



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

**Scientific Committee
Seventh Regular Session**

**Pohnpei, Federated States of Micronesia
9–17 August 2011**

SUMMARY REPORT

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EXECUTIVE SUMMARY

OPENING OF THE MEETING

1. The Seventh Regular Session of the Scientific Committee (SC7) took place in Pohnpei, Federated States of Micronesia from 9–17 August 2011. N. Miyabe (Japan) chaired the meeting.
2. Key matters considered by SC7 and its thematic groups — Ecosystem and Bycatch Mitigation (EB), Management Issues (MI), Data and Statistics (ST), and Stock Assessment (SA) — included:
 - a) a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
 - b) a review of the status of stocks of bigeye tuna, yellowfin tuna, skipjack tuna and South Pacific albacore tuna in the WCPO;
 - c) a review of the most recent information and assessments for tuna and billfish stocks in the North Pacific;
 - d) a review of research into the status and assessment of pelagic key shark stocks in the WCPO;
 - e) bycatch mitigation issues associated with seabirds, sharks, other animals, and the report of Kobe Joint Technical Working Group on Bycatch;
 - f) issues associated with the data available to the Commission, and initiatives to address data gaps;
 - g) the status of the West Pacific East Asia Oceanic Fisheries Management (WPEA OFM) Project, the Japan Trust Fund (JTF) and the Pacific Tuna Tagging Project (PTTP);
 - h) developing a Strategic Research Plan for 2012–2016;
 - i) recommendations for the 2012 SC work programme and budget; and
 - j) functioning and structure of SC meetings.

REVIEW OF FISHERIES

3. The provisional total Western and Central Pacific Fisheries Commission (WCPFC) Convention Area tuna catch for 2010 was estimated at 2,414,994 mt, the second highest annual catch recorded, and 80,000 mt lower the previous record in 2009 (2,494,112 mt). During 2010, the purse-seine fishery accounted for an estimated 1,820,844 mt (75% of the total catch), the pole-and-line fishery an estimated 171,604 mt (7%), the longline fishery an estimated 239,853 mt (10%), and the remaining catch (7%) was taken by troll gear and a variety of artisanal gear types, mostly in eastern Indonesia and the Philippines. The Convention Area tuna catch (2,414,994 mt) for 2010 represented 84% of the total Pacific Ocean catch of 2,875,909 mt, and 60% of the global tuna catch (the provisional estimate for 2010 is 4,017,660 mt, which is the lowest in eight years).

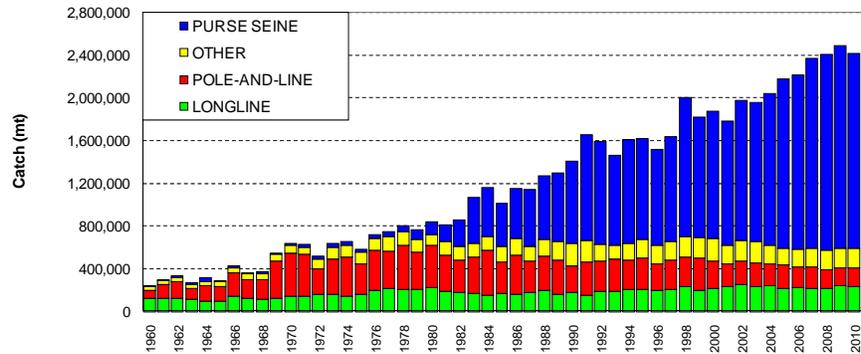


Figure 1: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area, by longline, pole-and-line, purse-seine and other gear types.

4. The 2010 Convention Area catch of skipjack (1,706,166 mt – 71% of the total catch) was the second highest recorded and 115,000 mt less than the previous record catch of 2009 (1,821,770 mt). The Convention Area yellowfin catch for 2010 (470,161 mt – 19%) was more than 50,000 mt higher than the 2009 catch level, but still 70,000 mt lower than the record catch taken in 2008 (541,262 mt). The Convention Area bigeye catch for 2010 (108,997 mt – 5%) was the lowest since 1996, mainly due to a drop in 2010 provisional estimates for the longline fishery. The 2010 Convention Area albacore catch (129,670 mt – 5%) was the second highest on record, with very good catches from the longline fishery.

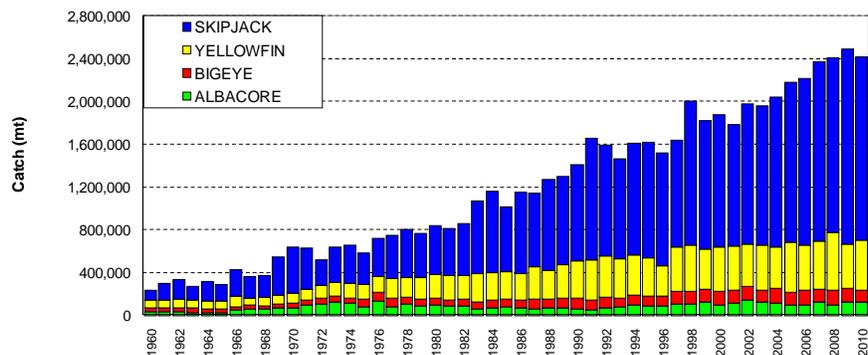


Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area.

STOCK ASSESSMENT THEME

WCPO bigeye tuna

Stock status and trends

5. The bigeye assessment in 2011 is comparable to recent assessments (Table BET2) although there is a range of data updates and a few changed structural assumptions. The primary differences include a revised structure of the fisheries based in Indonesia and Philippines; the incorporation of recent Pacific Tuna Tagging Programme tagging data; the use of standardized longline CPUE derived from operational-level data; and purse-seine, size-frequency data corrected for grab sample selectivity bias using experimental spill sample data.

6. SC7 selected Run 3j, which had an assumed steepness of 0.8 and was based on standardized CPUE derived from operational-level longline data (hereafter referred to as the base case) to represent the

stock status of bigeye. To characterize uncertainty in the assessment, SC7 chose additional models based on alternate values of steepness and standardized CPUE derived from either operational or aggregate longline data (Table BET1), as follows:

Model	CPUE	Steepness
H80-op (base case)	Operational CPUE standardization	steepness = 0.8
H65-op	Operational CPUE standardization	steepness = 0.65
H95-op	Operational CPUE standardization	steepness = 0.95
H80-agg	Aggregate CPUE standardization	steepness = 0.8
H65-agg	Aggregate CPUE standardization	steepness = 0.65
H95-agg	Aggregate CPUE standardization	steepness = 0.95

7. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures BET 1–4.

8. $F_{current}/F_{MSY}$ is estimated at 1.46 (base case; range 1.16–2.10), indicating that overfishing is occurring for the WCPO bigeye tuna stock and that in order to reduce fishing mortality to F_{MSY} the base case indicates that a 32% reduction in fishing mortality is required from 2006–2009 levels (Fig. BET5). Considering historical levels of fishing mortality, a 39% reduction in fishing mortality from 2004 levels is required and a 28% reduction from average 2001–2004 levels (consistent with the aim of CMM2008-01).

9. The base case indicates that the current total and spawning biomass are higher than the associated MSY levels ($B_{current}/\tilde{B}_{MSY} = 1.25$ and $SB_{current}/\tilde{SB}_{MSY} = 1.19$). However, two of the alternate models found that $SB_{current}/\tilde{SB}_{MSY} < 1.0$ with a range across the six models considered of 0.86–1.49. Therefore, there is a possibility that bigeye tuna is currently in an overfished state.

10. An analysis of historical patterns in the mix of fishing gear types indicates that MSY has been reduced to less than half its level prior to 1970 through the increased harvesting of juveniles (Fig. BET6). Recent overfishing could result in further losses in potential yields in the future (refer to Table BET2).

Management advice and implications

11. SC7 recommended a minimum of 32% reduction in fishing mortality from the average levels for 2006–2009 to return the fishing mortality rate to F_{MSY} . This recommended level of reduction is equivalent to a minimum 39% reduction of the 2004 level in fishing mortality, and a 28% reduction of the average 2001–2004 levels.

12. It is too early to quantitatively conclude whether CMM2008-01 has reduced fishing mortality of bigeye tuna to the levels specified in the CMM. Data for 2009 and 2010 have been incorporated into stock assessments, but data for these years are incomplete and estimates of fishing mortality in the final year of the model (2010) are particularly uncertain.

13. The FAD closure introduced in 2009 contributed to the reduction of bigeye catches in 2009 and preliminarily in 2010 (Agenda Item 4.3a). Total purse-seine effort between 20°N and 20°S is 14% and 21% higher in 2009 and 2010, respectively, relative to 2004, and is 27% and 35% higher in 2009 and 2010, respectively, relative to the average of 2001–2004 (for flag-specific references, refer to Attachment B, CMM 2008-01).

14. Total purse-seine effort between 20°N and 20°S has increased by 6% from 2008 to 2010 corresponding to the implementation of CMM2008-01, and 2009 was a near-record high for associated school effort despite the two-month FAD closure. This occurred because of an increase in days fished, the provisions and exemptions within CMM2008-01, and a variety of other reasons.
15. Longline catch in 2010 appeared to have been reduced by 34% from 2001–2004 levels and by 48% from 2004 (for flag-specific references, refer to Attachment F, CMM 2008-01). However this may be overestimated due to incomplete data for 2009 and 2010.
16. Reported catches since 2009 from the mix of surface fisheries in Indonesia and the Philippines declined by 33% in 2010; however, confirmation is required when more detailed data for 2010 are available, including purse-seine effort data.
17. Projections to 2021 indicate that fishing mortality would be reduced to close to the F_{MSY} level, and the stock would move to a slightly overfished state. However, these conclusions should be treated with caution because projections are based on incomplete data and the assumption that catch and effort levels in 2010 will be maintained.
18. Overfishing and the increase in juvenile bigeye catches have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. SC7 concluded that MSY levels would increase if the mortality of juvenile bigeye was reduced.
19. SC7 noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation and depletion rates were highest in equatorial regions (Regions 3 and 4 in the stock assessment model), which accounts for 88% of the total bigeye tuna catch (2001–2010), and that the spawning biomass in these regions is estimated to have declined to about 17% of the level that is estimated to occur in the absence of fishing ($SB_{2010, F=0}$). The Commission may consider measures that utilize a spatial management approach.
20. Considering the incomplete submission of data, SC7 highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes, and encouraged all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.
21. SC7 recommended that the Commission should consider the results of updated projections at WCPFC8, and adopt further measures to secure additional reductions in fishing mortality above those expected from the current CMM, to ensure that fishing mortality is reduced to at least the F_{MSY} level, and remove the risk of the stock being overfished. Measures that reduce fishing mortality across a range of fish sizes (e.g. fishing gear) are likely to produce the best results.

