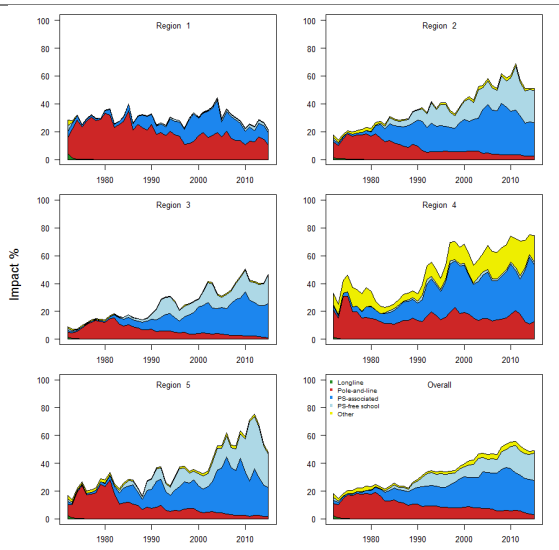


Figure SKJ4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1\text{-}SB_t/SB_{t,F=0}$) by region and for the WCPO attributed to various fishery groups for the reference case model.

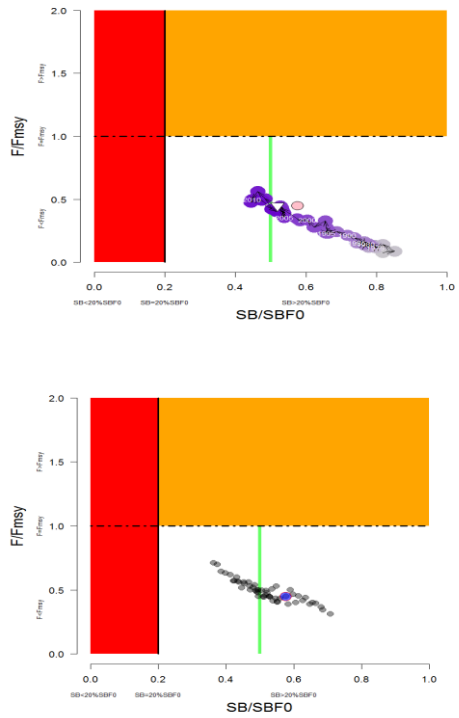


Figure SKJ5: Temporal trend for the reference case model (top) and the structural uncertainty grid (bottom panel) in stock status relative to $SB_{F=0}$ (x-axis) and F_{MSY} (y-axis). The red zone represents spawning potential levels lower than the agreed LRP, which is marked with the solid black line ($0.2SB_{F=0}$). The orange region is for fishing mortality greater than F_{MSY} ($F=F_{MSY}$; marked with the black dashed line). The green line indicates the interim target reference point 50%$SBF=0$.

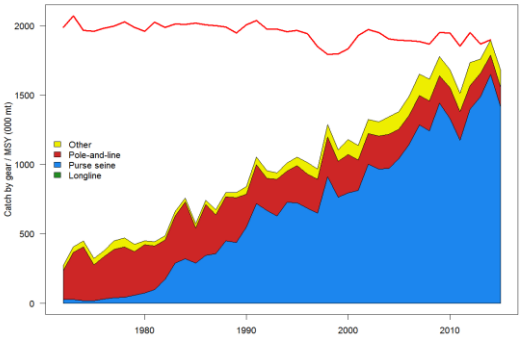


Figure SKJ6: History of annual estimates of MSY compared with catches of three major fisheries for the reference case model.

42. Dynamics of most model quantities are relatively consistent with the results of the 2014 stock assessment, although there has been a period of several subsequent years with high recruitments and increased spawning biomass.

43. Fishing mortality of all age-classes is estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY (Frecent/FMSY = 0.45 for the reference case), and is estimated to have decreased moderately in the last several years. Across the reference case and the structural uncertainty grid Frecent/FMSY varied between 0.38 (5% quantile) to 0.64 (95% quantile). This indicates that overfishing is not occurring for the WCPO skipjack tuna stock (Figure SKJ 5).

44. The estimated MSY of 1,891,600 mt is moderately higher than the 2014 estimate due to the adoption of an annual, rather than quarterly, stock-recruitment relationship. Recent catches are lower than, but approaching, this MSY value (Figure SKJ 6).

45. The latest (2015) estimate of spawning biomass is well above both the level that will support MSY (SBlatest/SBMSY = 2.56, for the reference case model) and the adopted LRP of 0.2 SBF=0 (SBlatest/SBF=0 = 0.58, for the reference case model), and SBlatest/SBF=0 was relatively close to the adopted interim target reference point (0.5 SBF=0) for all models explored in the assessment (structural uncertainty grid: median = 0.51, 95% quantiles = 0.39 and 0.67).

Alternative view of stock status and trends

46. China, Japan and Chinese Taipei considered it is not possible to select a base-case model from various sensitivity models in the 2016 assessment, given the advice from the Scientific Service Provider that a suite of the sensitivity models were plausible. Therefore, these members considered that it would be more appropriate to provide advice to WCPFC13 on skipjack stock status based on the range of uncertainty expressed by the alternative model runs in the sensitivity analysis rather than based on the single base case model.

47. The estimated MSY of WCPO skipjack stock ranges from 1,641,200 to 2,076,800 mt across the alternative skipjack stock assessment models represented in the sensitivity grid. These CCMs also noted that some alternative models indicate that the 2015 biomass is below the adopted TRP of 0.5SBF=0.

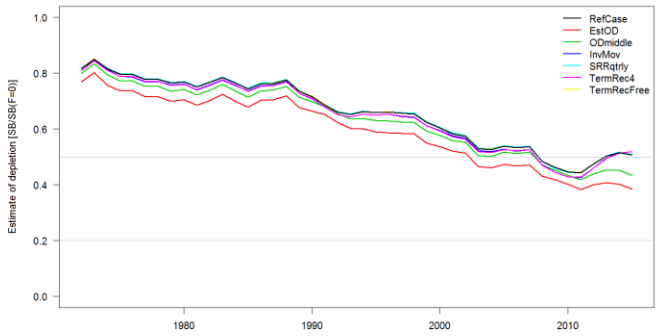


Figure SKJ 7. Estimated fisheries depletion SB/SBF=0, for each of the sensitivity models.

Management advice and implications

48. SC12 noted that the skipjack assessment continues to show that the stock is currently moderately exploited and fishing mortality level is sustainable. The recent catches are fluctuating around and some models also indicate that the stock is currently under the TRP.

49. SC12 noted that fishing is having a significant impact on stock size and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Niño and La Niña events, which impact on catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack tuna catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

50. SC12 noted that skipjack spawning biomass is now around the adopted TRP and SC12 recommends that the Commission take action to keep the spawning biomass near the TRP and also advocates for the adoption of harvest control rules based on the information provided.

51. In order to maintain the quality of stock assessments for this important stock, SC12 recommends 1) continued work on developing an index of abundance based on purse seine data; 2) regular large scale tagging cruises and complementary tagging work continue to be undertaken in a way that provides the best possible data for stock assessment purposes.

52. SC12 also notes that the current method of calculating the TRP is based on the most recent 10 years of recruitment information. However, the information on spawning potential, SB2015, which is used to evaluate current stock status relative to the TRP can change very rapidly for skipjack which mature at age 1 and this rapid maturation may provide an optimistic status evaluation when recruitment is estimated have an increasing trend but is estimated with substantial uncertainty, as is currently observed in the case of skipjack which does not have a fishery-independent index of recruitment strength.

53. There is ongoing concern by at least one CCM that high catches in the equatorial region may be causing a range contraction of WCPO skipjack tuna, thus reducing skipjack tuna availability to fisheries conducted at higher latitudes than the Pacific equatorial region. SC12 reiterates the advice of SC11 whereby there is no demonstrated statistical evidence for SKJ range contraction. As a result, SC12 recommends that ongoing research on range contraction of skipjack tuna be continued in the framework of Project 67.

4.1.4 South Pacific albacore tuna (*Thunnus alalunga*)

Stock status and trends

54. SC12 noted that no stock assessment was conducted for South Pacific albacore tuna in 2016. Therefore, the stock status description from SC11 is still current. For further information on the stock status and trends from SC11, please see http://www.wcpfc.int/node/26922.

55. SC12 noted that the total south Pacific albacore catch in 2015 was 68,594 mt, 16% lower than both the catch in 2014 and the average catch for 2010-14.

56. Longline south Pacific albacore catch in 2015 was 17% lower than that in 2014, while troll catch in 2015 was 16% higher than that in 2014.

57. SC12 considered an update of trends in South Pacific albacore fisheries (SC12-SA-WP-06) and noted that there had been some small reductions in southern longline effort in 2014 compared to 2013, but 2015 effort levels are currently considered uncertain. Status quo projections were calculated, assuming current southern longline and troll fishery effort would continue into the future

at levels equal to those seen in 2014 (based on the information available to SPC as at 2nd June 2016). Potential future spawning biomass levels relative to unfished levels were examined, and the probability that the south Pacific albacore stock may fall below the biomass Limit Reference Point was calculated.

58. If 2014 fishing effort levels continue into the future, the stock is predicted to continue to decline on average, falling to a projected spawning biomass depletion of SB2033/SBF=0 = 0.32 in 2033. The risk of falling below the LRP was estimated to be 19%. Furthermore, the CPUE was estimated to decline by 14% from 2013 levels.

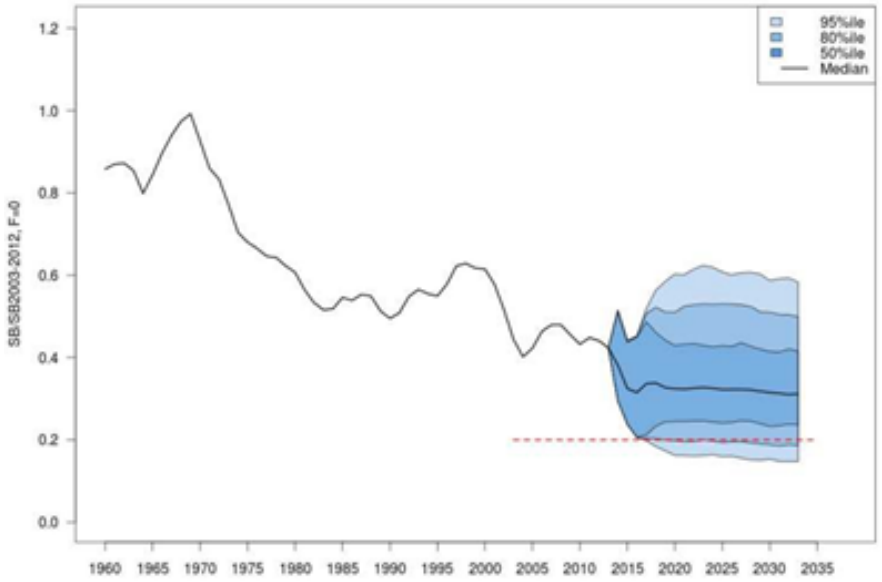


Figure SPA1 (Figure 10 from SC12-SA-WP-06). Stochastic projections of adult stock status under 2014 longline and troll effort levels. The limit reference point (20% SBF=0) is indicated by the horizontal dashed red line. Note that from 1960 up to 2013 inclusive the line represents the median across the 9 assessment model runs (structural uncertainty only); uncertainty after 2013 represents both structural uncertainty and stochastic recruitment.

Management advice and implications

59. SC12 noted that no management advice has been provided since SC11. Therefore, the advice from SC11 should be maintained, that longline fishing mortality and longline catch be reduced to avoid further decline in the vulnerable biomass so that economically viable catch rates can be maintained. SC12 also noted that the results of the indicator analyses supported the stock status results for South Pacific albacore that were obtained from the 2015 assessment.

60. Based on the indicator analysis, SC12 also advised that there is a 19% chance that the south Pacific albacore stock will fall below the Limit Reference Point by 2033 if 2014 fishing effort levels continue, and that overall decreases in vulnerable biomass (a proxy for longline CPUE) of 14% would also be likely to occur.

61. SC12 recommends that the Commission note the information presented on economic conditions in the south Pacific longline fishery. Information in SC12-ST-WP-04 indicated that

declining catch rates are contributing to declines in economic conditions that are likely to undermine profitability in the fishery. FFA members noted that this is impacting the viability of their fishing fleets and noted that this reinforces the need for management

4.2 Northern stocks

4.2.1 North Pacific albacore (*Thunnus alalunga*)

Stock status and trends

62. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC10 are still current. Updated information on North Pacific albacore catches is available in the ISC Plenary Report (SC12-GN-IP-02) but was not compiled for and reviewed by SC12. For further information on the stock status and trends from SC10, please see http://www.wcpfc.int/node/19472

Management advice and implications

63. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see http://www.wcpfc.int/node/19472

4.2.2 Pacific bluefin tuna (*Thunnus orientalis*)

Stock status and trends

64. SC12 noted that ISC provided the following conclusions on the stock status of Pacific bluefin tuna in the Pacific Ocean in 2016 presented in SC12-SA-WP-07 (2016 Pacific Bluefin Tuna Stock Assessment):

> The PBFWG conducted a benchmark assessment (base-case model) using the best available fisheries and biological information. The base-case model fits well the data that were considered to be more reliable and is internally consistent among most of the sources of data. The 2016 base-case model is a substantial improvement compared to the 2014 assessment and fits all reliable data well. The base-case model indicates: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2014) and (2) the SSB steadily declined from 1996 to 2010; and (3) the decline appears to have ceased since 2010, although the stock remains near the historic low. The model diagnostics suggest that the estimated biomass trend for the last 30 years is considered robust although SSB prior to the 1980s is uncertain due to data limitations.
>
> Using the base-case model, the 2014 (terminal year) SSB was estimated to be around 17,000 t (Figure 7-4), which is about 9,000 t below the terminal year estimated in the 2014 assessment (26,000 in 2012). This is because of improvements to the input data and refinements to the assessment model scaled down the estimated value of SSB and not because the SSB declined from 2012 to 2014.

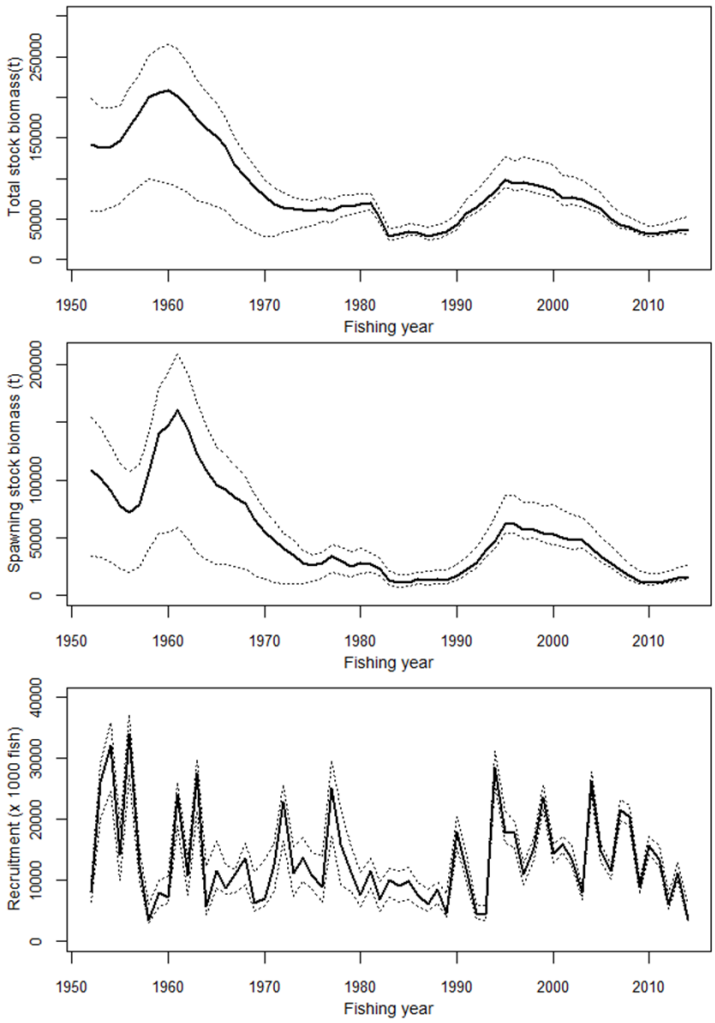


Figure 7-4. Total stock biomass (top), spawning stock biomass (middle) and recruitment (bottom) of PBF from the base-case model. The solid line indicates point estimate and dashed lines indicate the 90% confidence interval.

Recruitment estimates fluctuate widely without an apparent trend. The 2014 recruitment was relatively low, and the average recruitment for the last five years may have been below the historical average level (Figure 7-4). Note that recruitments in terminal years in an assessment are highly uncertain due to limited information on the cohorts. However, two of the last three data points from the Japanese troll CPUE-based index of recruitment, which was consistent with other data in the model, are at their lowest level since the start of the index (1980). Estimated age-specific fishing mortalities on the stock during 2011-2013 and 2002-2004 (the base period for WCPFC CMM 2015-04) are presented in Figure 7-5. Most age-specific fishing mortalities (F) for intermediate ages (2-10 years) are substantially above F2002-2004 while those for age 0 as well as ages 11 and above are lower (Table 7-1).

Table 7-1. Percent change of estimated age-specific fishing mortalities of PBF from 2002-2004 to 2011-2013.

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
change from F2002-2004 to F2011-2013	-28%	-1%	+96 %	+4%	+86 %	+43 %	-9%	+81 %	+21 %	+23 %	+5%	-5%	-7%	-8%	-9%	-10%	-10%	-10%	-11%	-11%	-11%

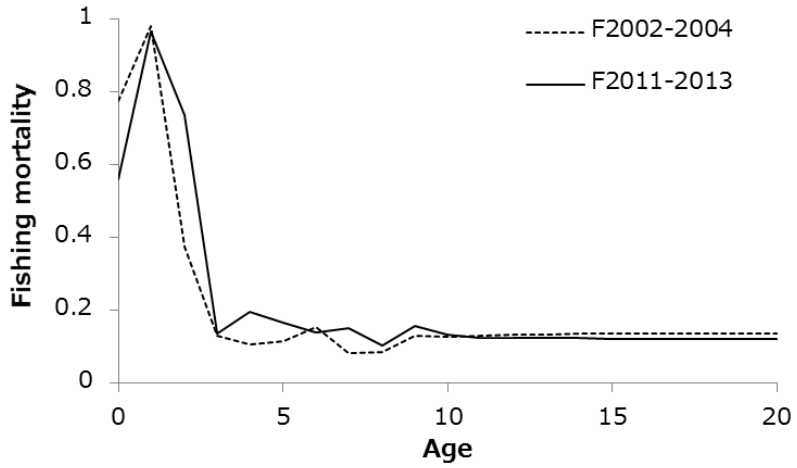


Figure 7-5. Geometric means of annual age-specific (years) fishing mortalities of PBF for 2002-2004 (dashed line) and 2011-2013 (solid line).

Although no limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the $_{F2011\text{-}2013}$ exceeds all calculated biological reference points except for FMED and FLOSS despite slight reductions to F in recent years (Table 7-2). The ratio of SSB in 2014 relative to the theoretical unfished[1] SSB (SSB2014/SSBF=0, the depletion ratio) is 2.6%[2] and SSB2012/SSBF=0 is 2.1% indicating a slight increase from 2012 to 2014. Although the $SSB_{2014}/SSB_{F=0}$ for this assessment (2.6%) is lower than $SSB_{2012}/SSB_{F=0}$ from the 2014 assessment (4.2%), this difference is due to improvements to the input data and model structure (Figure 7-4) rather than a decline in SSB from 2012 to 2014. Note that potential effects on Fs as a result of the measures of the WCPFC and IATTC starting in 2015 or by other voluntary measures are not yet reflected in the data used in this assessment.

Since reference points for PBF have yet to be identified, two examples of Kobe plots (Figure 7-6: plot A based on SSBMED and FMED, plot B based on SSB20% and SPR20%) are presented. These versions of the Kobe plot represent two interpretations of stock status in an effort to prompt further discussion. In summary, if these were the reference points, overfishing would be occurring or just at the threshold in the case of FMED; and the stock would be considered overfished. Plot B shows that the stock has remained in an overfished and -overfishing status for the vast majority of the assessment period if F20% and SSB20% are the reference points. The ISC notes that the SSB estimates before 1980 are more uncertain and that the reason why the fishing mortality is estimated to be so high right after the WWII is not well understood. The low biomass level at the beginning of the assessment period (1952) could potentially be the result of relatively high catches prior to the assessment period of PBF.

Table 7-2. Ratios of the estimated fishing mortalities F2002-2004, F2009-2011 and F2011-2013 relative to computed F- based biological reference points and SSB (t) and depletion ratio for the terminal year of the reference period for PBF.

[1] "Unfished" refers to what SSB would be had there been no fishing.

[2] The unfished SSB is estimated based upon equilibrium assumptions of no environmental or density-dependent effects.

	F_{max}	$F_{0.1}$	F_{med}	F_{loss}	$F_{10\%}$	$F_{20\%}$	$F_{30\%}$	$F_{40\%}$	Estimated SSB for terminal year of each reference period	Depletion ratio for terminal year of each reference period
2002-2004	1.86	2.59	1.09	0.80	1.31	1.89	2.54	3.34	41,069	0.064
2009-2011	1.99	2.78	1.17	0.85	1.41	2.03	2.72	3.58	11,860	0.018
2011-2013	1.63	2.28	0.96	0.70	1.15	1.66	2.23	2.94	15,703	0.024

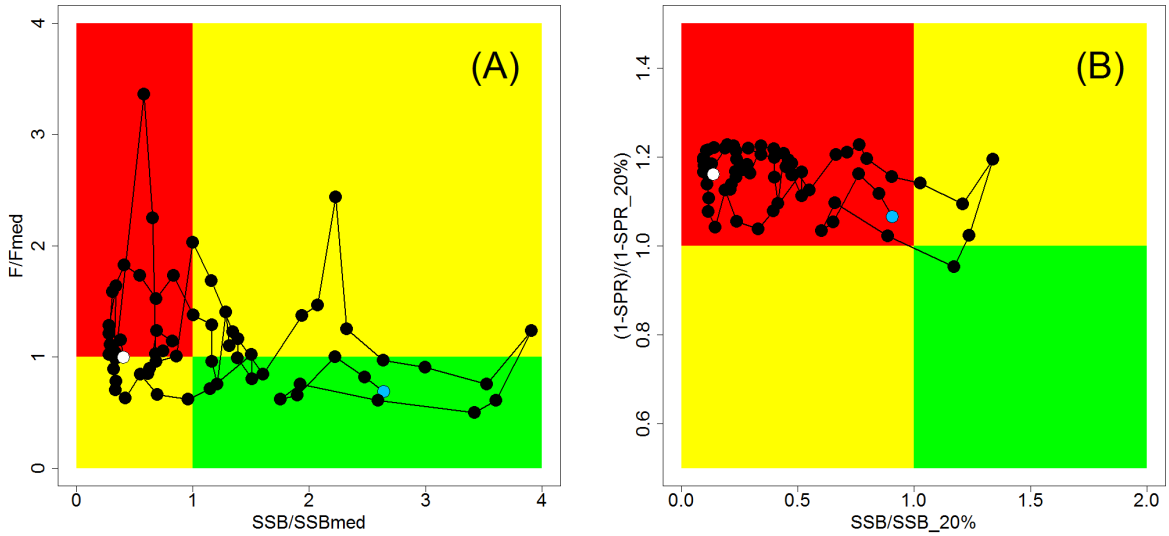


Figure 7-6. Kobe plots for PBF. (A) SSBMED and FMED; (B) SSB20% and SPR20% based. Note that SSBMED is estimated as the median of estimated SSB over whole assessment period (40,944 t) and FMED is calculated as an F to provide SSBMED in long-term, while the plots are points of estimates. The blue and white points on the plot show the start (1952) and end (2014) year of the period modelled in the stock assessment, respectively.

Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleets, in particular those targeting small fish[3] (age 0-1), have had a greater impact, and the effect of these fleets in 2014 was greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fleet has had a limited effect on the stock throughout the analysis period (Figure 7-7). This is because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish.

[3] It was noted that the term small fish is not used in CMM 2015-04; however, the measure states "Further substantial reductions in fishing mortality and juvenile catch over the whole range of juvenile ages should be considered…"

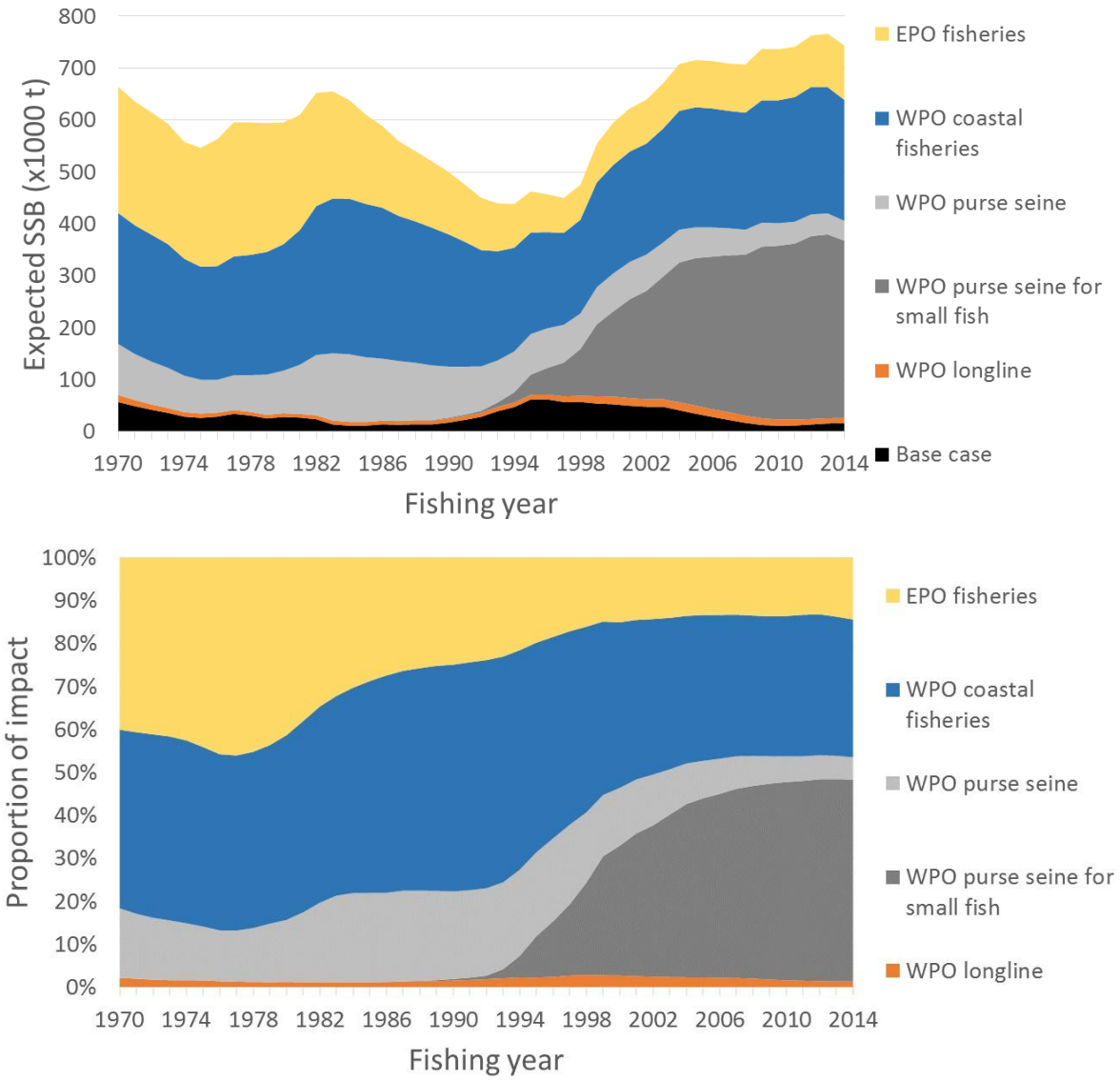


Figure 7-7. Trajectory of the spawning stock biomass of a simulated population of PBF when zero fishing mortality (F=0) is assumed and the STET at F=0 is the same as estimated in the base-case assessment model, estimated by the base-case model. (Top: absolute impact, bottom: relative impact). Fleet definition; WPO longline: F1, F12, F17. WPO purse seine for small fish: F2, F3, F18. WPO purse seine: F4, F5. WPO coastal fisheries: F6-11, F16, F19. EPO fisheries: F13, F14, F15.

65. In the absence of any agreed definition of a drastic drop in stock recruitment referred to in CMM 2015-04, SC12 notes with concern that the 2012 and 2014 recruitments are at the lowest levels observed since 1980, noting that ISC noted that recruitment in the terminal years of any assessment is highly uncertain. SC12 also noted a comment from Japan that some indices of 2015 recruitment are above the 2014 level and early anecdotal information regarding the 2016 recruitment suggests it is not particularly low.

66. The provisional total Pacific Bluefin tuna catch in 2015 was 11,020 mt in the North Pacific Ocean, which was a 36% decrease over 2014 and a 30% decrease over the average for 2010-2014.

67. SC12 noted that, based on the latest stock assessment carried out by ISC in 2016, SC12 noted that the Pacific bluefin tuna spawning stock biomass is depleted to 2.6% of the estimated unfished spawning stock biomass (SBF=0). SC12 emphasized that this depletion level is considerably below the biomass depletion-based Limit Reference Point of 20% of SBF=0 set by the Commission for all other WCPFC key tuna stocks (skipjack, yellowfin, bigeye, south Pacific albacore and north Pacific albacore). However, SC12 also notes that the Pacific bluefin tuna stock remained below 20% of SBF=0 for most of the time of assessment. SC12 also noted that the initial rebuilding target currently defined by the CMM 2015-04, the median of the SSB of the stock assessment period (42,582 mt) corresponds to a spawning biomass of around 7% of estimated unfished spawning stock biomass.

Management advice and implications

68. SC12 noted the following conservation advice from ISC:

The steady decline in SSB from 1996 to 2010 appears to have ceased, although SSB2014 is near the historic low and the stock is experiencing exploitation rates above all calculated biological reference points except for FMED and FLOSS.

The projection results based on the base-case model under several harvest and recruitment scenarios and time schedules are shown in Table 7-3 and Figure 7-8. Under all examined scenarios the initial goal of WCPFC, rebuilding to SSBMED by 2024 with at least 60% probability, is reached and the risk of SSB falling below SSBLOSS at least once in 10 years was low.

The projection results indicate that the probability of SSB recovering to the initial WCPFC target (SSBMED by 2024, 38,000 t, calculated in the same manner as the previous assessment) is 69% or above the level prescribed in the WCPFC CMM if low recruitment scenario is assumed and WCPFC CMM 2015-04 and IATTC Resolution C-14-06 continue in force and are fully implemented (Table 4: Scenario 2 with low recruitment).

The ISC notes there are technical inconsistencies in the calculation of SSBMED in the assessment and projection. The ISC also notes the current calculation of SSBMED in the projection includes the most recent estimates of SSB and unless a fixed period of years is specified to calculate SSBMED, the calculation of SSBMED could be influenced by future trends in spawning biomass. The ISC therefore recommends defining SSBMED as the median point estimate for a fixed period of time, either, 1952-2012 or 1952-2014. If 1952-2012 is chosen, then SSBMED is estimated to be 41,069 t, and if 1952-2014 is chosen, SSBMED is 40,994 t. The probabilities of achieving 41,000 t under various scenarios are provided in Table 7-3. The probabilities of achieving 43,000 t, where WCPFC CMM 2015-04's initial rebuilding target is specified as 42,592 t, are also provided in Table 7-3, although this value is derived from the previous assessment and is higher than the SSBMED calculated in the current assessment. The ISC recommends that in the future absolute values should not be used for the initial rebuilding target, as the calculated values of reference points would change from assessment to assessment.