Table BET1: Estimates of management quantities for selected stock assessment models from the 2011 base case model (Run 3j – H80-op) and the five combinations of steepness and longline CPUE series. For the purpose of this assessment, “current” is the average over the period 2006–2009 and “latest” is 2010.

	H80-op (base case)	H65-op	H95-op	H80-agg	H65-agg	H95-agg
$C_{current}$	141,160	141,365	141,029	141,561	141,805	141,356
C_{latest}	116,868	117,118	116,712	117,558	117,843	117,320
MSY	76,760	70,080	83,720	74,120	68,360	80,360
$C_{current}/MSY$	1.84	2.02	1.68	1.91	2.07	1.76
C_{latest}/MSY	1.52	1.67	1.39	1.59	1.72	1.46
F_{mult}	0.68	0.54	0.86	0.60	0.48	0.75
$F_{current}/F_{MSY}$	1.46	1.84	1.16	1.67	2.10	1.33
SB_0	739,900	810,000	698,500	688,400	762,000	644,200
SB_{MSY}/SB_0	0.29	0.33	0.24	0.29	0.33	0.24
$SB_{current}/SB_0$	0.35	0.33	0.36	0.30	0.29	0.32
SB_{latest}/SB_0	0.31	0.30	0.32	0.26	0.24	0.26
$SB_{current}/SB_{MSY}$	1.19	0.98	1.49	1.05	0.86	1.32
SB_{latest}/SB_{MSY}	1.08	0.89	1.36	0.88	0.72	1.10
$SB_{curr}/SB_{curr,F=0}$	0.23	0.23	0.22	0.20	0.20	0.19
$SB_{latest}/SB_{latest,F=0}$	0.21	0.22	0.21	0.17	0.18	0.17
Steepness (h)	0.80	0.65	0.95	0.80	0.65	0.95

Table BET2: Comparison of WCPO bigeye tuna reference points from the 2011 reference case model and the range of the six models in Table BET1; the 2010 base case model (steepness estimated as 0.98) — shown in parentheses is the alternative 2010 run (steepness assumed as 0.75); ranges of six sensitivity analyses in the 2009 assessment; and the base model and sensitivity analyses from the 2008 assessment.

Management quantity	2011 assessment base case (uncertainty)	2010 assessment Run3d (Run4b)	2009 assessment	2008 assessment
Most recent catch	116,868 mt (2010)	126,769 mt (2009)	134,315 mt (2008)	143,059 mt (2007)
MSY	76,760 mt (68,360 – 83,720)	73,840 mt (65,640 mt)	Range: 52,120–7,800 mt	Base case: 64,600 mt Range: 56,800–65,520 mt
$F_{current}/F_{MSY}$	1.46 (1.16–2.10)	1.41 (1.97)	Range: 1.51–2.55	Base case: 1.44 Range: 1.33–2.09
$B_{current}/B_{MSY}$	1.25 (0.96–1.48)	1.39 (1.09)	Range: 1.11–1.55	Base case: 1.37 Range: 1.02–1.37
$SB_{current}/SB_{MSY}$	1.19 (0.86–1.49)	1.34 (0.97)	Range: 0.85–1.42	Base case: 1.19 Range: 0.76–1.20
$Y_{F_{current}}/MSY$	0.89 (0.34–0.99)	0.94 (0.56)	Range: 0.12–0.92	Base case: 0.94 Range: 0.50–0.97
$B_{current}/B_{current, F=0}$	0.29 (0.25–0.30)	0.23 (0.24)	Range: 0.18–0.29	Base case: 0.26 Range: 0.20–0.28
$SB_{current}/SB_{current, F=0}$	0.23 (0.19–0.23)	0.17 (0.18)	Range 0.11–0.19	Not available

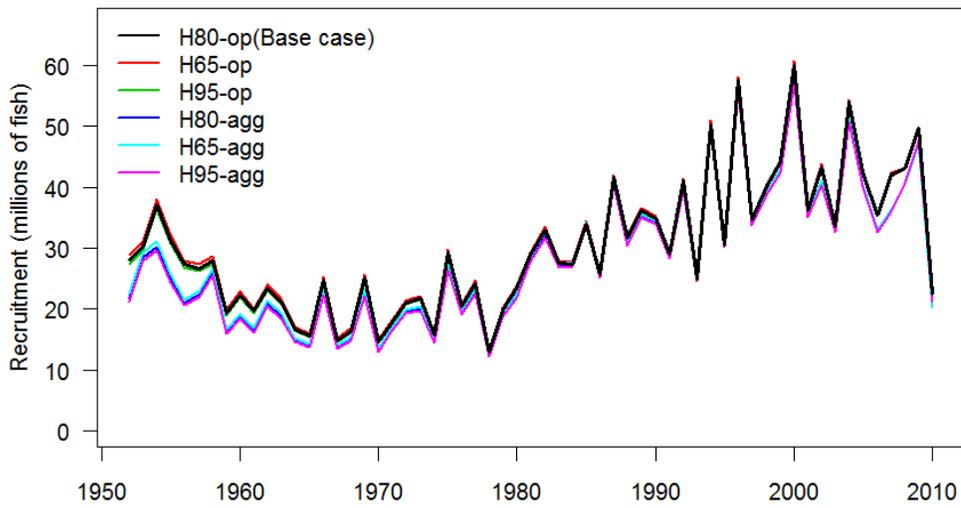


Figure BET1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the base case model (Run 3j – H80-opp [black line]) and the five combinations of steepness and longline CPUE series.

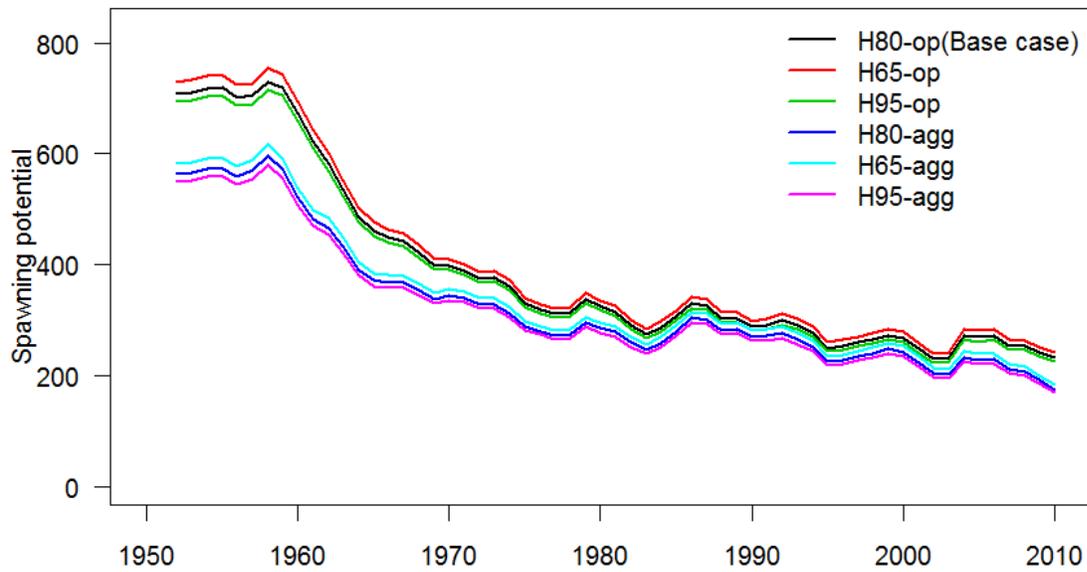


Figure BET2: Estimated annual average spawning potential for the WCPO obtained from the base case model (Run 3j – H80-opp [black line]) and the five combinations of steepness and longline CPUE series.

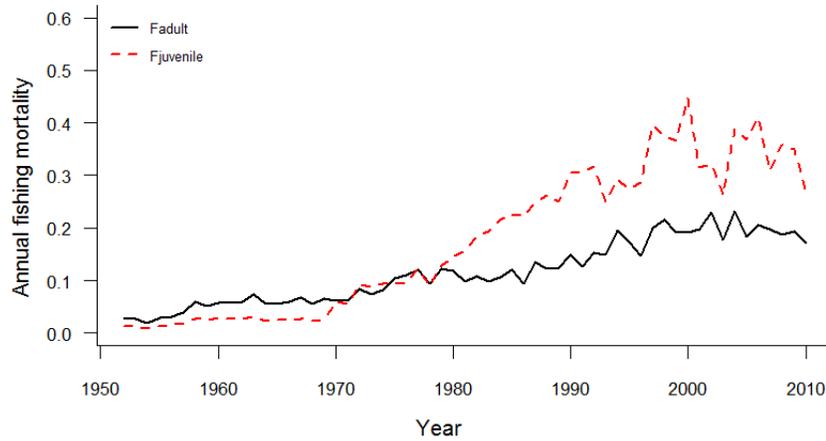


Figure BET3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base case model (Run 3j - H80-op).

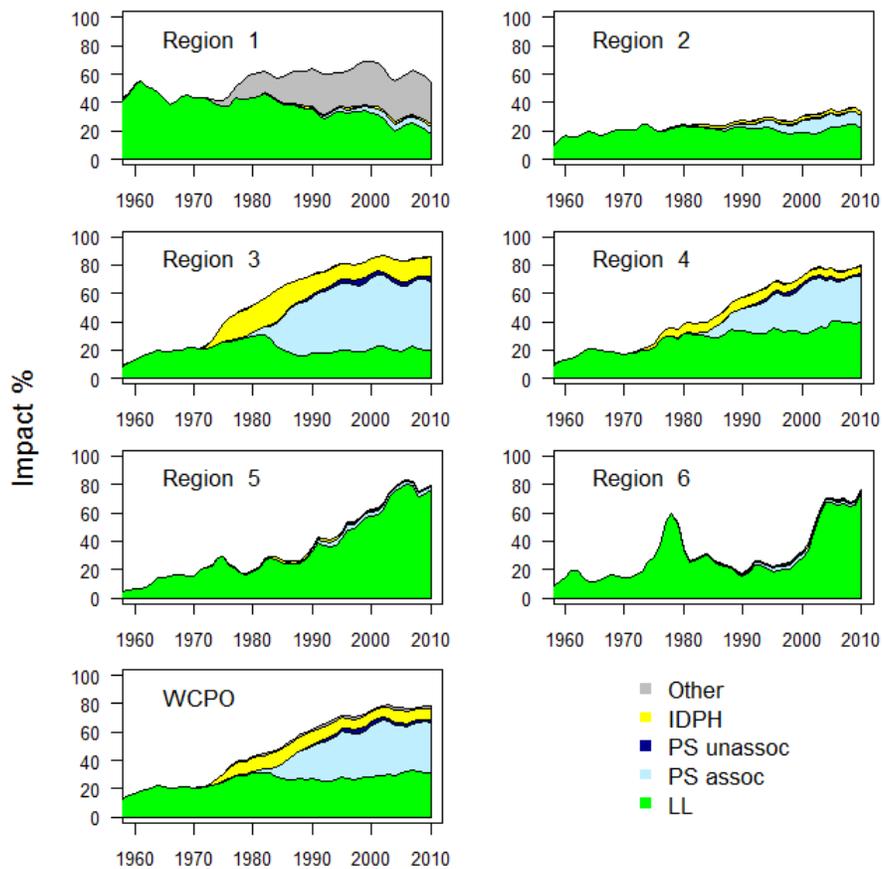


Figure BET4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base case model). LL = all longline fisheries; IDPH = Indonesia and Philippines domestic fisheries; PS assoc = purse-seine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

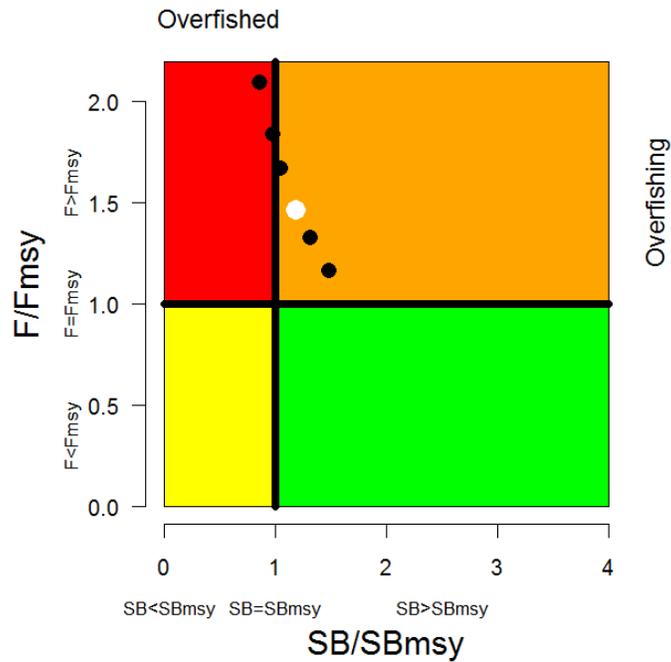
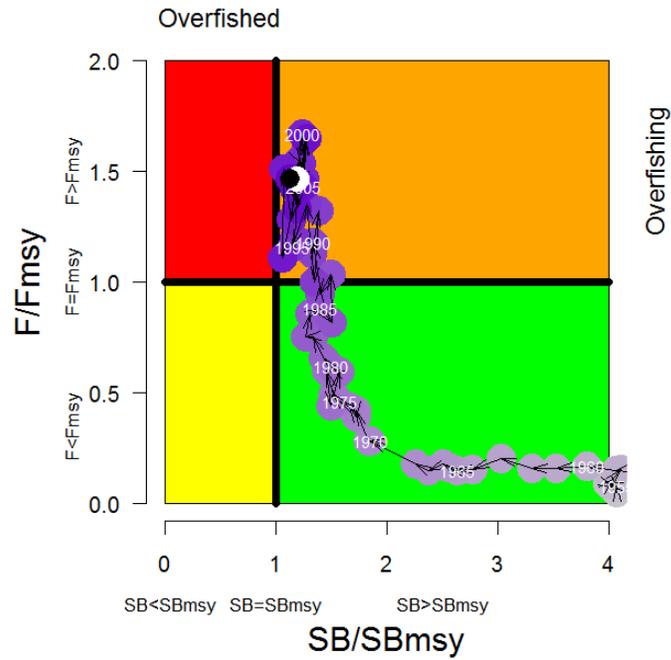


Figure BET5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base case (top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the base case (white circle) and the five combinations of steepness and longline CPUE series. See Table BET1 to determine the individual model runs.

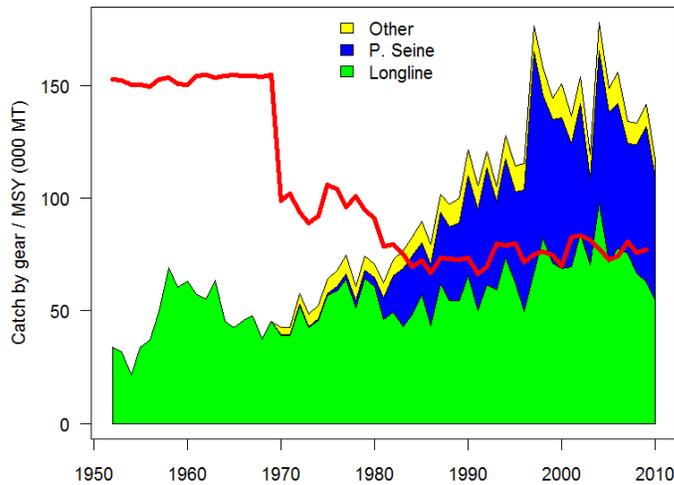


Figure BET6: History of annual estimates of MSY compared with catches of three major fisheries. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small bigeye.

WCPO yellowfin tuna

Stock status and trends

22. The 2011 yellowfin assessment is comparable to recent assessments (Table YFT2) although there is a range of data updates and a few changed structural assumptions. The primary differences are a revised structure of the fisheries based in Indonesia and Philippines; the incorporation of recent PTTP tagging data; the use of standardized longline CPUE derived from operational-level data; and purse seine size frequency data corrected for grab sample selectivity bias using experimental spill sample data.

23. SC7 selected the reference case (LLcpueOP_TWcpueR6_PTTP – H80), which had an assumed steepness of 0.8 and included recent PTTP tagging data (hereafter referred to as the base case) to represent the stock status of yellowfin. To characterize uncertainty in the assessment, SC7 chose additional models based on alternate values of steepness and with recent PTTP tagging data either included or excluded (Table YFT1), as follows:

Model	CPUE	Steepness
H80-pttp (base case)	PTTP data included	steepness = 0.8
H65-pttp	PTTP data included	steepness = 0.65
H95-pttp	PTTP data included	steepness = 0.95
H80-no-pttp	PTTP data excluded	steepness = 0.8
H65-no-pttp	PTTP data excluded	steepness = 0.65
H95-no-pttp	PTTP data excluded	steepness = 0.95

24. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures YFT 1–4.

25. For the base case, $F_{current}/F_{MSY}$ is estimated at 0.77 indicating that overfishing is not occurring for the WCPO yellowfin tuna (Fig. YFT5). However, one of the alternate models found that $\frac{F_{current}}{F_{MSY}} > 1.0$, with a range across the six models considered of 0.54–1.15. Therefore, there is a possibility that overfishing is occurring for yellowfin tuna.

26. The base case indicates that the current total biomass and spawning biomass are higher than associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.33$ and $\frac{SB_{current}}{SB_{MSY}} = 1.47$). None of the alternate models found that $\frac{SB_{current}}{SB_{MSY}} < 1.0$ with a range across the six models considered of 1.14–1.92. Therefore, yellowfin tuna is not considered to be in an overfished state. However, while the exploitation rates differ between regions, they continue to be highest in the western equatorial region.

27. An analysis of historical patterns in the mix of fishing gear types indicates that MSY has been reduced to approximately 60% of its levels prior to 1970 through the increased harvesting of juveniles (Fig. YFT6).

Management advice and implications

28. SC7 determined that the WCPO yellowfin appears to be capable of producing MSY. The stock is not experiencing overfishing and is not in an overfished state. Projections to 2021 indicate that fishing mortality is projected to remain below F_{MSY} and the spawning biomass will remain above SB_{MSY} .

29. However, SC7 noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation rates were highest in the western equatorial region (Region 3 in the stock assessment model), which accounts for ~81% of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 31% of the unexploited level ($SB_{2010, F=0}$).

30. SC7 recommended that there be no increase in fishing mortality in the western equatorial region.

31. The increase in catches of juvenile yellowfin has resulted in a moderate (~40%) reduction in the potential yield of the WCPO yellowfin stock. SC7 concluded that MSY levels would increase if the mortality of juvenile yellowfin was reduced.