Scenario 2 with low recruitment has the lowest prospect of recovery among the examined harvest scenarios. The probability of achieving the WCPFC's initial target (SSBMED by 2024) would increase if more conservative management measures were implemented as shown in Table 7-3 and Figure 7-8. The projection results indicate that a 10% reduction in the catch limit for fish smaller than the weight threshold in CMM 2015-04 would have a larger effect on recovery than a 10% reduction in the catch limit for fish larger than the weight threshold. (Figure 7-8 (D)). The ISC notes that the current assessment model uses a maturity ogive that assumes 20%, 50% and 100% maturity in age 3 (weight on July 1: 34kg), 4 (weight on July 1: 58kg) and 5 (weight on July 1: 85kg), respectively, while the WCPFC CMM 2015-04 specifies that catches of fish smaller than 30kg

should be reduced. The weight threshold in the CMM needs to be increased to 85kg (weight of age 5) if the intent is to reduce catches on all juveniles according to the maturity ogive in the assessment.

The projections results assuming a stronger stock-recruitment relationship (where h=0.9) than in the assessment model are not necessarily more pessimistic than the low recruitment scenario. The projection results assume that the CMMs are fully implemented and are based on certain biological or other assumptions. In particular, the ISC noted the implementation of size based management measures need to be monitored carefully. If conditions change, the projection results would be more uncertain. Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment has on stock biomass, monitoring recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

Table 7-3. Future projection scenarios for PBF and their probability of achieving various target levels by various time schedules based on the base-case model.

Harvesting Scenario #	Fishing mortality	Catch limit *		Threshold of Small/Large	Recruitment scenario **	Probability that SSB exceeds 38,000 tons (SSB median of Bootstrap analysis runs)			Probability that SSB exceeds 41,000 tons (SSB median of Base case model) ***			Probability that SSB is more than 43,000 tons (SSBmed@last assessment)			Probability that SSB is more than 10%SSB0			Probability that SSB is more than 20%SSB0			Average Catch	
		Small	Large			2024	2029	2034	2024	2029	2034	2024	2029	2034	2024	2029	2034	2024	2029	2034	2019	2024
Scenario1	F2002-2004	scenario 6 in 2014 assessment		30 kg	Low recruitment	77.0%	88.8%	89.9%	69.7%	83.3%	85.2%	64.3%	79.3%	81.9%	14.7%	28.0%	31.8%	0.0%	0.0%	0.1%	11619.2	13574.9
Scenario2		50% of 2002-2004 average catch for WPO fisheries 3,300 tons for EPO commercial fisheries	2002-2004 average catch for WPO fisheries		Low recruitment	69.3%	83.7%	86.6%	61.5%	77.8%	82.3%	56.1%	73.9%	79.0%	13.6%	29.3%	35.4%	0.1%	0.4%	0.6%	11749.7	12994.2
					Average recruitment	99.6%	100%	100%	99.3%	100%	100%	99.3%	100%	100%	96.3%	99.8%	100%	73.8%	95.0%	98.0%	12958.4	14750.8
					Stock Recruit Relationship w/ h=0.9	98.2%	99.8%	99.9%	97.7%	99.8%	99.9%	97.5%	99.7%	99.9%	93.5%	99.4%	99.9%	72.0%	97.3%	99.6%	13087.3	15020.1
Scenario3		50% of 2002-2004 average catch		50 kg	Low recruitment	80.5%	91.5%	94.0%	73.8%	87.9%	90.7%	69.1%	85.1%	88.5%	22.2%	43.6%	51.7%	0.2%	0.9%	1.3%	11404.4	12672.3
Scenario4				80 kg	Low recruitment	86.4%	94.6%	96.5%	80.6%	91.9%	94.7%	76.6%	90.0%	93.0%	27.8%	51.8%	61.3%	0.2%	1.1%	1.6%	11292.6	12542.7
Scenario5		90% of scenario 2	same as Scenario 2	30 kg	Low recruitment	90.0%	96.5%	98.1%	85.3%	94.8%	97.0%	81.5%	93.4%	95.9%	35.0%	61.7%	70.4%	0.3%	2.5%	3.7%	11306.4	12881.3
					Average recruitment	99.9%	100%	100%	99.9%	100%	100%	99.9%	100%	100%	98.4%	100%	100%	82.2%	97.8%	99.3%	12442.0	14126.3
					Stock Recruit Relationship w/ h=0.9	99.4%	100%	100%	99.2%	100%	100%	99.1%	100%	100%	97.0%	99.8%	100%	81.8%	99.0%	99.9%	12576.4	14448.2
Scenario6		same as Scenario 2	90% of scenario 2		Low recruitment	75.3%	88.2%	90.2%	67.2%	82.9%	86.5%	61.7%	78.6%	83.4%	15.7%	32.5%	38.7%	0.1%	0.5%	0.7%	11496.2	12632.4
					Average recruitment	99.7%	100%	100%	99.6%	100%	100%	99.5%	100%	100%	96.8%	99.9%	100%	75.1%	95.2%	98.1%	12686.3	14071.5
					Stock Recruit Relationship w/ h=0.9	98.9%	99.9%	100%	98.6%	99.9%	100%	98.4%	99.9%	100%	95.0%	99.7%	100%	75.5%	98.0%	99.9%	12761.0	14379.7
Scenario7		90% of scenario 2		30 kg	Low recruitment	90.3%	96.8%	98.3%	86.2%	95.4%	97.6%	82.7%	94.2%	96.8%	39.4%	68.0%	77.4%	0.5%	3.5%	5.6%	11231.0	12607.1
					Average recruitment	99.9%	100%	100%	99.9%	100%	100%	99.9%	100%	100%	98.5%	100%	100%	83.5%	98.1%	99.6%	12139.4	13461.7
					Stock Recruit Relationship w/ h=0.9	99.2%	100%	100%	99.1%	100%	100%	99.0%	99.9%	100%	96.9%	99.8%	100%	81.6%	99.0%	99.9%	11227.3	12461.8
Scenario8		80% of scenario 2	same as Scenario 2		Low recruitment	97.5%	99.6%	99.9%	96.1%	99.3%	99.7%	94.8%	98.9%	99.5%	65.4%	89.2%	94.0%	1.9%	14.5%	22.8%	10922.8	12688.4
Scenario9		same as Scenario 2	80% of scenario 2		Low recruitment	78.1%	89.9%	92.5%	70.4%	85.6%	88.8%	65.0%	81.9%	86.3%	18.4%	37.1%	44.7%	0.2%	0.6%	0.9%	11327.0	12329.9
Scenario10		80% of scenario 2			Low recruitment	98.3%	99.8%	99.9%	97.4%	99.6%	99.9%	96.3%	99.5%	99.8%	73.2%	93.8%	97.5%	3.1%	22.4%	34.1%	10585.9	11586.4
					Average recruitment	100%	100%	100%	100%	100%	100%	100%	100%	100%	99.7%	100%	100%	91.0%	99.5%	100%	11194.1	12104.9
					Stock Recruit Relationship w/ h=0.9	99.8%	100%	100%	99.7%	100%	100%	99.7%	100%	100%	98.7%	100%	100%	90.0%	99.7%	100%	11227.3	12461.8
Scenario11	F2011-2013	same as Scenario 2	same as Scenario 2		Low recruitment	82.6%	93.0%	95.0%	75.9%	89.9%	92.1%	71.3%	86.4%	89.9%	23.6%	46.2%	56.0%	0.1%	1.2%	1.6%	12266.8	13587.4

* Catch limits for EPO commercial fisheries is applied for all the catch (small and large fish) made by the Fleets.
** Average recruitment refers to the recruitment for the whole assessment period while low recruitment refers to that of 1980-1989.
*** Probability that SSB exceeds 41,000 tons (SSB median of Base case model) developed by PBFWG at ISC16 Plenary.

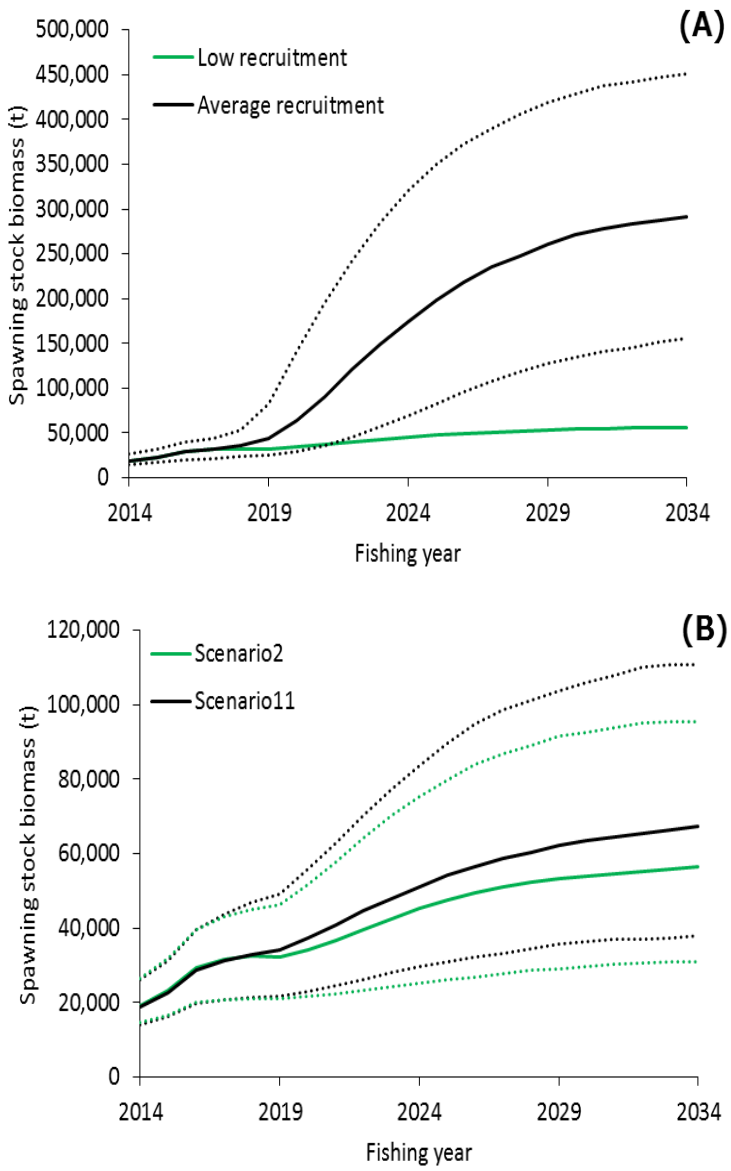
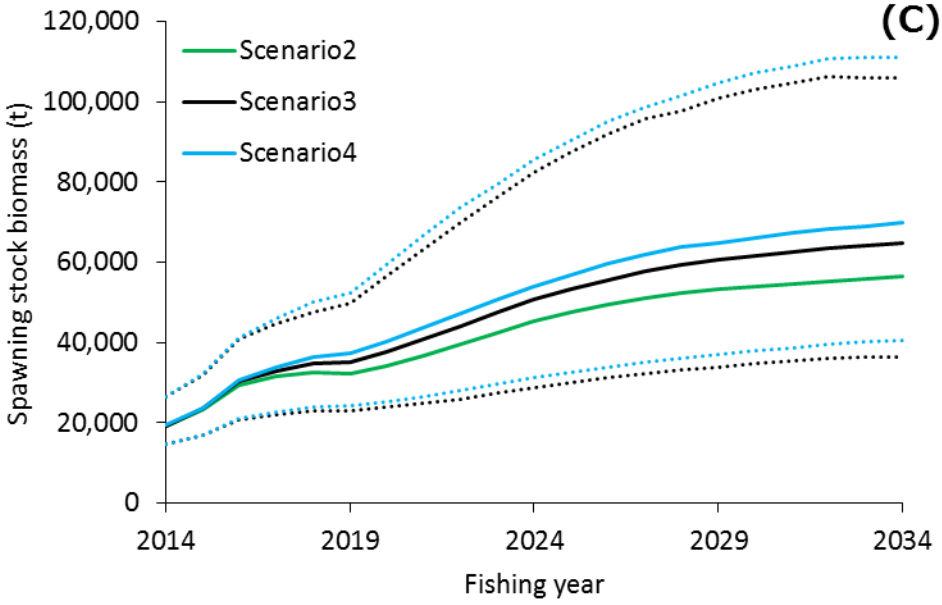


Figure 7-8. Comparisons of various projection results for PBF. (A) Low recruitment vs. historical average recruitment (Scenario 2). (B) Current CMMs (Scenario 2) vs. current F (Scenario 11) (low recruitment). The solid lines indicate median of bootstrapped projection results and dotted lines indicate 90% confidence interval.



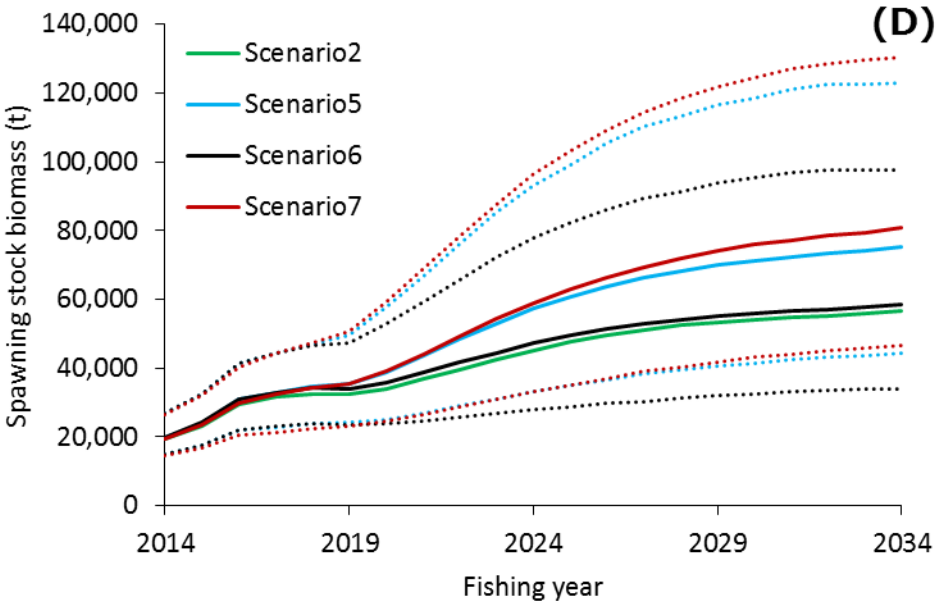


Figure 7-8 (cont.) Comparisons of various projection results for PBF. (C) Different definition of small fish (30kg (Scenario 2) vs. 50kg (Scenario 3) vs. 80kg (Scenario 4)) (low recruitment). (D) Current CMMs (Scenario 2) vs. additional 10% catch limit reduction for small fish (Scenario 5), for large fish (Scenario 6) and for all fish (Scenario 7) (low recruitment). The solid lines indicate median of bootstrapped projection results and dotted lines indicate 90% confidence interval. ”

69. SC12 advised WCPFC13 that FFA members expressed concern that the substantial depletion of the Pacific bluefin stock due to excess fishing in the northern WCPFC region has probably resulted in range contraction, thus greatly reducing the availability of bluefin tuna (*Thunnus orientalis*) in the south Pacific. This is of particular significance to Pacific island CCMs because it limits their future opportunities for the participation in fisheries for this stock. SC12 also noted no

statistical demonstration is provided to support the range contraction of Pacific Bluefin tuna. SC12 noted the need for additional information.

70. In view of the upcoming IATTC-WCPFC joint meeting on Pacific bluefin tuna management, SC12 expressed the need of urgent coordinated actions between WCPFC and IATTC in reviewing the current rebuilding plan, establishing the emergency rule as well as considering and developing reference points and HCRs for the long term management of PBF.

4.2.3 North Pacific swordfish (*Xiphias gladius*)

Stock status and trends

71. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC10 are still current. Updated information on North Pacific albacore catches is available in the ISC Plenary Report (SC12-GN-WP-02) but was not compiled for and reviewed by SC12. For further information on the stock status and trends from SC10, please see http://www.wcpfc.int/node/19472

Management advice and implications

72. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see http://www.wcpfc.int/node/19472

4.3 WCPO sharks

4.3.1 Oceanic whitetip shark (*Carcharhinus longimanus*)

Stock status and trends

73. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

74. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.2 Silky shark (*Carcharhinus falciformis*)

Stock status and trends

75. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

76. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.3 South Pacific blue shark (*Prionace glauca*)

Stock status and trends

77. SC12 noted that WCPFC has not yet determined limit biological reference points for South Pacific blue shark.

78. SC12 noted that the stock status for shark assessments presented to the Scientific have been traditionally assessed relative to MSY-based reference points. It was also noted that realistic estimates of equilibrium unexploited recruitment and spawning biomass could not be obtained in the 2016 South Pacific blue shark assessment due to the lack of available data, conflicting CPUE time series, and uncertainty in the estimated stock recruitment relationship.

79. SC12 noted that the 2015 catch of south Pacific blue shark provided within aggregate 5-degree square catch data was 26% lower than in 2014, and a 34% reduction over the average for 2010-14.

80. SC12 noted that the 2016 South Pacific blue shark assessment is preliminary and is considered to be a work in progress. As a result, it cannot be used to determine stock status and form the basis of management advice.

81. SC12 noted that there are a number of data uncertainties within the South Pacific blue shark assessment, especially with regard to historical and contemporary longline catch and CPUE estimates. The data-poor nature of the South Pacific blue shark assessment indicates that an improvement in the amount and quality of available biological and fishery information will be required in order to develop a useful integrated stock assessment model.

82. SC12 noted the recommendations in the working papers (SC12-SA-WP-08 and SC12-SA-WP-09) for data improvements and other analytical work needed to improve the assessment for South Pacific blue shark, and recommends prioritizing such work.

Management advice and implications

83. SC12 noted that no management advice has been provided for South Pacific blue shark.

4.3.4 North Pacific blue shark (*Prionace glauca*)

Stock status and trends

84. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

85. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.5 North Pacific shortfin mako (*Isurus oxyrinchus*)

Stock status and trends

86. SC12 noted that there is no existing stock assessment for North Pacific shortfin mako shark.

Management advice and implications

87. SC12 noted that no management advice has been provided for North Pacific shortfin mako shark.

4.3.6 Pacific bigeye thresher shark (*Alopias superciliosus*)

Stock status and trends

88. SC12 noted that there is no existing stock assessment for Pacific bigeye thresher shark but acknowledged the submission of SC12-SA-IP-17 which represents the initial chapters of a stock assessment currently in preparation.

89. SC12 noted that, although it was planned that the bigeye thresher shark assessment would be presented to and reviewed by SC12, the full assessment report could not be completed in time and is currently being finalized by the consultants, the WCPFC Secretariat, the SPC (on behalf of some of their members), the United States and Japan. SC12 understands that the finalized bigeye thresher assessment report will be posted on the ABNJ Tuna Project website when ready, and then provided to SC13 for discussion.

Management advice and implications

90. SC12 noted that no management advice has been provided for Pacific bigeye thresher shark.

4.4 WCPO billfishes

4.4.1 South Pacific swordfish (*Xiphias gladius*)

Stock status and trends

91. SC12 noted that no stock assessment was conducted for South Pacific swordfish in 2015. Therefore, the stock status description from SC9 is still current.

Management advice and implications

92. SC12 noted that no management advice had been provided since SC9. Therefore, the advice from SC9 should be maintained.

4.4.2 Southwest Pacific striped marlin (*Kajikia audax*)

Stock status and trends

93. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin are still current. Updated information on North Pacific striped marlin catches may be available in the ISC Plenary Report (SC12-GN-IP-02), and for South Pacific striped marlin in SC12-ST-IP-01, but was not compiled for and reviewed by SC12.

Management advice and implications

94. SC12 noted that no management advice has been provided since SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.4.3 North Pacific striped marlin (*Kajikia audax*)

Stock status and trends

95. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin are still current. Updated information on North Pacific striped marlin catches may be available in the ISC Plenary Report (SC12-GN-IP-02), and for South Pacific striped marlin in SC12-ST-IP-01, but was not compiled for and reviewed by SC12.

Management advice and implications

96. SC12 noted that no management advice has been provided since SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.4.4 Pacific blue marlin (*Makaira nigricans*)

Stock status and trends

97. SC12 noted the stock status for Pacific blue marlin provided by ISC in SC12-GN-IP-02 and SC12-SA-WP-12:

> Estimates of total BUM stock biomass show a long term decline. Population biomass (age-1 and older) averaged roughly 130,965 t in 1971-1975, the first 5 years of the assessment time frame, and has declined by approximately 40% to 78,082 t in 2014 (Figure 7-11). Female spawning biomass was estimated to be 24,809 t in 2014, or about 25% above SSBMSY (Table 7-3 and Table 7-4). Fishing mortality on the stock (average F, ages 2 and older) averaged roughly F = 0.28 during 2012-2014, or about 12% below FMSY. The estimated spawning potential ratio of the stock (SPR, the predicted spawning output at the current F as a fraction of unfished spawning output) is currently SPR2012-2014 = 21%. Annual recruitment averaged about 897,000 recruits during 2008-2014, and no long-term trend in recruitment was apparent. Overall, the time series of spawning stock biomass and recruitment estimates indicate a long-term decline in spawning stock biomass and suggest a fluctuating pattern without trend for recruitment (Figure 7-11).

Table 7-3. Reported catch (t) used in the stock assessment along with annual estimates of population biomass (age-1 and older, t), female spawning biomass (t), relative female spawning biomass (SSB/SSB_{MSY}), recruitment (thousands of age-0 fish), fishing mortality (average F, ages-2 and older), relative fishing mortality (F/F_{MSY}), and spawning potential ratio of Pacific BUM.

Year	2008	2009	2010	2011	2012	2013	2014	Mean[1]	Min[1]	Max[1]
Reported Catch	17,828	18,282	20,086	18,165	19,407	20,727	20,356	18,232	9,160	25,589
Population Biomass	71,768	69,720	72,696	72,995	76,697	78,761	78,082	101,149	69,720	135,623
Spawning Biomass	22,706	23,065	22,392	23,182	23,432	24,771	24,809	41,717	20,972	71,807
Relative Spawning Biomass	1.14	1.16	1.13	1.17	1.18	1.25	1.25	2.10	1.06	3.62
Recruitment (age 0)	687	1031	702	1061	763	909	839	897	589	1181
Fishing Mortality	0.27	0.29	0.30	0.26	0.27	0.28	0.28	0.22	0.09	0.38
Relative Fishing Mortality	0.82	0.88	0.92	0.82	0.83	0.87	0.87	0.67	0.26	1.17

[1] During 1971-2014										

Table 7-4 Estimates of biological reference points along with estimates of fishing mortality (F), female spawning stock biomass (SSB), recent average yield (C), and spawning potential ratio (SPR) of BUM, derived from the base case model assessment model, where "MSY" and "20%" indicate reference points based on maximum sustainable yield and a spawning potential ratio of 20%, respectively.

Reference Point	Estimate
F_{MSY} (age 2+)	0.32
$F_{20\%}$ (age 2+)	0.30
$F_{2012\text{-}2014}$ (age 2+)	0.28
SSB_{MSY}	19,853 mt
$SSB_{20\%}$	22,727 mt
SSB_{2014}	24,809 mt
MSY	19,901 mt
$C_{2012\text{-}2014}$	20,163 mt
SPR_{MSY}	0.18
$SPR_{2012\text{-}2014}$	0.21

Note: SSB values represent female spawning biomass only.

The Kobe plot depicts the stock status relative to MSY-based reference points for the base case model (Figure 7-12) and shows that spawning stock biomass decreased to roughly the MSY level in the mid-2000s, and has increased slightly in recent years (Table 7-4 and Figure 7-11).Based on the results of this 2016 stock assessment update, the Pacific blue marlin stock is not currently overfished and is not experiencing overfishing. Because Pacific blue marlin is mainly caught as bycatch, direct control of the annual catch amount through the setting of a total allowable catch may be difficult."

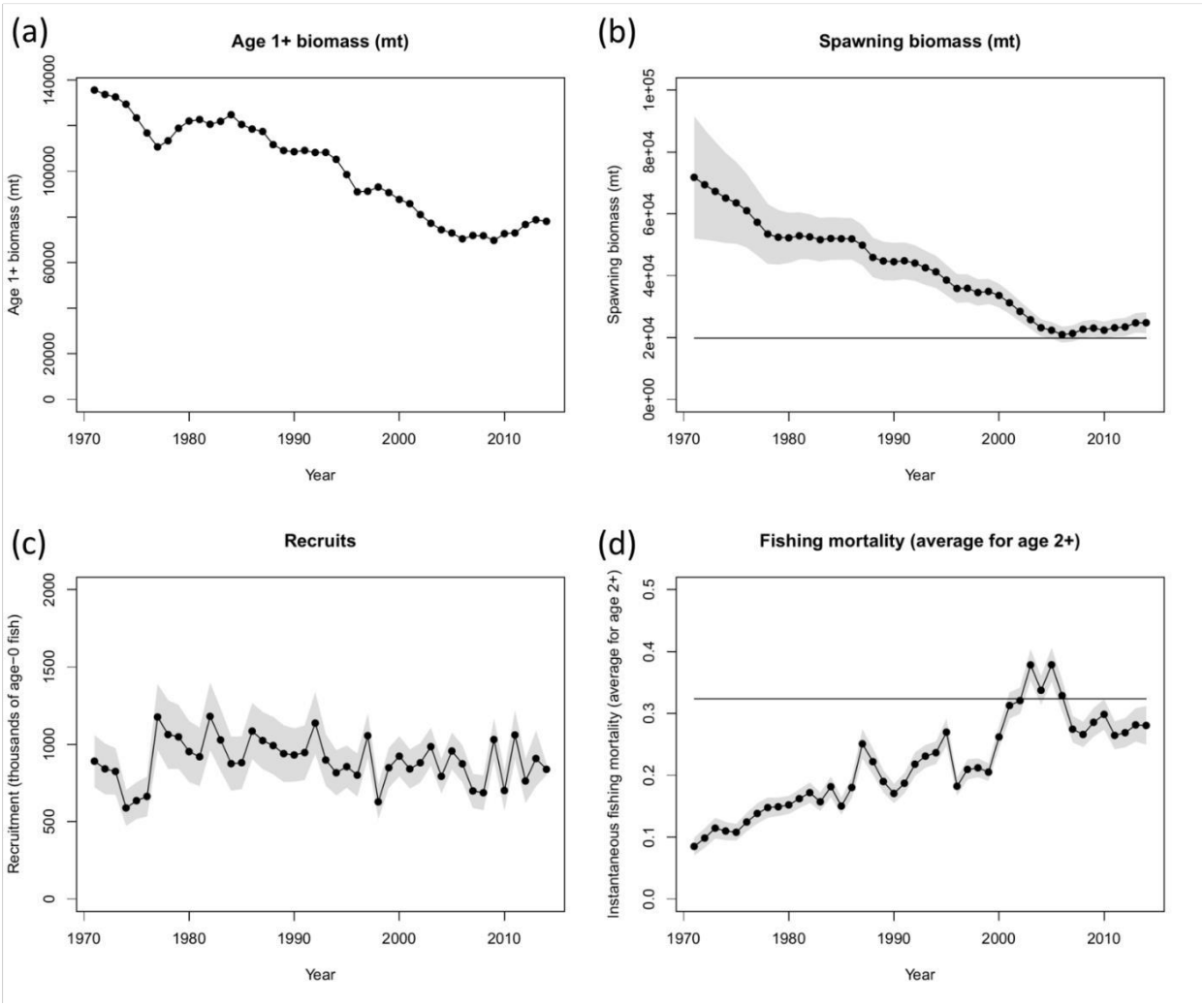


Figure 7-11. Time series of estimates of (a) population biomass (age 1+), (b) female spawning biomass, (c) recruitment (age-0 fish), and (d) instantaneous fishing mortality (average for age 2+, year-1) for BUM derived from the 2016 stock assessment update. The solid circles represents the maximum likelihood estimates by year for each quantity and the shadowed area represents the uncertainty of the estimates (± 1 standard deviation), except for the total biomass time series. The solid horizontal lines indicate the MSY- based reference points for spawning biomass and fishing mortality.

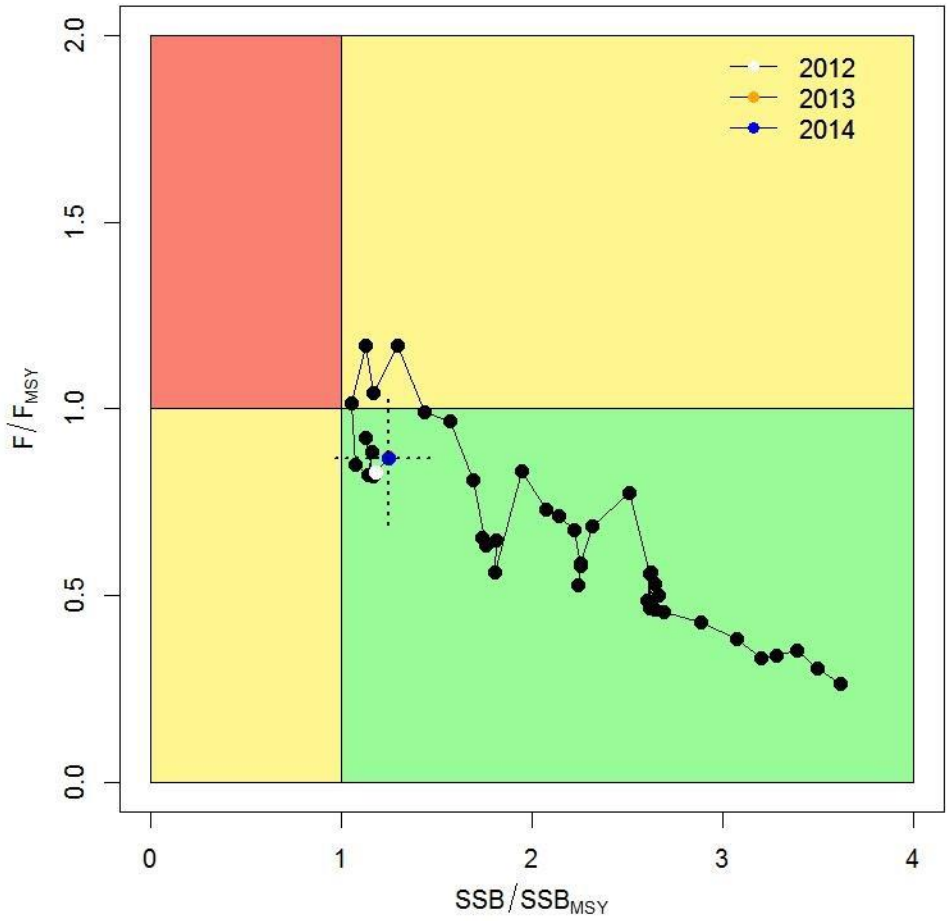


Figure 7-12. Kobe plot of the time series of estimates of relative fishing mortality (average of age 2+) and relative spawning stock biomass of BUM during 1971-2014. The dashed lines denote the 95% confidence intervals for the estimates in the year 2014.