Table YFT1: Estimates of management quantities for selected stock assessment models from the 2011 base case model LLc_{pue}OP_TWc_{pue}R6_P_{TTP} (H80-pttp) and the five combinations of steepness and tagging data sets included. For the purpose of this assessment, “current” is the average over the period 2006–2009 and “latest” is 2010.

	H80-pttp (base case)	H65-pttp	H95-pttp	H80-no pttp	H65- no pttp	H95-no pttp
$C_{current}$	551,120	551,300	551,283	551,488	551,508	551,480
C_{latest}	507,100	507,443	507,358	508,329	508,398	508,286
MSY	538,800	498,000	644,800	493,600	432,000	551,200
$C_{current}/MSY$	1.02	1.11	0.85	1.12	1.28	1.00
C_{latest}/MSY	0.94	1.02	0.79	1.03	1.18	0.92
F_{mult}	1.30	1.10	1.84	1.11	0.87	1.44
$F_{current}/F_{MSY}$	0.77	0.91	0.54	0.90	1.15	0.70
SB_0	2,001,000	2,272,000	2,145,000	2,035,000	2,108,000	1,984,000
SB_{MSY}/SB_0	0.29	0.34	0.24	0.30	0.34	0.25
$SB_{current}/SB_0$	0.42	0.43	0.45	0.40	0.39	0.41
SB_{latest}/SB_0	0.37	0.38	0.40	0.32	0.31	0.32
$SB_{current}/SB_{MSY}$	1.47	1.28	1.92	1.34	1.14	1.67
SB_{latest}/SB_{MSY}	1.30	1.12	1.69	1.06	0.90	1.32
$SB_{curr}/SB_{curr,F=0}$	0.44	0.47	0.47	0.40	0.40	0.40
$SB_{latest}/SB_{latest,F=0}$	0.41	0.44	0.44	0.35	0.35	0.35
Steepness (h)	0.80	0.65	0.95	0.80	0.65	0.95

Table YFT2: Comparison of WCPO yellowfin tuna reference points from the 2011 reference case model (with uncertainty based on the six models in Table YFT1) with 2009 and 2007 assessments (across a range of models).

Management quantity	2011 assessment	2009 assessment	2007 assessment
Most recent catch	507,100 mt	539,481 mt (2008)	426,726 mt (2006)
MSY	538,800 mt (432,000-644,800)	Range: 493,600– 767,200 mt	Base case: 400,000 mt Range: 344,520 ~ 549,200 mt
$F_{current}/F_{MSY}$	0.77 (0.54–1.15)	Range: 0.41–0.85	Base case: 0.95 Range: 0.56–1.0
$B_{current}/B_{MSY}$	1.33 (1.12–1.54)	Range: 1.38–1.88	Base case: 1.17 Range: 1.13–1.42
$SB_{current}/SB_{MSY}$	1.47 (1.14–1.92)	Range: 1.44– 2.43	Base case: 1.25 Range: 1.12–1.74
$Y_{Fcurrent}/MSY$	0.97 (0.88–0.99)	Range: 0.76–0.98	Base case: 1.0 Range: 0.88–1.0
$B_{current}/B_{current, F=0}$	0.53 (0.48–0.55)	Range: 0.53–0.63	Base case: 0.51 Range: 0.51–0.58
$SB_{current}/SB_{current, F=0}$	0.44 (0.40–0.47)		

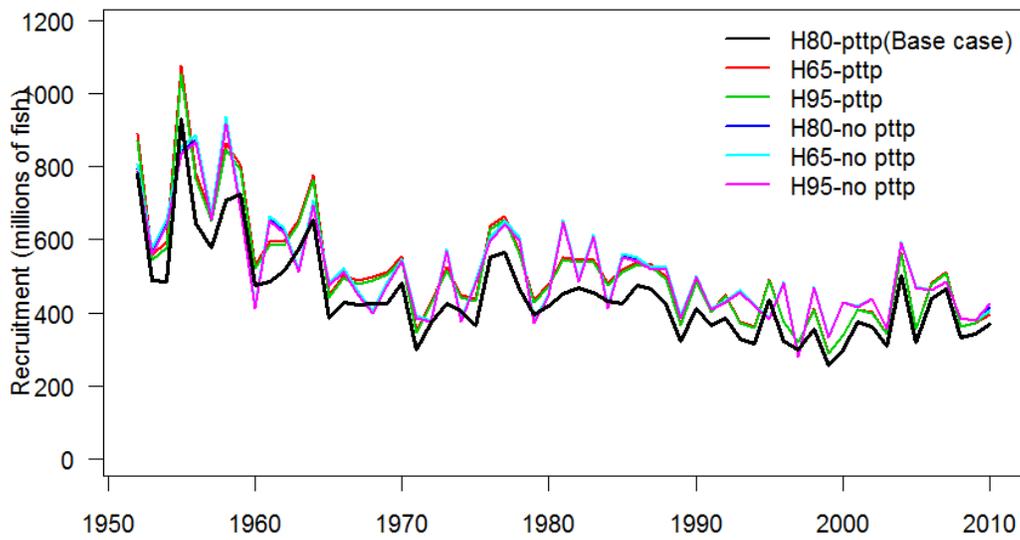


Figure YFT1: Estimated annual recruitment (millions of fish) for the WCPO obtained for the base case (LLcpueOP_TWcpueR6_PTTTP – H80pttp) and the five combinations of steepness and tagging datasets included.

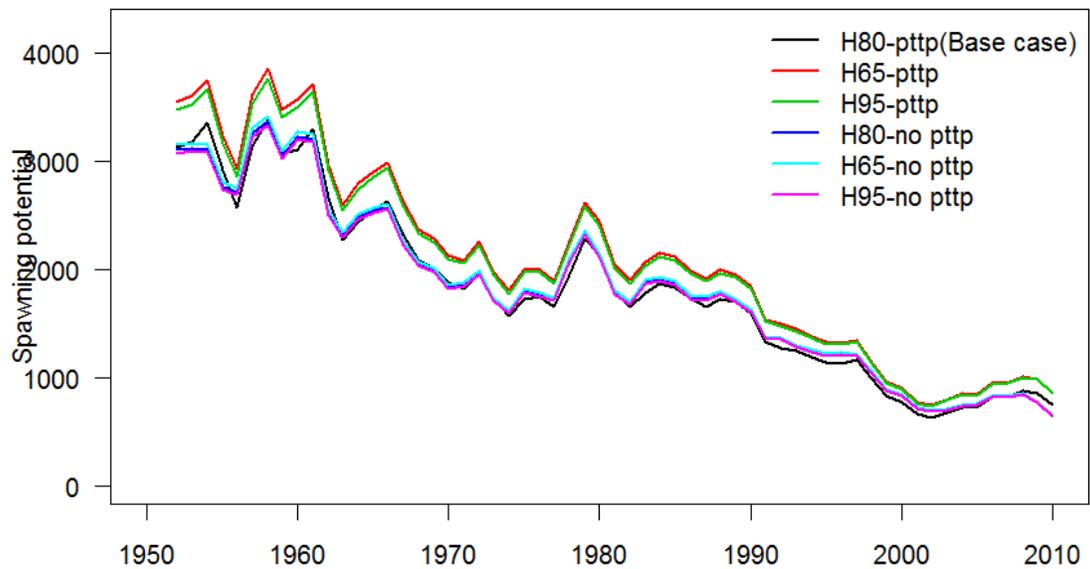


Figure YFT2: Estimated average annual spawning potential for the WCPO obtained from for the base case (LLcpueOP_TWcpueR6_PTTTP – H80pttp) and the five combinations of steepness and tagging datasets included.

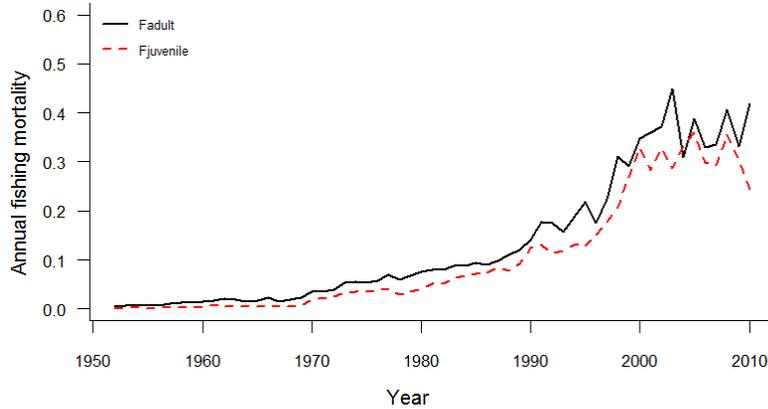


Figure YFT3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base case model (LLcpueOP_TWcpueR6_PTTP – H80pttp).