Management advice and implications

98. SC12 noted the conservation advice for Pacific blue marlin provided by ISC in SC12-GN-IP-02 and SC12-SA-WP-12:

Since the stock is nearly full exploited, the ISC recommends that fishing mortality remain at or below current levels (2012-2014).

AGENDA ITEM 5 – MANAGEMENT ISSUES THEME

5.1 Development of harvest strategy framework

5.1.1 Management objectives

99. SC12 noted that the Commission is scheduled to 'record' the management objectives for each fishery or stock (south-Pacific albacore, skipjack, yellowfin and bigeye) in 2016. Noting the direct relationship between management objectives, and the need to identify performance indicators within the Management Strategy Evaluation (MSE) currently being developed, SC12 encourage WCPFC13 to provide additional clarity on the management objectives for skipjack and south-Pacific albacore.

5.1.2 Reference points

a. South Pacific albacore

100. SC12 reviewed information related to the biological and economic consequences of alternative catch trajectories to achieve a candidate south Pacific albacore target reference point (SC12-MI-WP-01) and provided a number of suggestions to clarify aspects of the paper before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the biological and economic consequences of the various trajectory options modelled in this paper in making a decision on an appropriate target reference point for south Pacific albacore. In particular, SC12 draws the attention of WCPFC13 to the importance of assumptions on key bycatch species catch levels for economic estimates; and the need to include additional economic losses due to the exit of vessels from the fishery.

b. Bigeye tuna

101. SC12 reviewed information related to biologically reasonable rebuilding timeframes for bigeye tuna (SC12-MI-WP-02) and provided a number of suggestions to clarify aspects of the paper before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the various options modelled in this paper in making a decision on an appropriate rebuilding timeframe for bigeye tuna. In particular, SC12 draws the attention of WCPFC13 to i) the estimated bigeye generation time of 4 years, and minimum rebuilding time in the absence of fishing of 2-4 years, ii) that consideration of acceptable risk for the bigeye stock falling below the limit reference point will influence the findings, and iii) it will be important to examine not only the timeframe but also the stock trajectory of rebuilding.

5.1.3 Implications of alternative levels of acceptable risk

102. SC12 reviewed a proposal for adopting interim acceptable levels of risk for breaching limit reference points in the WCPO (SC12-MI-WP-03) and provided a number of suggestions to clarify aspects of the rationale within the paper before a revised version is forwarded to WCPFC13. Noting that WCPFC13 is scheduled to agree levels of risk for the four key tuna species, SC12 recommended that WCPFC13 take into consideration the rationale outlined in this paper for identifying acceptable levels of risk and again notes that the UN Fish Stocks Agreement states that the risk of exceeding LRPs should be very low. SC12 also recommends that adopted risk levels be seen as interim and be reviewed in light of the outcomes of the Management Strategy Evaluation work-plan. SC12 recommended that WCPFC13 notes that levels of risk for breaching LRP should be considered coupled with the corresponding conservative or liberal nature of the LRP. For example, the bigeye tuna LRP (20% of unfished spawning biomass) is very close to the depletion expected to occur (0.21) if the fishery attained the spawning biomass at MSY. Therefore the bigeye tuna LRP is viewed as conservative and could have associated higher levels of risk for breaching the LRP.

5.1.4 – 5.1.5 Performance indicators and Monitoring strategy

103. SC12 reviewed candidate performance indicators and monitoring strategies for skipjack and South Pacific albacore commensurate with candidate management objectives for the tropical purse seine and southern longline fisheries (SC12-MI-WP-04) and provided a number of suggestions to clarify aspects of the paper and expand on the list of performance indicators before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the candidate performance indicators and monitoring strategies listed in this paper, and noting that the number of key performance indicators should be kept to a tractable level, provide advice on what performance indicators and monitoring strategies should be included for the development of harvest strategies under CMM 2014-06.

5.1.6 Harvest control rules and management strategy evaluation

104. SC12 reviewed the report of the expert consultation held at SPC in June 2016 on the development of a management strategy evaluation framework for WCPFC tuna stocks (SC12-MI-WP-05). SC12 endorsed the scope of the work to be undertaken as outlined in this report and recommended that i) while a model-based management strategy may be appropriate for skipjack, the concern of the workshop was on the future availability of abundance indices and tagging data for skipjack and WCPFC13 should consider how these necessary data can continue to be provided to support the assessment and MSE, and ii) that both empirical and model-based management strategies could be tested for South Pacific albacore but that CPUE based methods may be dependent on access to operational longline logbook data.

105. SC12 also recommended that WCPFC13 support the recommendation of the MSE workshop for the continued involvement of experts to provide technical advice on the MSE work as well as a process for ongoing science and management dialogue to facilitate stakeholder involvement in the development of harvest strategies. The SC12 considers both of these additional processes are essential for completion of the harvest strategies work-plan under CMM 2014-06, with separate consideration required for each of the species included in this work-plan. SC12 recommends that expert technical advice to the Scientific Service Provider be facilitated via informal meetings and/or workshops similar to the arrangements for the annual Pre-Assessment Workshop. With respect to science and management dialogue, SC12 recommended that stakeholder involvement should be undertaken via in-country stakeholder engagement with the Scientific Service Provider together with a higher-level meeting or workshop for broader stakeholder engagement (to be held as needed) to finalise input to the MSE analyses (e.g. performance indicators and harvest control rules) as well as subsequent refinements and feedback based on preliminary and ongoing results. WCPFC13 is encouraged to explore mechanisms and options for facilitating and funding these arrangements.

106. SC12 reviewed an evaluation of candidate harvest control rules for the tropical skipjack purse seine fishery (SC12-MI-WP-06). SC12 recommends that WCPC13 note i) the utility of the approach taken for evaluating harvest control rules, ii) the associated need to develop appropriate performance indicators to adequately track effort creep in this and other fisheries in the WCPO, and iii) the need to identify an appropriate time-frame for evaluating the effectiveness of a harvest control rule.

107. SC12 was informed about the work undertaken by the Northern Committee and the ISC on the development of harvest control rules and Management Strategy Evaluation for Pacific bluefin and North Pacific albacore stocks (SC12-MI-WP-07). SC12 recommends that WCPFC13 note these developments and consider the need to facilitate discussion on Management Strategy Evaluation

between those groups undertaking such work within the WCPO (i.e. the Scientific Service Provider and ISC) and across all t-RFMOs.

5.2 Limit reference points for WCPFC sharks

5.2.1 Identifying appropriate limit reference points for elasmobranchs for the WCPFC

108. Based on a request from WCPFC12, SC12 developed a scope of work to progress development of limit reference points for sharks within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). The adopted scope of work for this project is in Attachment F. WCPFC13 is requested to note the development of this project scope.

5.3 Implementation of CMM 2015-01

5.3.1 Yellowfin tuna catch limit

109. SC12 discussed the request from WCPFC12 to provide comments and/or recommendations to the Commission on how to further develop catch limit options for yellowfin tuna as specified in paragraphs 28, 29 and 43 of CMM-2015-01. SC12 reiterated its advice from SC11 that yellowfin tuna stock status in the WCPO is relatively insensitive to whether purse seine effort is comprised of mainly associated sets or unassociated sets. SC12 also noted that the latest catch estimates for 2015 suggest that catch of yellowfin in the longline and purse seine fisheries appears relatively stable and as such several CCMs do not consider yellowfin catch limits in the longline and purse seine fisheries to be immediately necessary. Nevertheless, some concern was expressed with the increase in yellowfin catch reported in the "other" fisheries category, particularly in the Indonesian and Philippines handline fisheries, though it was noted that these catches are presently provisional and increases may be attributed to changes in data collection in recent years. SC12 therefore recommended WCPFC13 consider the need for continued improvements for data collection in these fisheries and the need for CCMs to provide information to the Commission on the management tools they have available to them to bring these catches under control.

5.3.2 Other issues related to CMM 2015-01

110. SC12 reviewed a management option to limit bigeye catches on purse seine vessels with higher percentage of bigeye tuna catch to assist the recovery of the bigeye tuna stock in the WCPO (SC12-MI-WP-09) though noted that further work on this option was required to clarify and validate specific outcomes. SC12 was also informed about additional options considered by some CCMs (e.g., the introduction of FAD charges to manage FAD usage in PNA waters) to achieve this same objective. SC12 recommends that WCPFC13 note that there are various options to limit bigeye catches on purse seine vessels when considering additional management measures for rebuilding the bigeye tuna stock within the WCPO.

111. SC12 discussed the request from WCPFC12 to provide comments and/or recommendations to the Commission on proposals from CCMs that wish to claim exemption from the 2017 high seas FAD closure on the basis of footnote 5 of CMM 2015-01. SC12 was informed that the EU would be requesting such an exemption on the basis of the 2015 bigeye catch in the purse-seine fishery according to SC12-MI-IP-06. However SC12 has not been able to review this proposal due to the lack of guidance on how this review should be done. SC12 also noted that the present CMM is unclear as to how this exemption is to be applied as it does not specify a time period over which the drop in bigeye bycatch to no more than the 55% level of 2010-12 average needs to be sustained. SC12 recommends that TCC12 and WCPFC13 clarify how this assessment should be done.

112. SC12 reviewed candidate indicators of effort creep in the WCPO purse seine fishery (SC12-MI-WP-08) noting that SPC had undertaken the work for the PNA to inform consideration of adjusting the Vessel Day Scheme TAE for effort creep. SC12 strongly supported this work, noting that this work was also directly relevant to the development of a harvest control rule for skipjack. SC12 also identified effort creep as an important issue related to all fleets operating in the WCPO and recommends that WCPF13 that note of these comments and prioritise continued research on this important issue.

AGENDA ITEM 6 – ECOSYSTEM AND BYCATCH MITIGATION THEME

6.1 Ecosystem effects of fishing

6.1.1 Review of research and information

6.1.1.1 SEAPODYM

113. SC12 recommended that WCPFC13 endorses the results of the review of SEAPODYM (EB-IP-14) as follows:

> **SEAPODYM has the potential to be a useful complementary model to MULTIFAN-CL for MSE work that includes spatial management. Similarly, the capacity of SEAPODYM to include alternate oceanographic states (e.g. ENSO phases and climate change projections) would allow climate proofing (reducing risks and capitalizing on opportunities presented by climate change) to be a consideration in the MSE work undertaken by WCPFC.**

6.2 Sharks

6.2.1 Review of potential mitigation measures to reduce fishing-related mortality on silky and oceanic whitetip sharks

Choice of longline mitigation approaches

114. The following conclusions of SC12-EB-WP-06 were affirmed by SC12:

- The possibility offered in CMM 2014-05 to choose which fishing technique is excluded (either wire trace or shark-lines) has the potential to substantially lessen the reductions of fishing mortality to silky shark and oceanic whitetip shark; and

- By choosing to exclude the technique least used by their fishing vessels, the median predicted reductions in fishing-related mortality are 6% for silky shark and 10% for oceanic whitetip shark. This compares to reductions of 24% and 37% respectively if choice was removed and both techniques excluded.

Furthermore:

- Survival rate post release is a crucial factor to evaluate the fishing mortality on shark species.

- CMM 2014-05 entered into force in July 2015 and the fleet gear characteristics data used in this analysis are prior to the adoption of this CMM and covering only a short timeframe.

- Work on the estimation of reliable post release survival rates of sharks and in particular those covered by CMM 2014-05 is prioritised under the SC Work Plan.

115. SC12 also affirmed the following conclusions of SC12-EB-WP-03:

- Redistribution of effort from FADs to free schools resulted in substantial reductions in estimated catches of silky shark (by 83%) and oceanic whitetip shark (by 57%) compared to the 'status quo'. There was large uncertainty in total catch estimates due to low confidence in assumed estimates of non-zero shark catches.

6.2.2 Review of conservation and management measures for sharks

a. CMM 2010-07 (CMM for Sharks)

116. With regard to CMM 2010-07 (CMM for Sharks), especially related with Paragraphs 4, 8, and 13 with reference to data provision, fin to carcass ratios, and the need for a revised or new CMM, SC12 recommended that TCC12 and WCPFC13 note that SC12 was able to review the ratio of fin weight to shark carcass weight from one study (SC12-EB-IP-10). This study demonstrated that shark fin weight data have some serious limitations, potential biases and errors. SC12 was unable to confirm the validity of using a 5% fin to carcass ratio in CMM 2010-07 and forwards these concerns to TCC, noting that an evaluation of the 5% ratio is not currently possible due to insufficient information for all but one of the major fleets implementing these ratios. SC12 took note of SC12-EB-IP-02 that confirms that the information which can be used to evaluate the effectiveness of the WCPFC ban on shark finning (CMM 2010-07) is currently very limited.

b. CMM 2014-05 (CMM for sharks)

Shark targeting and management plans

117. SC12 considered that it is problematic to agree and apply a definition of longline fisheries "targeting" sharks, noting that fisheries need not be targeting sharks to be having a significant impact on vulnerable shark stocks. The Commission may wish to refer to the potential definitions in WCPFC-2016-SC12-EB-WP-05 as a starting point for further consideration, if required.

118. SC12 recommended that the Commission adopt the contents list at Attachment G for the development of any new shark management plans.

119. SC12 recommended that the Commission review newly submitted shark management plans for completeness and quality, with a view toward encouraging continuous improvement and documenting the scientific basis for all national management measures referenced in the shark management plans.

c. Safe release guidelines

120. SC12 agreed to change the title of 'Guidelines for the safe release of encircled animals, including whale sharks' to 'Guidelines for the safe release of encircled whale sharks'.

6.2.3 Shark Research Plan

a. Progress of shark research plan

121. SC12 adopted the review of the Shark Research Plan (Attachment H).

b. Information on non-key-shark species

122. SC12 recommended that the process for the designation of key sharks species should be clarified by the WCPFC secretariat and TCC.

123. SC12 recommended that TCC12 clarifies that the designation of a shark species as WCPFC "key shark species for assessment":

1. **is not involving any change in the reporting requirements and logsheets of CCMs ;**
2. **meets the requirements of para 4 of CMM 2010-07;**
3. **results in its listing under the Sharks Research Plan.**

124. SC12 recommended that purse seine observer training programmes add emphasis to Mobula spp. identification as part of their curricula.

125. SC12 recommends that WCPFC13 takes note of SC-EB-WP-08 and SC12-EB-IP-09 and considers adopting guidelines for safe release of Manta and Mobula rays caught incidentally in WCPFC fisheries.

6.3 Seabirds

126. Regarding the results of research on seabird distributions, SC12 recommended that the Commission:

1. Note that the northern limit of the spatial distribution of seabird density data presented extends to areas north of 30°S.

2. Within the southern hemisphere part of the WCPO the main area of distribution for New Zealand's vulnerable seabirds, especially the Antipodean albatross and the black petrel, is south of 25°S.

3. Note that use of effective bycatch mitigation measures across the full range of at-risk seabirds should enhance conservation of those seabirds.

4. Note the above information from SC12 and other relevant information when discussing seabird mitigation measures and request that the TCC consider reviewing the 30°S boundary of the seabird CMM further north.

Seabird bycatch mitigation measures for small-scale longline vessels

127. Regarding the results of tori line research, SC12 recommends that the Commission:

- **Note the tori line options reported here (EB-WP-10 and EB-WP-13), developed especially for small longline vessels, and recognise that some of the options may have the potential to be effective in reducing seabird bycatch. SC12 recommends to continue the experimental**

trials of tori line designs and procedures adapted to the activities of small-scale longline vessels.

- **Consider these tori line designs, together with the information on their effectiveness in reducing seabird bycatch and usability in actual fishing operations, during the review or development of any updated tori line specifications, as will be required for the review of specifications set out in CMM 2015-03.**

6.4 Sea turtles

128. SC12 recommends that the Commission notes:

The results from the first workshop on Joint Analysis of Sea Turtle Mitigation Effectiveness in Longline Fisheries. The workshop considered data from 31 fleets and factors associated with 2,300 observed sea turtle interactions. The results indicated that interactions rates are lower when large circle hooks are used, higher at the two hooks closest to the floats and higher when squid baits are used.