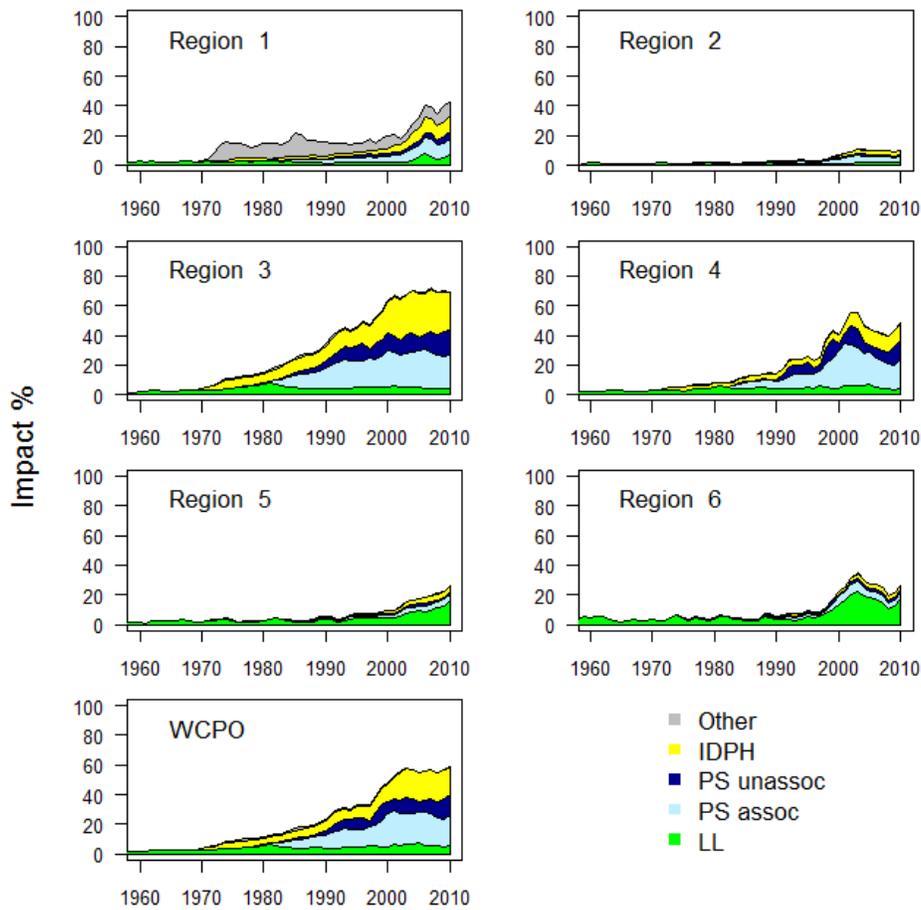


Figure YFT4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base case model LLcpueOP_TWcpueR6_PTTP – H80pttp). L = all longline fisheries; IDPH = Indonesia and Philippines domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

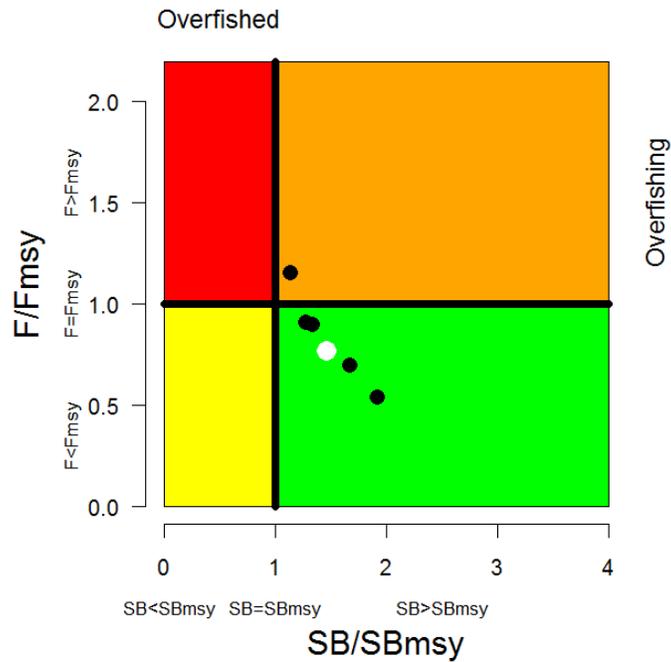
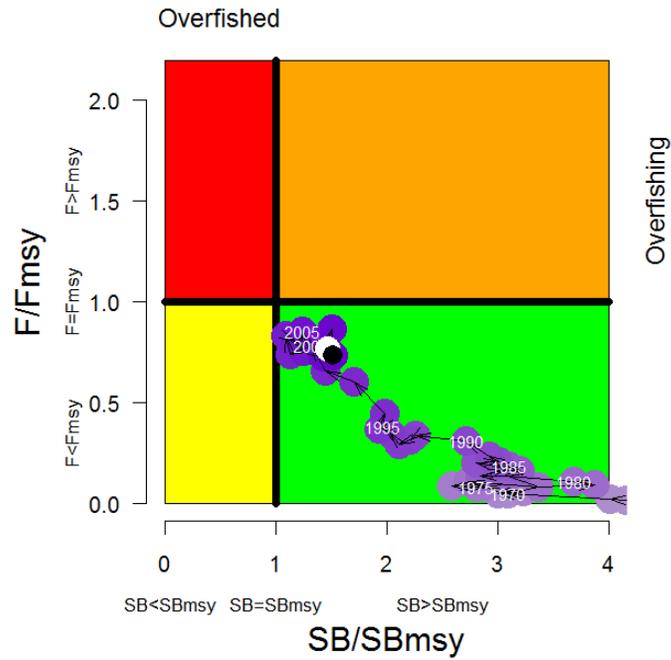


Figure YFT5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base case model (LLcpueOP_TWcpueR6_PTPP – H80pttp, top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the base case (white circle) and the five combinations of steepness and tagging data sets included. See Table YFT1 to determine the individual model runs.

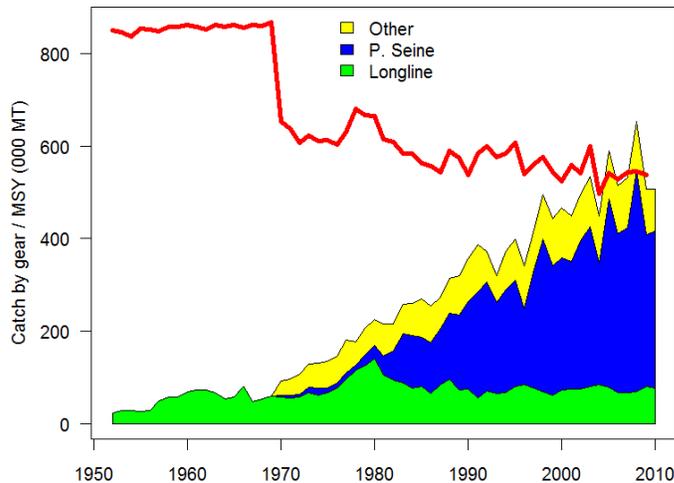


Figure YFT6: History of annual estimates of MSY compared with catches of three major fisheries. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small yellowfin.

WCPO skipjack tuna

Stock status and trends

32. SC7 selected the reference case as the base model to represent the stock status and Committee's advice on skipjack tuna. A value of 0.8 was chosen as the mid-point of the range of steepness values considered in the 2011 assessment. Similar to other tuna species, the actual value of steepness for the WCPO skipjack currently remains unknown.

33. Fishing mortality rates tended to be higher during the last decade than for the preceding period, and fishing mortality and biomass indicators relative to MSY started to move towards 1.0, although they remained substantially below the F_{MSY} level ($F_{current}/F_{MSY} = 0.37$). The stock is not in an overfished state because biomass is above B_{MSY} ($B_{current}/B_{MSY} = 2.68$).

Management advice and implications

34. Catches in 2010 were roughly 1.556 million mt, the second highest recorded and below the record high catch of 1.608 million mt in 2009. Equilibrium yield at the current F is about 1.14 million mt. This is about 76% of the MSY level. The assessment continues to show that the stock is currently only moderately exploited ($F_{current}/F_{MSY} = 0.37$) and fishing mortality levels are sustainable. However, there is concern that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand and Hawaii) fisheries.

35. If recent fishing patterns continue, catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored. The Commission should consider developing limits on fishing for skipjack to limit the declines in catch rate associated with further declines in biomass.

36. Fishing is having a significant impact on stock size, especially in the western equatorial region 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 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.

37. Noting the uncertainty in purse-seine species composition, SC7 urged the Commission to continue improving estimates of purse-seine composition data. SC7 requested CCMs, port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with effort to collect landings and cannery data.

Table SKJ1: Estimates of management quantities from the 2011 reference case model and two alternate models using steepness values of 0.65 and 0.95 respectively. For the purpose of this assessment, “current” is the average over the period 2006–2009 and “latest” is 2010.

	H80 (base case)	H65	H95
$C_{current}$	1,484,702	1,484,729	1,484,894
C_{latest}	1,556,643	1,556,596	1,556,924
MSY	1,503,600	1,274,000	1,818,000
$C_{current}/MSY$	0.99	1.17	0.82
C_{latest}/MSY	1.04	1.22	0.86
F_{mult}	2.71	1.9	4.46
$F_{current}/F_{MSY}$	0.37	0.53	0.22
SB_0	5,787,000	5,940,000	5,888,000
SB_{MSY}/SB_0	0.27	0.32	0.22
$SB_{current}/SB_0$	0.79	0.77	0.82
SB_{latest}/SB_0	0.60	0.58	0.62
$SB_{current}/SB_{MSY}$	2.94	2.45	3.69
SB_{latest}/SB_{MSY}	2.21	1.84	2.80
$SB_{curr}/SB_{curr_{F=0}}$	0.63	0.63	0.65
$SB_{latest}/SB_{latest_{F=0}}$	0.54	0.54	0.56
Steepness (h)	0.80	0.65	0.95

Table SKJ2: Estimates of reference points from the 2011 (with uncertainty based on the range of models in Table SKJ1), 2010, and 2008 skipjack tuna stock assessments. The spatial domain of the 2008 assessment was limited to the equatorial region of the WCPO.

Management quantity	2011 assessment (uncertainty)	2010 assessment	2008 assessment
Most recent catch	1,556,643 mt	1,575,287 mt (catch based on spill sampling) ^a	1,546,436 mt (2007 ^b) 1,726,702 mt (2007 ^c) 1,410,389 (WCPO catch based on spill sampling)
MSY	1,503,600 mt (1274000–1818000)	1,375,600 mt	1,280,000 mt
$Y_{F_{current}}/MSY$	0.76 (0.65–0.86)	0.80	0.70
$B_{current}/B_{current, F=0}$	0.65 (0.65–0.67)	0.63	0.66
$F_{current}/F_{MSY}$	0.37 (0.22–0.53)	0.34	0.26
$B_{current}/B_{MSY}$	2.68 (2.32–3.17)	2.24	2.99
$SB_{current}/SB_{MSY}$	2.94 (2.45–3.69)	2.67	3.82

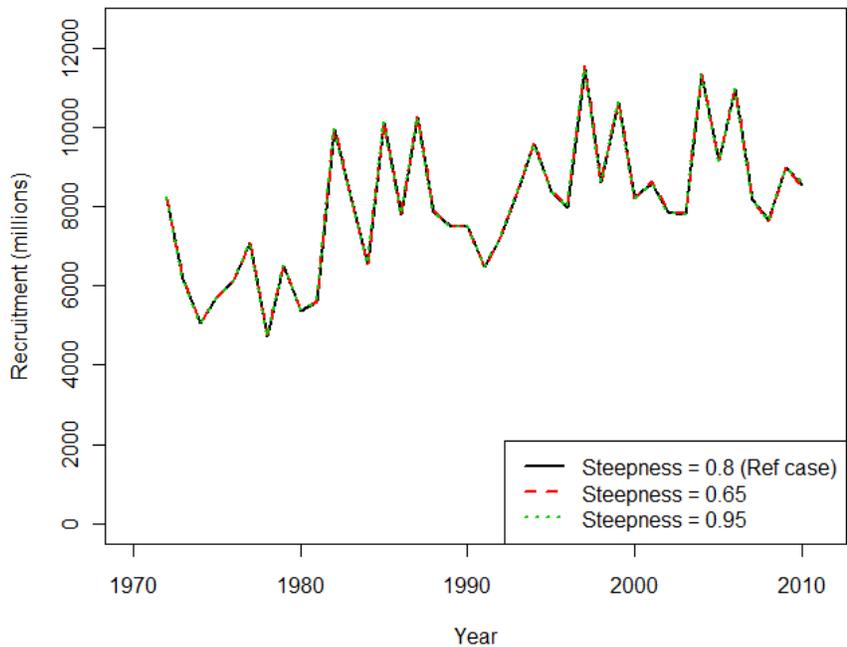


Figure SKJ1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference model (steepness = 0.8, black line) and the two alternative steepness values.

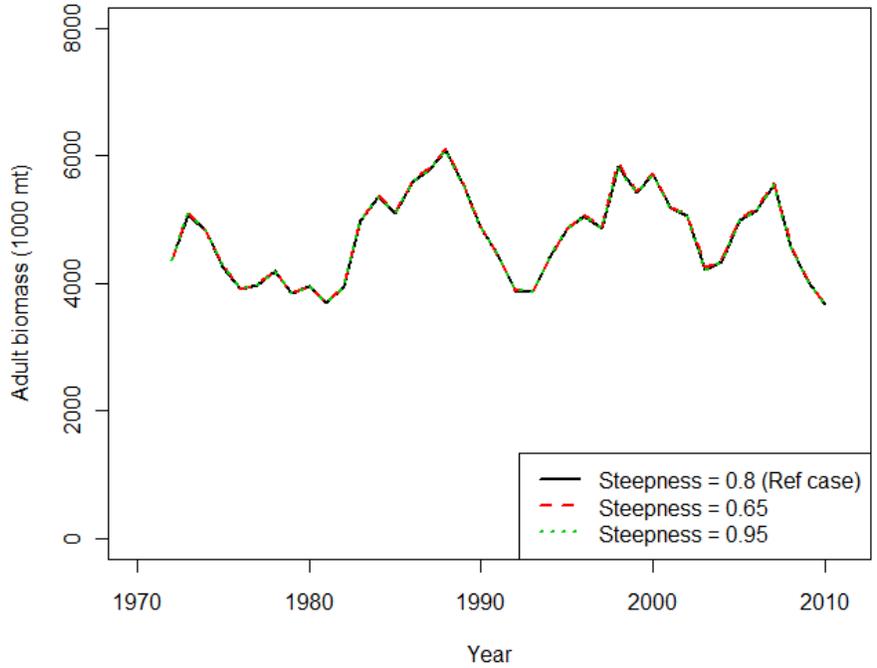


Figure SKJ2: Estimated average annual average spawning biomass for the WCPO obtained from the reference model and the two alternative steepness values.

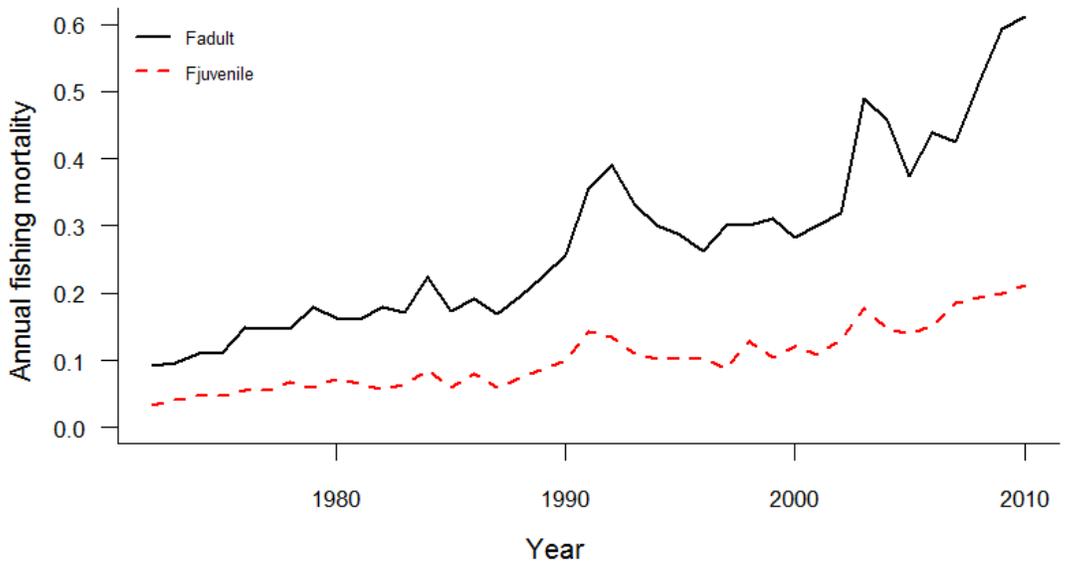


Figure SKJ3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model.

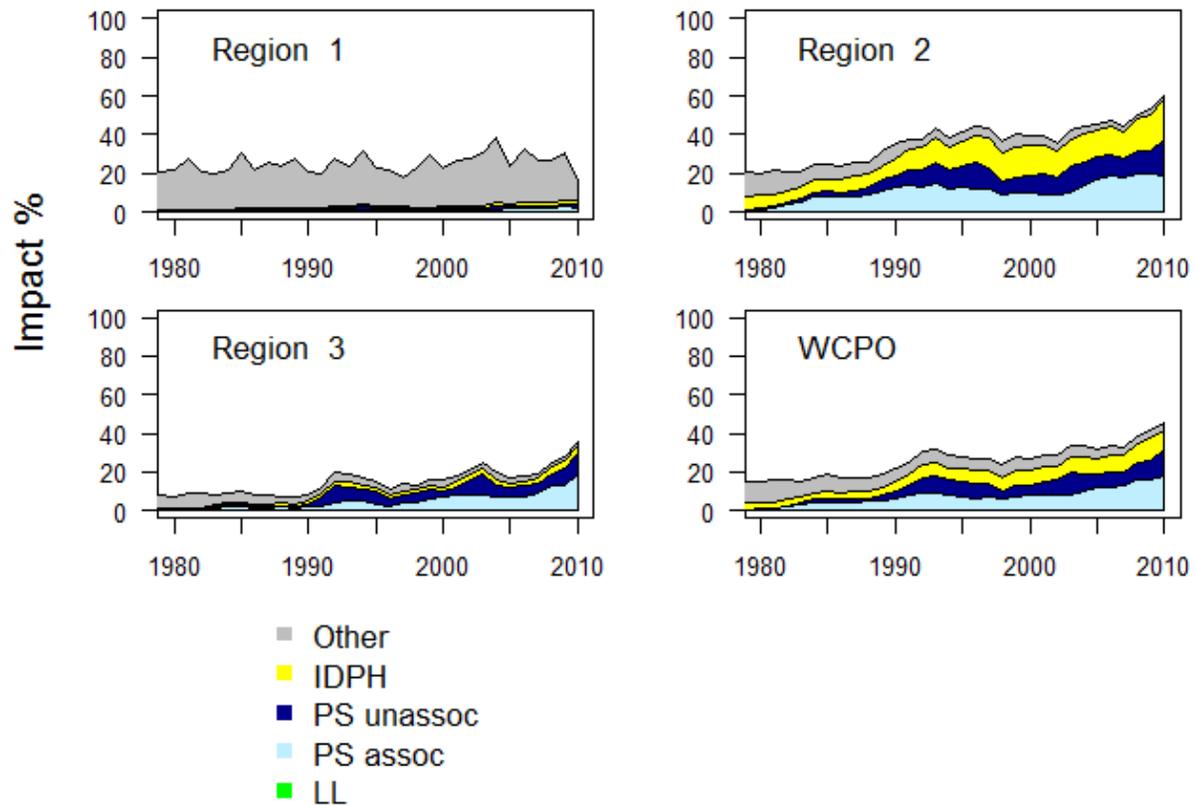


Figure SKJ4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (reference case model). L = all longline fisheries; IDPH = Indonesia and Philippines domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