The recommendations for future work and look forward to receiving the results from the second workshop to be held in November 2016.

6.5 Data exchange

129. SC12 noted that the BDEP is currently designed for the purpose of dissemination of bycatch data.

130. SC12 considered the following three options for future work:

A. Basic, no-cost (reprioritise other DM tasks). Continue trial in 2017-18 (1), publish on web (2) , with any issues addressed in the generic data gaps paper..
B. Enhance, low cost. As for A., plus, resolve purse seine form links (3), provide table of observer effort (4), resolve vessel identifiers (5), report seabirds to the species level (6), include marine mammals (7).
C. Focus, moderate cost. As for B., plus, review and update L:L and L:W relationships for SSIs (Species of Special Interest) (8), and undertake regional trial (9).

131. SC12 recommended that the Commission notes that SC12 recommends the choice of Option A (Basic, no cost).

AGENDA ITEM 7 – OTHER RESEARCH PROJECTS

7.1 West Pacific East Asia Project

132. SC12 was briefed on the progress of the WPEA project, a GEF-funded 3-year project working together with Indonesia, Philippines and Vietnam and managed by the Secretariat.

7.2 Pacific Tuna Tagging Project

133. The 9th Steering Committee meeting for the Pacific Tuna Tagging Project was held during SC12, and the PTTP Steering Committee made the following recommendations to SC12:

a) that the tagging programme be normalised as part of the ongoing work of SC, ideally with cruises every year alternating between skipjack-targeted via pole and line fishing in one year and bigeye-targeted via handline and dangler fishing in the next and starting with skipjack in 2017 (yellowfin would also be covered by these surveys); and

b) that SC supports efforts to identify sustainable financing of the tagging programme, through a combination of WCPFC budget support and voluntary contributions from WCPFC members or other stakeholders.

134. SC12 endorsed the two recommendations of the PTTP Steering Committee above.

7.3 ABNJ (Common Oceans) Tuna Project-Shark and Bycatch Components

135. A brief overview of the ABNJ (Common Oceans) Tuna Project activities being led by the WCPFC Secretariat and SPC was presented, covering shark data improvement and harmonization, shark stock status assessment, and bycatch management and information.

136. Noting that information about a Hawaii and American Samoa tagging project had been presented earlier in the meeting, USA noted its willingness to collaborate in post-release mortality tagging projects in the Pacific, urging consistency in project design.

7.4 WCPFC Tissue Bank (Project 35b)

137. SPC-OFP provided a report on the work of Project 35, which consists of research on the age and growth and reproductive biology of bigeye tuna and the operation of the WCPFC Tissue Bank.

138. SC12 adopted the revised WCPFC Tissue Bank Project protocols (Attachment I).

AGENDA ITEM 8 – COOPERATION WITH OTHER ORGANISATIONS

139. SC12 reviewed the status of cooperation with other organizations.

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

140. SC12 discussed intersessional activities related to science capacity building, including for developing States and participating territories supported by the Commission's Special Requirements Fund and the Japan Trust Fund (JTF).

AGENDA ITEM 10 – FUTURE WORK PROGRAM AND BUDGET

10.1 Development of the 2017 Work Programme and budget, and projection of 2018-2019 provisional Work Programme and indicative budget

141. **The SC 2017 Work Programme and budget and provisional work programme and indicative budget for 2018-2019 were adopted (Attachment J).**

AGENDA ITEM 11 – ADMINISTRATIVE MATTERS

11.1 Process for the independent review of stock assessments

142. **SC12 endorsed a process for the independent review of stock assessments (Attachment K).**

11.2 Future operation of the Scientific Committee

143. SC12 provided a number of suggestions for better operation of the future Scientific Committee, which will be reflected in future meetings.

11.3 Election of Officers of the Scientific Committee

144. The SC Chair, B. Muller, was approved as SC Chair for the next 2 years, and the SC Vice-Chair, A. Batibasaga, reconfirmed his availability to complete his two year term.

11.4 Next meeting

145. SC12 confirmed that SC13 in 2017 would be held in the Cook Islands and proposed that SC14 in 2018 be held in Korea.

AGENDA ITEM 12 – OTHER MATTERS

146. Indonesia made a statement urging SC to develop tools to estimate the catch from IUU fishing and related activities, and conduct analysis to deliver appropriate advice on IUU fishing to managers.

AGENDA ITEM 13 – ADOPTION OF THE SUMMARY REPORT OF THE TWELFTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

147. **SC12 adopted the recommendations of the Twelfth Regular Session of the Scientific Committee, noting that they had been worked on extensively during the theme sessions. According to the Rule 33 of the Commission's Rules of Procedure, the following procedure for the development of SC12 Summary Report was agreed on by the SC12 plenary.**

Due by	Activity
11 August	Close of SC12
18 August	Theme convenors receive SC12 draft summary report for review from the Secretariat
23 August	The Secretariat receives theme convenors' comments
23 August	The Secretariat posts the provisional Executive Summary on the SC12 website
26 August	The Secretariat distributes the draft summary report to all CCMs and Observers by email
30 September	The Secretariat receives comments from CCMs and Observers

AGENDA ITEM 14 – CLOSE OF MEETING

148. The meeting closed at 3:20pm on Thursday 11 August 2016.

Attachment F

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

Scientific Committee
Twelfth Regular Session

Bali, Indonesia
3-11 August 2016

Scope of work to progress development of limit reference points for sharks

SC12 adopted the following scope for Project 57:

Project 57: Identifying appropriate Limit Reference Points (LRPs) for elasmobranchs within the WCPFC

Background:

The Commission endorsed SC11's request of USD 25,000 for the continued development of limit reference points for elasmobranchs. The Commission tasked SC12 to develop a scope of work to progress this work within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). SC12-ISG-2 also supported the project collaborating with the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark.

Aim:

This project is to complete the work initiated by S. Clarke and S. Hoyle and presented to SC10 (as described in SC10-MI-07), and the subsequent work undertaken by the Pacific Shark Life History Expert Panel (as described in SC11-EB-13), to identify and quantify appropriate limit reference points for key shark species in the WCPO.

Scope of Work:

This project will facilitate a small workshop, or similar, of shark and stock assessment experts to undertake the following tasks:

1. For those elasmobranchs which have been evaluated using a stock assessment model, recalculate the risk-based limit reference points (as described in Table 5, SC10-MI-07) using the updated life history information produced by the Shark Life History Expert Panel.

2. For those elasmobranchs which have not been evaluated using a stock assessment model advise on ways of developing an estimate of current fishing mortality (F), for example using catch curves, the method used in the bigeye thresher assessment (SC12-SA-IP-17), or other suitable means. Risk-based LRPs (as described in SC10-MI-07) should then be developed for all WCPFC key shark species.

3. Where the stock-recruitment relationship is highly uncertain, compare $F_{current}$ to SPR-based LRP such as $F_{60\%SPRunfished}$ and discuss any new insights into the recommended estimated LRPs so that the WCPFC Scientific Committee can decided on a case-by-case basis which LRP is most appropriate.

4. Review the use or otherwise of other potential LRPs based on SPR, reduction of recruitment or empirical measures (e.g. catch rate or length values designed to signal unacceptable population states).

5. Advise on any changes or updates to the recommended LRPs in SC10-MI-07 based on new developments, including any suggestions for further technical work before consideration of adoption of LRPs by fishery managers.

6. Review the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark and assess the applicability of extending this work to other key shark species, especially South Pacific blue shark.

Output:

The project will produce a final report which shall be presented to and reviewed by SC13.

Secretariat Support:

The Principal Investigator for the project should liaise with the WCPFC Secretariat to help facilitate and coordinate arrangements for the workshop (e.g. arranging travel for the participants).

Attachment G

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

Scientific Committee
Twelfth Regular Session

Bali, Indonesia
3-11 August 2016

Contents list for the development of any new shark management plans

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Components to be included in a shark management plan:

- **Species**: List the shark species and stocks (if known) covered by the plan

- **Fleet**: Describe the fleet covered by the plan:
  - Enumerate the vessels catching shark and indicate whether or not they appear on the WCPFC Record of Fishing Vessels
  - Include a map indicating the coordinates of the fishing grounds for the fleet
  - Quantify the fishing effort of the fleet (in annual raised hooks fished if possible)
  - Describe the licensing arrangements applicable to the fleet and note whether effort is controlled (if so, in what way)

- **Catches**: Describe the catch arrangements of the fleet for the shark species covered by the shark management plan:
  - Provide a table showing the retained catches by the fleet of the sharks covered for the last five years (by species if possible)
  - If discards are recorded, show the quantities discarded by species and the total catch (retained + discarded)
  - Describe the mechanism for limiting the catch of sharks, by species if applicable (e.g. input/output controls, regulation, license, no-retention, etc), and the arrangements for monitoring, verification and enforcement
  - Describe the catch limits set (e.g. X tonnes of blue shark, Y tonnes of shortfin mako shark) and provide the rationale for the limit with reference to the latest available stock assessments and reference points
  - If there are any shark species allowed to be retained but not subject to catch limits, please identify them and provide a rationale

- **Mitigation**: Describe operational practices that avoid or reduce mortality to non-retained species
  - Describe the implementation arrangements for no-retention and safe release of oceanic whitetip (CMM 2011-04) and silky (CMM 2013-08) sharks, including safe release guidelines
  - Describe implementation arrangements for the WCPFC full utilization policy (CMM 2010-07). Specifically, if fins are allowed to be removed from

carcasses at sea, describe what arrangements are in place to demonstrate that finning is not occurring
    - Identify whether shark lines or wire leaders have been prohibited (by fleet or vessel per CMM 2014-05)
    - List any other shark mitigation measures, e.g. size limits, closed areas or seasons, gear restrictions

- **Management**: Describe how the plan is implemented and reviewed
    - List the dates over which the plan applies
    - Describe how and when the plan is reviewed and reported against, including any linkages with monitoring, control and surveillance (MCS) systems
    - Describe how and when the plan is revised/renewed

Attachment H

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

Scientific Committee
Twelfth Regular Session

Bali, Indonesia
3-11 August 2016

Review of the Shark Research Plan

Task: review the shark research plan adopted by SC11 (https://www.wcpfc.int/node/21717) and recommend any changes to the list of projects or the stock assessment schedule with particular reference to 2017.

The following ongoing or planned work is noted:

1) ABNJ Tuna Project (see SC12-RP-ABNJ-01) which runs through Jan 2019:
   - The southern hemisphere porbeagle assessment will be completed in early 2017
   - The Pacific-wide bigeye thresher assessment will be completed shortly
   - Two further Pacific-wide shark stock assessments (TBD) are planned (indicative budget: 100,000 USD each)
   - A post-release mortality tagging study (indicative budget: 250,000 USD)
   - A pair of international workshops planned to focus on post-release mortality tagging sampling designs and analysis (first planned for Jan 2017; all funding allocated to travel for developing coastal States and invited experts)

2) ISC Shark Working Group (see SC12-GN-IP-02):
   - A north Pacific blue shark assessment is in progress for completion in 2017
   - A north Pacific shortfin mako shark assessment is planned for 2018

3) JIMAR, NOAA and ISSF are conducting a study of post-release mortality under different handling and discard practices for blue, silky, oceanic whitetip and bigeye thresher sharks (n=112 tags with n=51 deployed to date; see SC12-EB-WP-07)

4) IATTC is conducting a post-release mortality study of silky sharks in Ecuador and Costa Rica (n=34) with EU funding

5) NOAA, SPC and ABNJ are conducting a post-release mortality tagging study of whale sharks in Papua New Guinea (n=10, none deployed yet)

6) Researchers from James Cook University are proposing to tag and take genetic samples from 20 silky and 20 oceanic whitetip sharks in the Cook Islands to evaluate the effectiveness of spatial management measures (see SC12-EB-IP-15)

7) ISSF is conducting work on FADs and sharks including entanglement and safe release

ISG6 proposed the schedule of analyses and stock assessments in Table 1 with the primary focus on the year 2017. Project outlines are provided for upcoming work.

ISG6 also made reference to the "*Principles for determining stock assessment timing and scheduling*" that were adopted by SC11

Table 1. SC12:ISG6 proposed schedule of analyses and stock assessments under the WCPFC Shark Research Plan. Project outlines are provided for some items (marked with #) and the funding source for projects in 2017 are provided in brackets. Tuna assessment schedule is for information only.

Species	Stock	Last assessment	2016	2017	2018	2019	2020
Bigeye tuna	WCPO	2014		X			X
	Pacific-wide	-					
Skipjack tuna	WCPO	2014	X			X	
Yellowfin tuna	WCPO	2014		X			X
Albacore	South Pacific	2012			X		
Striped marlin	Southwest Pacific	2012			X		
	Northwest Pacific	2012			X?		
Swordfish	Southwest Pacific	2013		X			
Silky shark	WCPO	2013					
	Pacific-wide	-		Assessment (#2) (unfunded)		Stock discrimination?	Stock discrimination?
Oceanic whitetip shark	WCPO	2012				Assessment (if data supports) (WCPFC)	
Blue shark	Southwest Pacific	-	Assessment SC12-SA-WP-08 SC12-SA-WP-09				
	South Pacific-wide						
	Northwest Pacific	2014		Assessment (ISC) Participation in ISC NP blue shark stock assessment activities (#4) (unfunded)			
Mako shark (shortfin)	Southwest Pacific	-			Assessment (if data supports)		
	Northwest Pacific	2015 (Indicator analysis)			Assessment (ISC)		

Species	Stock	Last assessment	2016	2017	2018	2019	2020
Porbeagle	Pacific-wide (southern hemisphere)	-		Assessment (to be submitted to SC13) (ABNJ)			
Bigeye thresher	Pacific-wide	-	Assessment (to be submitted to SC13)				
Hammerhead	WCPO	-			Update catch history? Biological research to determine species specific age, growth and reproductive parameters?	Stock discrimination? Biological research to determine species specific age, growth and reproductive parameters?	Stock discrimination? Biological research to determine species specific age, growth and reproductive parameters?
	Pacific-wide	-					
Whaleshark	WCPO	-			Stock discrimination?	Stock discrimination?	
	Pacific-wide	-					
General shark work	WCPO		Develop proposed limit reference points for elasmobranchs (#8) (WCPFC)	Review of shark data and modelling framework to support stock assessments (#5) (WCPFC) Post-release mortality studies in longline (#3) and purse seine fisheries (ABNJ + EU) Operational planning for shark biological data improvement (#7) (unfunded)	Assess spawner recruit relationships? SRP mid-term review?	Updated indicator analysis?	Develop a 2021-2025 shark research plan to be presented to SC16 in 2020?