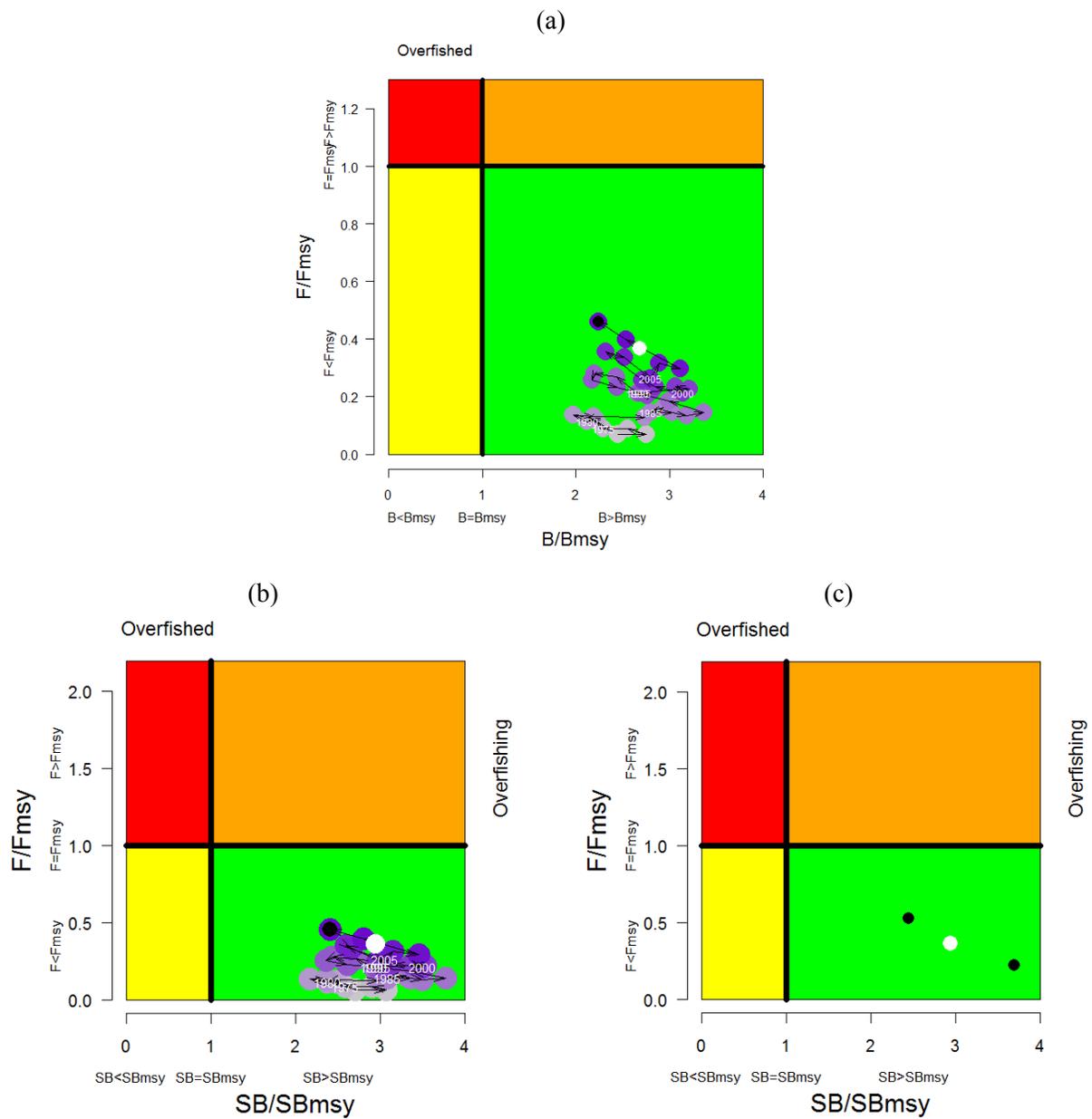


Figure SKJ5: Temporal trends in annual stock status, relative to B_{MSY} or SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points. Figures are provided for the reference case model (a, b, and the white circle in c) and the two alternative steepness values (black circles in c). See Table SKJ1 for the individual model runs.

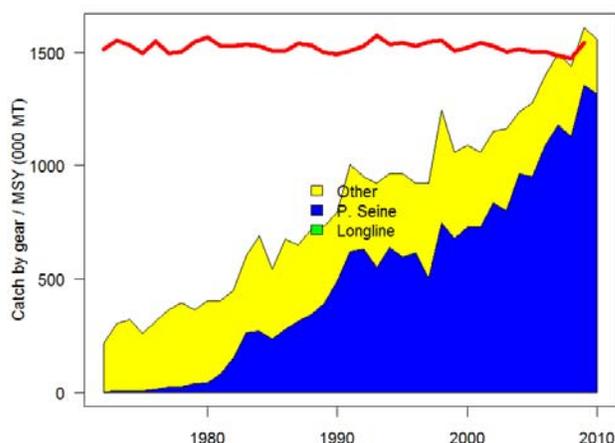


Figure SKJ6: History of annual estimates of MSY compared with catches of three major fisheries.

South Pacific albacore

Status and trends

38. The 2011 assessment results are similar to those of the 2009 assessment (Tables ALB1).
39. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figs. ALB1–4, and Table ALB1 compares reference points between 2011 and 2009 assessments.
40. The key conclusion of the reference case is that overfishing is not occurring and the stock is not in an overfished state (Fig. ALB5). Reference point levels estimated in the 2011 assessment were similar to those estimated in the 2009 assessment and depletion levels ($SB_{2009}/SB_{2009, F=0}$) of albacore were moderate at ~37%. However SC7 noted that depletion levels of albacore available to longline fisheries north of 25°S was above 50%.

Management advice and implications

41. The South Pacific albacore stock is currently not overfished nor is overfishing occurring, and current biomass levels are sufficient to support current catch levels. Any increases in catch or effort are likely to result in catch rate declines, especially for longline catches of adult albacore, with associated impacts on vessel profitability. SC7 further noted that vessel activity must be managed, as per the requirements of CMM 2010-05.
42. SC7 noted that the impact of oceanographic and climatic variability is a key area of uncertainty, and supported continued integration in future stock assessments. SC7 recognized the economic difficulties faced by the domestic albacore fisheries of Pacific Island countries and territories.

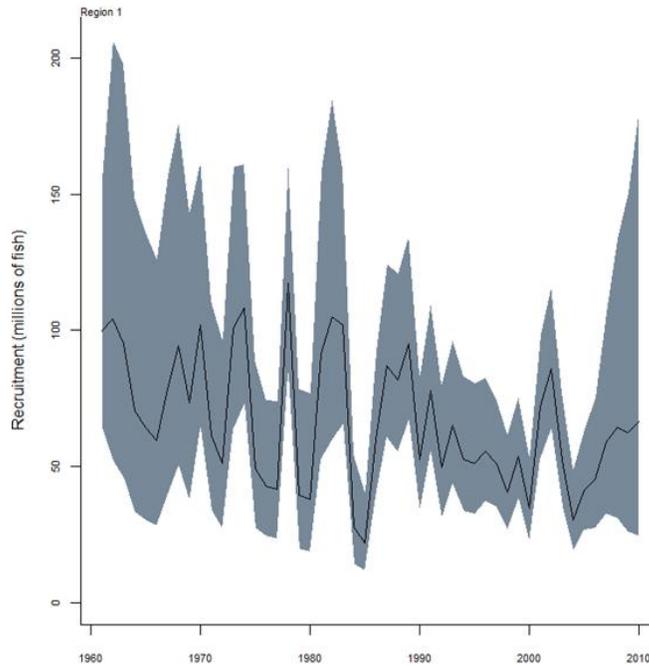


Figure ALB1: Annual recruitment (number of fish) estimates. Grey area represents parameter uncertainty estimated from the Hessian matrix.

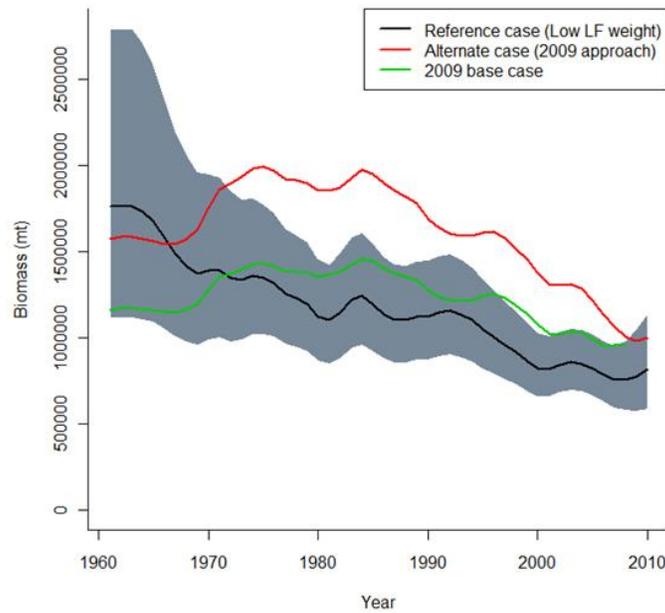


Figure ALB2: Annual estimates of total biomass (thousands of metric tonnes). Several scenarios are shown to illustrate the change between this year’s reference case, the alternate case that used the same approach as in 2009, and the biomass trend estimated in the 2009 base case. The comparisons illustrate some effects of conflict between CPUE and length-frequency data. Grey area represents parameter uncertainty estimated from the Hessian matrix.

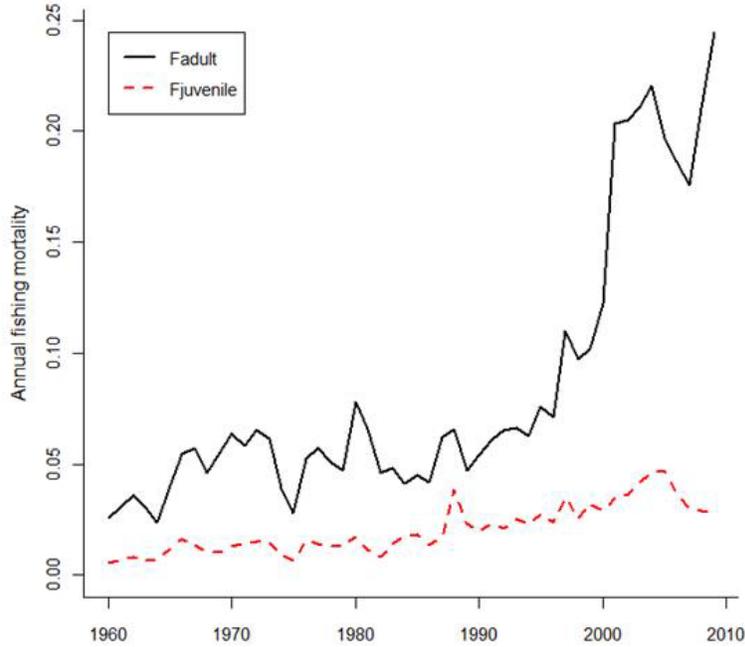


Figure ALB3: Annual estimates of fishing mortality for juvenile and adult South Pacific albacore.