Sheet Number	2
Project	Update of silky shark status as a Pacific-wide assessment
Objectives	Revisit the 2013 silky shark assessment working with IATTC* to explore stock definitions and new methods to account for potential regional patterns across the Pacific.
Rationale	• This species has been identified by both WCPFC and IATTC as being depleted and in need of management (and is currently proposed for CITES) • Assessment of this species is a priority shark research topic for IATTC • Leverages ABNJ funds • Four years have passed since the last WCPO assessment and two years since the implementation of WCPFC no-retention measures • Builds on previous assessment work for this species • Promotes useful cooperation with IATTC
Assumptions	• Much of the existing data are readily available • SPC and IATTC can collaborate and share data • Combined data prep work identifies a viable Pacific-wide assessment strategy • No-retention measures have not seriously degraded the information content of recent data • SPC workload can support undertaking this work
Scope	Revisit the existing silky shark assessment (SC9-SA-WP-03) in collaboration with IATTC to improve methods, increase understanding of data strengths and weaknesses, and update stock status. Specifically: • Explore a combined data set to determine appropriate methods • Explore ways of developing purse seine-based indices of abundance for WCPO data • Compare WCPO and IATTC indices of abundance that overlap in time and space in order to evaluate trends and define stock boundaries • Update WCPO LL catch estimates and abundance indices using recent observer data • Re-run SS3 model to compare to 2013 results • Consider what might be appropriate limit reference points • Prepare a report containing the above results for SC13
Budget	1 FTE at SPC (ABNJ can contribute up to 100,000 USD with priority on EPO extension work)

* subject to further discussions with IATTC staff scientists

Sheet Number	3
Project	Post-release mortality tagging study
Objectives	Obtain better estimates of post-release mortality, especially for oceanic whitetip and silky sharks, across a broader range of longline fisheries.
Rationale	• The data obtained will be useful for assessments as well as for evaluating the effectiveness of mitigation measures • This work can be focused on the shark species of greatest conservation and management interest • This work can reinforce several ongoing studies in other fisheries (see Preface) • Leverages ABNJ funds (funding already confirmed)
Assumptions	• Tags can be deployed using observers (thereby avoiding vessel costs) • Sufficient catches by vessels with trained observers onboard • Study design to be developed during an early 2017 workshop to be supported by the ABNJ Tuna Project
Scope	The ABNJ Tuna Project plans an early 2017 expert workshop to develop a sampling programme. Scope is somewhat flexible in terms of fisheries and species but at present is aimed toward longline fisheries with a priority on oceanic whitetip and silky sharks. It will be important to consider shark condition and handling practices as key factors when attaching tags, i.e. there may be a need for observers to record additional information or use different codes. ABNJ Tuna Project funding has been budgeted to buy up to 50 tags; contributions from other sources could increase the statistical power of the design. Compatibility with similar programmes in other fisheries should be maximized. This work is expected to begin in 2017 and be completed in 2018.
Budget	ABNJ has 250,000 USD budgeted for this study (other contributions welcome)

Sheet Number	4
Project	Participation in ISC North Pacific blue shark stock assessment activities
Objectives	Contribute to and learn from ISC work toward revising the North Pacific blue shark stock assessment, thereby aiding methods development for other WCPO shark stocks.
Rationale	• The ISC is currently conducting an update of the North Pacific blue shark stock assessment of 2014 • The ISC assessment would benefit from the contribution of additional blue shark observer data in the North Pacific • Participation in this collaborative stock assessment may lead to the development of new methods and/or new data insights • Cooperation between the WCPFC and its Northern Committee could be strengthened
Assumptions	• If SPC were available to participate, it would contribute its blue shark data holdings • If the Secretariat or ABNJ participates, fewer data can be contributed • ISC is able and willing to incorporate these contributions to its work • ISC meetings avoid scheduling conflicts with other work
Scope	Available WCPO data would be compiled, formatted and analysed to produce data products that could be contributed to ISC Shark Working Group (SWG) meetings (no raw data would be contributed; this is similar to the contributions of ISC member countries). It is assumed that participation in two ISC SWG meetings would be required (the FTE estimate is intended to account for travel costs). Total time input including data handling and analysis, ISC SWG meetings and other tasks, and report review is estimated at ~2.5 months. The ISC SWG aims to complete its North Pacific blue shark stock assessment in the first half of 2017.
Budget	$20,000

Sheet Number	5
Project	Review of shark data and modelling framework to support stock assessments
Objectives	Implement a review of the data availability, data quality and data gaps for undertaking shark assessments, and the associated need to identify appropriate data assumptions for re-constructing data time-series and appropriate modelling techniques
Rationale	• Implements recommendations from the South Pacific blue shark, the 2016 SPC data gaps paper and the BDEP paper regarding the need to inspect and clean existing shark data holdings • Assessments usually do not have time for this type of work, and general data management budgets do not provide for this depth of focus • While providing an improved understanding of existing data holdings and their utility for assessments, the project would also improve the modelling framework to be used in shark assessments.
Assumptions	• Would require either SPC, or a consultant working with SPC, so that all data holdings that are usually accessed for stock assessments can be included.
Scope	This study should be conducted by a scientist familiar with shark biology and assessment methods (not by a data management generalist). The review should cover all WCPFC key species and include: • Assess the quality of the data currently held including the spatial and temporal coverage of logbook and observer data, • Identify significant data gaps and the uncertainties which these gaps imply, • Comparing observer and logsheet data with a view to identifying and adjusting for under-reporting, discarding, non-species specific recording and other missing data, • Assess impact of specific shark related CMMs on data quality, • Investigate data reporting patterns by fleet including whether i) annual catches and discards are reported for all key species; ii) whether operational or aggregated logsheet data are provided for all key species; and iii) the extent to which the provided data are estimated and how that might affect their precision, • Identify mechanisms to addressing the current data gaps including identifying potential sources of new historical data, • Identify appropriate data assumptions for re-constructing data time-series and propose methods (e.g. weighting, extrapolation, etc) to adjust for identified biases, • Provide advice on what types of analyses the data can support including advice on appropriate modelling approaches (e.g. CPUE standardisation) where the data is considered sufficient, • Produce a paper containing recommendations, and revised datasets as appropriate, for SC13.
Budget	$65,000

Sheet Number	6
Project	Operational and management histories for WCPO longline fleets
Objectives	Compile timelines and brief descriptions for major longline fleets detailing the history of management measures and operational practices
Rationale	• This project addresses an SC11 (and prior) discussion about how to interpret changes in CPUE indices and the potential biases in constructing indices of stock abundance based on standardised CPUE from various fleets' data without knowing and adequately accounting for operational and management changes over time. • As indices of stock abundance are one of the key inputs to stock assessment models, adequately accounting for changes in operational practices that may influence CPUE is a high priority. • Australia has produced a simple fleet history that can serve as a template for other CCMs (SC12-SA-IP-11). • These histories would serve as a resource not only for WCPFC analyses but for any analyses of Pacific shark data
Assumptions	• The information exists and can be located in a reasonable timeframe • CCMs are willing to assist with producing their own fleet histories • Funding is available to assist CCMs in producing their summaries (if they wish)
Scope	The fleet histories should, in the first instance, focus on longline fleets as it is these data that are often used as indices of stock abundance. Separate fleet histories for purse seine fleets could also be prepared as resources allow. The fleet histories should include details on management measures, fishing strategies, gears and sampling regimes over time. It is anticipated that each history would be up to 3 pages of text with key events described in sequence, with a few key figures and an excel spreadsheet version of the timeline. A coordinator should be appointed to compile and assist with the fleet histories. For those CCMs that are willing to produce their own fleet histories, the coordinator would just be involved in editing and formatting. For those CCMs that are willing to have a fleet history produced but cannot undertake it themselves the coordinator could assist in writing up information or interviews facilitated by the CCM for approval by the CCM. At a minimum, the coordinator could research and pull together public domain information for each fleet. A collection of fleet histories would be presented by the coordinator to SC13, with the potential for CCMs to update or replace them over time.
Budget	$30,000

Sheet Number	7
Project	Operational planning for shark biological data improvement
Objectives	Collect, review and prioritize a list of biological data gaps for the WCPFC key shark species and propose a scalable and practical plan for filling them
Rationale	• The Pacific Shark Life History Expert Panel Workshop urged the t-RFMOs to be more proactive in setting a research agenda for life history and stock structure research • ISC and ICCAT have developed mechanisms for this type of work, but there is little shark biological work being done by the WCPFC • Various recommendations for further studies have been made by the Shark Research Plan, various stock assessments and the Expert Panel itself. • The regional observer programme and SPC tissue bank provide opportunities for sample collection and access • It is difficult to begin filling data gaps without a focused, practical plan that can be proposed and costed • This project will develop such a plan, thereby spinning-off implementable projects that can proceed if funded
Assumptions	• There are cost-effective ways of gathering the necessary data and conducting the appropriate analyses • CCMs may be able to assist with sample collection or other research coordination • SPC or another regional body is willing to act as the focal point • At least some of the projects developed can be funded through WCPFC or other sources
Scope	Review the Shark Research Plan, shark stock assessments in the WCPO and elsewhere, the report of the Pacific Shark Life History Expert Panel Workshop to develop a list of biological studies necessary to support conservation and management for WCPFC key shark species, potentially including: • Stock discrimination • Age and growth sampling • Inter-laboratory calibration of ageing methods • Validation/verification of ageing methods • Reproductive sampling • Length-length and length-weight relationships • Movement/migration Prioritize these studies based on the usefulness of the information, ease of sample access and cost and develop practical plans (including a budget) such that priority studies can proceed as soon as funding is sourced. A minimum of three studies should be fully developed, organized and costed and tabled at SC13.
Budget	$30,000

Sheet Number	8
Project	**Identifying appropriate Limit Reference Points (LRPs) for elasmobranchs within the WCPFC (Scope for Commission approved project)**

Background:

The Commission endorsed SC11's request of USD 25,000 for the continued development of limit reference points for elasmobranchs. The Commission tasked SC12 to develop a scope of work to progress this work within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). SC12-ISG-2 also supported the project collaborating with the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark.

Aim:

This project is to complete the work initiated by S. Clarke and S. Hoyle and presented to SC10 (as described in SC10-MI-07), and the subsequent work undertaken by the Pacific Shark Life History Expert Panel (as described in SC11-EB-13), to identify and quantify appropriate limit reference points for key shark species in the WCPO.

Scope of Work:

This project will facilitate a small workshop of shark and stock assessment experts to undertake the following tasks:

7. For those elasmobranchs which have been evaluated using a stock assessment model, recalculate the risk-based limit reference points (as described in Table 5, SC10-MI-07) using the updated life history information produced by the Shark Life History Expert Panel.
8. For those elasmobranchs which have not been evaluated using a stock assessment model advise on ways of developing an estimate of current fishing mortality (F), for example using catch curves, the method used in the bigeye thresher assessment (SC12-SA-IP-17), or other suitable means. Risk-based LRPs (as described in SC10-MI-07) should then be developed for all WCPFC key shark species.
9. Where the stock-recruitment relationship is highly uncertain, compare $F_{current}$ to SPR-based LRP such as $F_{60\%SPRunfished}$ and discuss any new insights into the recommended estimated LRPs so that the WCPFC Scientific Committee can decided on a case-by-case basis which LRP is most appropriate.
10. Review the use or otherwise of other potential LRPs based on SPR, reduction of recruitment or empirical measures (e.g. catch rate or length values designed to signal unacceptable population states).
11. Advise on any changes or updates to the recommended LRPs in SC10-MI-07 based on new developments, including any suggestions for further technical work before consideration of adoption of LRPs by fishery managers.
12. Review the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark and assess the applicability of extending this work to other key shark species, especially South Pacific blue shark.

Output:

The project will produce a final report which shall be presented to and reviewed by SC13.

Secretariat Support:

The Principal Investigator for the project should liaise with the WCPFC Secretariat to help facilitate and coordinate arrangements for the workshop (e.g. arranging travel for the participants).

Timing:

The Commission allocates funds on an annual basis. As such, the project funds would need to be spent or contracted in 2016/17, otherwise the Commission would need to re-approve funding for this project at WCPFC13.

Budget	$25,000 (Commission funding approved for 2016)

Attachment I

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

Scientific Committee
Twelfth Regular Session

Bali, Republic of Indonesia
3-11 August 2016

WCPFC Tissue Bank Access Protocols

Background

1. The WCPFC has established a tissue bank of biological samples collected from pelagic species in the WCPO for the purposes of studies to advance fisheries management in the WCPO. The bank contains otoliths, fin spines, gonads, liver, muscle, stomach and blood from tuna, billfish and other pelagic species.

2. The purpose of this document is to specify the rules for scientific researchers to access these samples for the purpose of scientific study.

3. For projects approved and funded by the WCPFC, nominated researchers who have identified their need to access the WCPFC tissue bank to undertake the project do not have to follow the selection and approval process set out in paragraph 10 below. However, all the other access protocols will apply to such access.

4. In the planning stages of a project, applications by researchers to access the web-data tool for meta-data describing the WCPFC tissue bank's samples should be sought from the WCPFC Scientific Services Provider. The Scientific Services Provider will only supply such a log-in to allow the project's researchers appropriate access and for a limited period of time.

Rules and Procedures

5. Applications to access samples from the tissue bank should be addressed to the Executive Director, WCPFC Secretariat and must include:

a. WCPFC Scientific Committee Project Name, Project Number, Objectives, or recommendation if applicable
b.
c. Specification of the samples to be withdrawn from the bank (number, type, species, size of sample and proportion of available sample to be used, any location/sex/date limits, etc.)
d. The methods for processing and analyses of the samples (in particular whether the method will destroy part or all of a sample, and what sample record will be retained, e.g. sectioned otolith slides)
e. Past contributions to the tissue bank by the researcher or CCM
f. Intended collaborations with other researchers or institutions
g. Timeline for the study and intended outcomes.

Additional information may be requested from the researcher by the WCPFC Research Sub-Committee or the WCPFC Secretariat to assist in considering the application.

6. It will be a requirement of access to the WCPFC tissue bank for the researcher or CCM to provide an annual report to the Executive Director, WCPFC Secretariat. This must include documentation of raw and analysed results, however this does not imply a requirement for this data to be publicly available. When data can be made publicly available a report to WCPFC's Scientific Committee is required on progress of the study. The reports must follow WCPFC standards and must include method description and meta data. All data derived from WCPFC tissue bank samples will become publicly available 5 years after WCPFC Secretariat determines the project analyses are complete or at WCPFC's discretion.

7. The WCPFC Research Sub-Committee will give consideration to the sequencing of analyses such that those which involve the samples being destroyed or modified are undertaken last when approving applications. For example otolith weight and morphometric analyses may be prioritised before sectioning, which may be prioritised before chemical analyses.

8. Where the analyses involve the preparation of secondary products such as sectioned otoliths and histological slides these products are to be provided to the WCPFC tissue bank at the completion of the study for future curation, comparative reference and study.

9. Researchers or CCM's must acknowledge the WCPFC tissue bank in any publication of results from the study undertaken.

10. The selection and approval of projects will be determined by the WCPFC Research Sub-Committee. This sub-committee may meet within the margins of WCPFC meetings or electronically. This sub-committee will prepare and submit a summary of its decision on each project proposal to the WCFPC Executive Director for final approval. Decisions should be taken within 30 days of the application being received. The project approval process will consider, inter alia, the following:

a. Preferential access to the tissue bank will be given to researchers or WCPFC CCM's who have contributedto the collection of samples,
b. Preferential access to the tissue bank will be given to collaborative projects with priority to those where the collaboration includes the WCPFC Science Services Provider and more than one WCPFC CCM.
c. Priority will be given to requests that are part of the WCPFC Scientific Committee's research and work plan and those projects whose spatial scale is regional in preference to local and
d. Past participation with those who acknowledge the source of the samples and provide secondary products as required above given priority.

11. Once approval for access to samples from the tissue bank has been provided by the WCPFC Research Sub-Committee the researcher/CCM will enter into a formal agreement with the Secretariat of the WCPFC that will specify access requirements, reporting and any data confidentiality that the WCPFC may require.

12. A reasonable fee may be charged for the cost associated with preparing the samples for shipping and cost recovery for freight or transport agent fees and freight (loss and damage) insurance. An additional fee will be charged to applications from researchers or institutions who are not associated with WCPFC CCMs. This fee will be based on the full cost recovery of the collection of samples requested (estimated at USD10 per sample in 2015). The total amount of this second fee that is collected in each year will be used to offset WCPFC's costs of running the tissue bank in the following year.

Attachment J

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

Scientific Committee
Twelfth Regular Session

Bali, Indonesia
3-11 August 2016

SC12 Work Programme and Budget for 2017-2019

Table 1: List of SC work programme titles and budget for 2017, and indicative budget for 2018–2019, which require funding from the Commission's core budget. Other projects also prioritised by SC12 without funding request are also listed to indicate the support by SC12 for those projects.

(Budget in USD)

Project title	TORs	Essential	Priority / Rank	2017	2018	2019
SPC Oceanic Fisheries Programme Budget		Yes		871,200	871,200	871,200
SPC – Additional resourcing for harvest strategy evaluation, including stock assessments		Yes		160,000	160,000	160,000
Project 14. West Pacific East Asia (WPEA) Project		Yes		25,000	25,000	25,000
Project 35b. Maintenance and enhancement of the WCPFC Tissue Bank	Annexed	Yes	High	95,000	95,000	95,000
Project 42 Pacific Tuna Tagging Programme (PTTP)	Annexed	Yes	High	250,000	500,000	650,000
Additional funding required from external sources				*950,000*	*190,000*	*550,000*
Project 60: Further paired sampling and unloading data comparisons.	Annexed		Medium / 1	50,000	0	0
Project 67: Review of impacts of recent high catches of skipjack on fisheries on the margins of the WCPFC Convention Area	Annexed		Medium / 4	40,000	40,000	30,000
Project 68. Estimation of seabird mortality across the WCPO Convention area	Annexed		Medium / 3	72,500	22,500	17,500
Project 78 Review of shark data and modelling framework to support stock assessments	Annexed		Medium / 2	65,000	0	0
Project 79 Spatial longline analyses in support of bigeye tuna management in the WCPFC	Annexed		NR[1]	NBR[2]	0	0
Unobligated (Contingency) Budget Note: Any science-related projects requested by the Commission with no budget allocation				83,000	83,000	83,000
SC12 TOTAL BUDGET	**Excluding External Funding of Project 42**			**1,711,700**	**1,796,700**	**1,931,700**
	Including External Funding for Project 42			**2,661,700**	**1,986,700**	**2,481,700**

1. NR = Not Ranked, 2. NBR = No Budget Request from WCPFC

TERMS OF REFERENCE / SCOPE OF WORK

PROJECT 35B

Collection and evaluation of purse-seine species composition data

The scope of work will include, but not limited to, the following:

- Maintain and develop:
  - the public SPC webpage informing interested parties of the tissue bank, including the rules of procedure to access samples from the tissue bank.
  - a web-accessed database holding non-public data
  - a relational database that catalogues the samples to include fishery/sampling metadata
- Tissue sample utilisation and a record of outcomes/outputs will also be detailed in the relational database.
- Subject to approval by the WCPFC Executive Director:
  - metadata will be made available to institutions or organizations responsible for providing scientific advice in fisheries through the web-accessible component of the database, and subsequently,
  - SPC-OFP will facilitate the transmission of requested samples to specified researchers/organisations, and the return of unused and/or processed samples to the relevant storage facility.

<u>Additional $15,000 to Project 35B</u>

Australia has provided access to their quarantine and sample storage infrastructure through CSIRO. To date this has been an in-kind contribution to the operation of the tuna tissue bank. The challenge is that although the samples are stored, they are not curated which makes access when needed very difficult and time consuming. It is also creating problems with quarantine data. This work would see the samples curated at the Brisbane site on an ongoing basis and eliminate the quarantine issues. CSIRO can commit to the in-kind contribution of maintaining space and transfer of specimens on an ongoing basis with this funding for sorting and curation.)

This proposal is to extend aspects of the existing WCPFC tissue bank. The funding is additional to the existing ongoing budget for Project 35b. The scope of this extension work is to curate and store specimens at an additional site.

The specific work is to:

- Sort specimens on arrival and reconcile with quarantine data
- Enter data describing specimens received into BioDaSys
- Store specimens systematically so that they can be retrieved when requested

Laboratory and storage materials to complete curation

PROJECT 42 (REVISED PROPOSAL)
Pacific Tuna Tagging Programme (PTTP)

It has been highlighted in SC12-SA-WP-04, SC12-MI-WP-05 and SC12-RP-PTTP-01 that regular tagging is required to support stock assessment and harvest strategy implementation for tropical tuna.

SC12-RP-PTTP-01 proposed that skipjack and yellowfin focused tagging using pole-and-line fishing and bigeye tagging using handline fishing be conducted in alternate years.

The following funding support would be required to implement this work, which would target the release of 20,000 SKJ and 5,000 YFT in each pole-and-line cruise and 2,000 BET in each handline fishing cruise. The two budget columns below refer to the alternating years targeting SKJ/YFT and BET:

Budget item	**SKJ+YFT (PL)**	**BET (HL)**
Vessel charter	600,000	300,000
Tags/equipment	150,000	100,000
Personnel	150,000	100,000
Tag recovery	300,000	100,000
Admin/reporting	180,000	90,000
TOTAL	**1,380,000**	**690,000**

PROJECT 60

Collection and Evaluation of Purse-Seine Species Composition Data

The scope of work will include, but not limited to, the following items below:

a. Continue to identify key sources of sampling bias in the manner in which species composition data are currently collected from WCPO purse seine fisheries and investigate how such biases can be reduced
b. Review a broad range of sampling schemes at sea as well as onshore; develop appropriate sampling designs to obtain unbiased species composition data by evaluating the selected sampling procedures; extend sampling to include fleets, areas and set types where no representative sampling has taken place; verify, where possible, the results of the paired sampling against cannery, unloading and port sampling data
c. Review current stock assessment input data in relation to purse-seine species composition and investigate any other areas to be improved in species composition data, including the improvements of the accuracy of collected data,
d. Update standard spill sampling methodology if required.
e. Analyse additional data collected to evaluate the benefits of spill sampling compared to corrected grab-sampling.

<u>2016-18 Tasks</u>

This work should be progressed by the following activities:

- Subject to the availability of data, analyse the spill and grab sampling data for the trips conducted on PNG purse seiners in 2014, and compare those results to the estimates of species composition obtained from intensive port sampling.
- Undertake additional observer sampling / unloading comparisons where it is possible to conduct paired sampling trials and obtain accurate estimates of catch by species for the same trips from unloadings.
- Extend the comparisons of grab- and spill-sampling-based species composition with accurate unloadings data to include the comparison of grab samples corrected for selectivity bias with the unloadings data.

- Where possible and logistically feasible, observer programmes should continue to undertake paired sampling trials on a limited basis (say 10 trips per year) to continue to refine estimates of selectivity bias and to support additional simulation modelling.
- Undertake additional simulation modelling to estimate precision and bias of using corrected spill sampling data as the basis for estimating purse seine species composition at various levels of resolution.
- Consider other work in progress to assess the accuracy of cannery records with respect to estimates of species composition at the trip level. If accurate data could be obtained from canneries, it would be an invaluable additional source of information for the estimation of species composition of the purse seine catch.

PROJECT 67
Review of impacts of recent high catches of skipjack on fisheries on the margins of the WCPFC Convention Area

(For 2016)

Data update until 2015 and down scale the new optimization at coarse resolution to the corrected GLORYS + Mercator operational model and conduct fishing impact and connectivity analysis. The progress will be presented at the SC13 as well as preliminary results of otolith data analysis.

(For 2017-2019)

SEAPODYM work, Tagging activities, including in sub-tropical and temperate regions, genetic analysis and otolith analysis focusing on early growth rate to provide better information on stock connectivity and movement.

1. SEAPODYM works to investigate spatial fishing impact in the WCPO (continue)
2. Collection and analysis of genetic samples from skipjack around Japan and in various areas of the equatorial fishery, to potentially determine the likely spawning ground origin of skipjack around Japan.
3. Otolith data analysis to identify spawning or hatching area using different growth pattern in different areas (2 years : preliminary analysis using Japanese data and tissue bank data)
4. tagging activities in sub-tropical and template regions to provide better information on stock connectivity and movement (this is in relation to SC11 recommendation)

PROJECT 68
Estimation of seabird mortality across the WCPO Convention area

- Fulfil the requirement under the WCPFC seabird CMMs to estimate the total number of seabirds being killed per year in WCPFC fisheries.
- Assess mortality per year over the ten years since the first WCPFC seabird CMM, as requested under CMM2006-02, CMM 2007-04 and CMM 2012-07, and assess whether there is any detectable trend.
- Describe the methods used to estimate total mortality, including treatment of data gaps, and
- Identify the limitations in the data available, allowing the SC to generate advice to the Commission on what improvements are needed to enable better analyses to be made.
- Generate advice on what further level of seabird assessment at species or species-group level can be conducted, given the amount and quality of data currently available

PROJECT 78
Review of shark data and modelling framework to support stock assessments

Objectives	Implement a review of the data availability, data quality and data gaps for undertaking shark assessments, and the associated need to identify appropriate data assumptions for re-constructing data time-series and appropriate modelling techniques
Rationale	• Implements recommendations from the South Pacific blue shark, the 2016 SPC data gaps paper and the BDEP paper regarding the need to inspect and clean existing shark data holdings • Assessments usually do not have time for this type of work, and general data management budgets do not provide for this depth of focus • While providing an improved understanding of existing data holdings and their utility for assessments, the project would also improve the modelling framework to be used in shark assessments.
Assumptions	• Would require either SPC, or a consultant working with SPC, so that all data holdings that are usually accessed for stock assessments can be included.
Scope	This study should be conducted by a scientist familiar with shark biology and assessment methods (not by a data management generalist). The review should cover all WCPFC key species and include: • Assess the quality of the data currently held including the spatial and temporal coverage of logbook and observer data, • Identify significant data gaps and the uncertainties which these gaps imply, • Comparing observer and logsheet data with a view to identifying and adjusting for under-reporting, discarding, non-species specific recording and other missing data, • Assess impact of specific shark related CMMs on data quality, • Investigate data reporting patterns by fleet including whether i) annual catches and discards are reported for all key species; ii) whether operational or aggregated logsheet data are provided for all key species; and iii) the extent to which the provided data are estimated and how that might affect their precision, • Identify mechanisms to addressing the current data gaps including identifying potential sources of new historical data, • Identify appropriate data assumptions for re-constructing data time-series and propose methods (e.g. weighting, extrapolation, etc) to adjust for identified biases, • Provide advice on what types of analyses the data can support including advice on appropriate modelling approaches (e.g. CPUE standardisation) where the data is considered sufficient, • Produce a paper containing recommendations, and revised datasets as appropriate, for SC13.
Budget	$65,000

PROJECT 79
Spatial longline analyses in support of bigeye tuna management in the WCPFC

Objective	Conduct Multifan-CL projections to provide managers information on spatial aspects of regional depletion due to longline fishing
Rationale	Regarding fishing mortality, the WCPFC SC has previously commented on spatial considerations given high fishing exploitation rates and fishery depletion in some regions of the MFCL assessment. The SC has expressed concern with regard to depletion in some regions for both yellowfin and bigeye tuna.
Assumptions	1) Structure of analyses which would use the 2014 bigeye tuna reference case assessment in the western and central Pacific Ocean with deterministic projections; 2) Using recent average recruitment (2002 - 2011); 3) Using 2015 purse seine choices for future effort levels; and 4) Using 2012 catch in the Philippines and Indonesia.
Scope	Identify alternative levels of regional longline bigeye catch (relative to those in 2012) that achieve fishing mortality at the Maximum Sustainable Yield (Fmsy) level within a certain time frame, such as initially 10 years or additionally in 20 years if computationally feasible. Identified runs could include: 1) Scenario 1 - The analysis would identify combinations of longline effort that represent similar regional exploitation rates and estimate a time-series of regional catches that achieved Fmsy in the time frame. Outputs would be a time-series of regional catch and effort and depletion. 2) Scenario 2 – The analysis would identify combinations of longline effort that represent similar regional depletion estimates and achieve Fmsy in the time frame. Outputs would be a time-series of regional catch and effort and depletion.
Expected outcomes	Regional understanding of longline effort and bigeye catch resulting from differing assumptions on using similar exploitation rates or obtaining similar depletion among regions
Budget	The U.S. is willing to make a voluntary contribution to WCPFC in support of these analyses.

Attachment K

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

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Process for the independent review of stock assessments

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

RECOGNIZING the importance of sound scientific advice as the central piece for the conservation and management of tuna and tuna-like species in the Western and Central Pacific Ocean;

AWARE that the availability of adequate scientific information is fundamental to carrying out the objectives of the WCPFC Convention laid down in its Article 2;

NOTING the role of the Oceanic Fisheries Programme of the Pacific Community (SPC-OFP) which is contracted to provide independent scientific advice;

ACKNOWLEDGING the need to ensure that relevant, professionally independent and objective scientific advice, based on the best available and peer-reviewed scientific analysis, be provided by the Scientific Committee to the Commission;

Implements the following processes for the independent review of WCPFC stock assessments conducted by the SPC-OFP and encourage a comparable process[4] for non SPC-OFP WCPFC stock assessments:

Scientific Committee's recommendation to the Commission

1. The Scientific Committee should recommend a multi-year schedule for independent peer review of stock assessments.

2. The Scientific Committee will recommend to the Commission a specific independent peer review for a stock assessment, with an associated budget. The peer review panel will comprise three (3) independent experts. The budget will include consultancy fees, pre-workshop study, travel costs etc. and the peer review chair's attendance to report at the following Scientific Committee meeting.

Commission's approval of the peer review

[4] It is noted that the science provider to the Northern Committee, the ISC, is developing an interactive independent expert peer review process informed in part by this document.

3. The Commission at its annual meeting will consider the recommendation (Para 2. above) from the Scientific Committee for an independent peer review of a stock assessment and the associated budget.

4. Subject to the Commission's approval, the Scientific Committee will be tasked to develop Terms of Reference for the upcoming peer review and the Secretariat to implement the peer review process.

Selection of the independent peer review panel

5. The WCPFC secretariat is responsible for administering the selection and timely contracting of the three (3) independent peer reviewers.

1) The Secretariat will distribute a Circular seeking Member's nomination of candidate experts.

2) Each Member may recommend a maximum of two candidates[5] through their official WCPFC contacts.

3) Subject to the availability of the recommended experts and agreement with the terms of reference, the Science Research Sub-Committee comprising the SC Chair, the SC Theme Conveners and the Chief Scientist SPC-OFP will select eight candidates for short listing, and circulate the shortlist with their curriculum vitae to all Members.

4) Each Member will rank the eight candidates with scores 1 (most preferred) to 8(less preferred) and submit these rankings to the Executive Director.

5) The Secretariat will finalize the list of the peer review panel and contract with the three (3) experts. If any of the selected three (3) individuals are unable to undertake the review, the shortlisted candidate next in rank will be invited to join the peer review panel.

Panel's review process

6. At the start of the review process, SPC-OFP will prepare a procedural plan including detailed schedules, activities, provision of assessment results (possibly including all the input data, modeling software, output of basic runs as well as all the sensitivity runs) and provide these to the panel for advanced reviewing.

7. Once the review process is finished, a draft review report will be provided to SPC-OFP for their review and response. If time permits, this step may be concluded towards the end of the peer review workshop.

8. The final panel report, incorporated with SPC-OFP's response(s) and the panel's feedback to SPC-OFP if needed, shall be submitted to the WCPFC Executive Director, in advance of the following Scientific Committee meeting as scheduled in the contract.

9. The Chair of the independent peer review panel will be expected to present the results of the review to the following Scientific Committee meeting.

[5] The nomination may be for an individual or it may be to approach an organisation e.g. IATTC to provide an appropriate expert.

10. In preparing and conducting the review process, due considerations will be devoted to the following elements.

a) Location

Peer reviews of stock assessments will be conducted at the headquarters of SPC-OFP in Noumea, New Caledonia.

B) DURATION

Subject to species, a five (5) day workshop is proposed, comprising a two (2) day period for peer reviewing the stock assessment, and a further three (3) day period for iteratively reviewing and advising on various aspects of subsequent assessment runs developed in light of the first two days.

C) SCHEDULING

Timing is dependent upon existing schedules of the SPC-OFP, the WCPFC Secretariat and the selection process and availability of the independent expert peer reviewers. The Chair of the peer review panel will present the review to the following Scientific Committee.

D) COMPOSITION

The peer review panel should comprise three (3) independent scientists that have significant expertise and experience in all aspects of stock assessments, preferably in relation to the stock assessment under review; one of whom will be assigned the role of Chair. The reviewers should not be directly involved with current WCPFC stock assessments.

Attendance to the peer review workshop will be limited to the peer review panel members, scientists directly involved in the relevant assessments, and the Secretariat as a coordinator of the whole process.