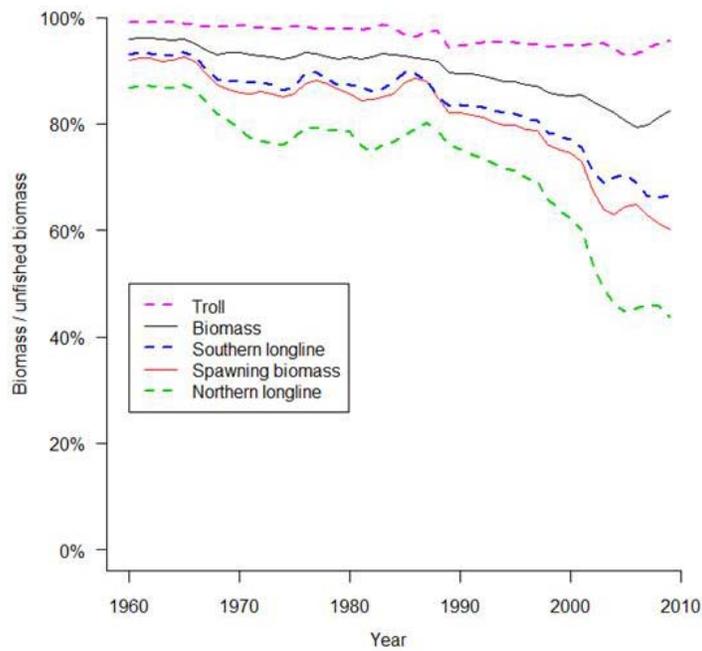


Figure ALB4: Decline in biomass due to the impact of fishing mortality, for exploitable biomass in the troll, southern longline, and northern longline fisheries, for total biomass and for spawning biomass.

Table ALB1: Management parameters estimated from the 2011 reference case model, and estimates from the 2009 assessment, for comparison.

Management quantity	Reference case	Management quantity	2009 base case	2009 median
$C_{2007-2009}$	54,520	$C_{2005-2007}$	66,869	65,801
$YF_{2007-2009}$	57,130	$YF_{2005-2007}$	64,490	58,955
MSY	85,200	MSY	97,610	81,580
$YF_{2007-2009} / MSY$	0.67	$YF_{2005-2007} / MSY$	0.66	0.72
$C_{2007-2009} / MSY$	0.64	$C_{2005-2007} / MSY$	0.69	0.80
F_{MSY}	0.14	F_{MSY}	0.14	0.16
$F_{2007-2009} / F_{MSY}$	0.26	$F_{2005-2007} / F_{MSY}$	0.25	0.29
B_0	1,141,000	B_0	1,309,000	1,098,500
B_{MSY}	605,900	B_{MSY}	692,100	553,200
B_{MSY} / B_0	0.53	B_{MSY} / B_0	0.53	0.49
$B_{2007-2009}$	762,240	$B_{2005-2007}$	965,860	863,665
$BF_{2007-2009}$	903,500	$BF_{2005-2007}$	1,041,000	836,300
$B_{2007-2009}F_0$	950,947	$B_{2005-2007}F_0$	1,159,433	1,084,933
SB_0	400,700	SB_0	460,400	406,600
SB_{MSY}	104,200	SB_{MSY}	120,000	101,700
SB_{MSY} / SB_0	0.26	SB_{MSY} / SB_0	0.26	0.24
SB_{2009}	234,537	SB_{2007}	273,557	236,793
SBF_{2009}	251,500	SBF_{2007}	292,500	235,250
$SB_{2009}F_0$	372,043	$SB_{2007}F_0$	402,873	390,193
$B_{2007-2009} / B_0$	0.67	$B_{2005-2007} / B_0$	0.74	0.76
$BF_{2007-2009} / B_0$	0.79	$BF_{2005-2007} / B_0$	0.80	0.74
$B_{2007-2009} / B_{MSY}$	1.26	$B_{2005-2007} / B_{MSY}$	1.40	1.53
$BF_{2007-2009} / B_{MSY}$	1.49	$BF_{2005-2007} / B_{MSY}$	1.50	1.49
$B_{2007-2009} / B_{2007-}$	0.80	$B_{2005-2007} / B_{2005-}$	0.83	0.80
SB_{2009} / SB_0	0.59	SB_{2007} / SB_0	0.59	0.60
SBF_{2009} / SB_0	0.63	SBF_{2007} / SB_0	0.64	0.59
SB_{2009} / SB_{MSY}	2.25	SB_{2007} / SB_{MSY}	2.28	2.44
SBF_{2009} / SB_{MSY}	2.41	SBF_{2007} / SB_{MSY}	2.44	2.36
$SB_{2009} / SB_{2009}F_0$	0.63	$SB_{2007} / SB_{2007}F_0$	0.68	0.64

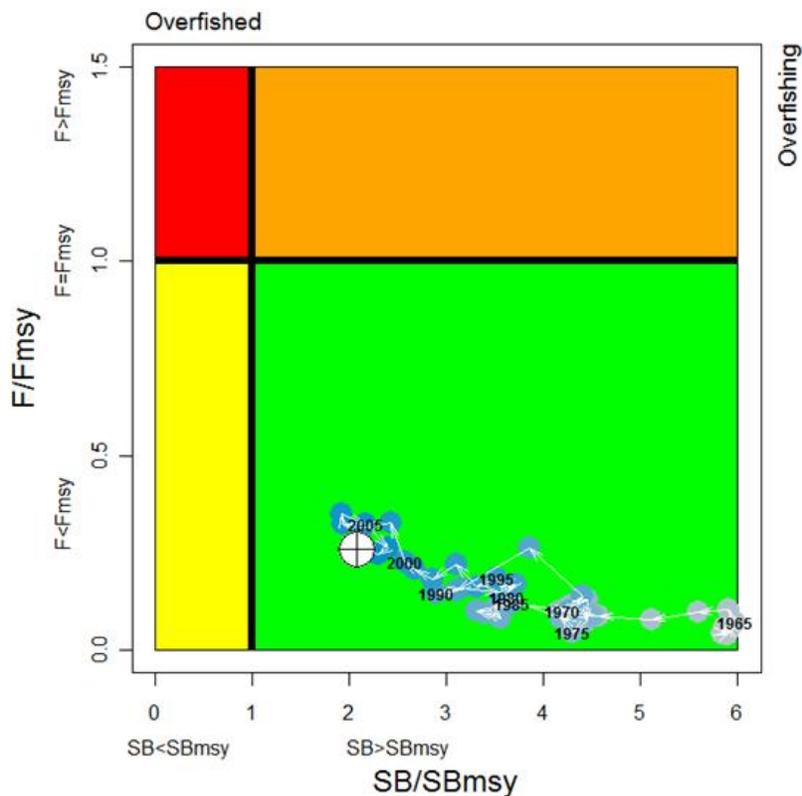


Figure ALB5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (starting in 1960). The color of the points is graduated from pale blue (1960) to blue (2009), and points are labeled at five-year intervals. The last year of the model (2010) is excluded because it is highly uncertain.

South Pacific swordfish

Status and trends

43. SC7 noted that no stock assessment was conducted for South Pacific swordfish in 2011; therefore, the stock status description and management recommendations from SC5 are still current.

44. SC7 noted that current WCPFC data holdings are insufficient to undertake an assessment in 2012, as indicated in SC7-ST-IP-04. The EU advised that the provision of its operational longline data will be provided to the WCPFC shortly. SC7 recommended that SPC work with the EU with regards to their data, and provide an assessment as to whether the dataset will be useful in expanding the spatial scope of previous assessments to include the south-central Pacific, or if possible the entire South Pacific Ocean. SC7 further recommended that an analysis of fishery indicators of this stock be prepared for presentation at SC8.

Management advice and implications

45. The advice from SC5 should be maintained, pending a new assessment or other new information. SC7 recommended that SC7-ST-IP-04 be forwarded to the TCC for consideration.

Southwest Pacific striped marlin

Status and trends

46. SC7 noted that no stock assessment was conducted for southwest Pacific striped marlin in 2011; therefore, the stock status description and management recommendations from SC2 are still current.

47. SC7 further noted the progress of Project 64, the compilation of striped marlin data by New Zealand and Australia that will be completed in March 2012. Results of this work will be presented to the pre-assessment workshop for incorporation into the stock assessment in 2012. It was noted that the last stock assessment was carried out in 2006, and an updated assessment is required. It was proposed that SPC be tasked with carrying out a revised stock assessment for presentation at SC8.

Management advice and implications

48. The stock status description and management advice from SC2 should be maintained, pending a new assessment or other new information.

North Pacific striped marlin

Status and trends

49. SC7 noted that no stock assessment was conducted for North Pacific striped marlin in 2011; therefore, the stock status description and management recommendations from SC6 are still current.

Management advice and implications

50. SC7 recommended an immediate reduction in fishing mortality for this stock, and noted that CMM 2010-01 was agreed on by WCPFC7 to achieve this goal, but that the catch limits in that CMM need to be reviewed to ensure that they are sufficient.

51. SC7 recommended that SPC should work with ISC on data-related work required for the next assessment. If ISC fails to provide stock assessment results by SC8, future stock assessments for this stock should be undertaken by the science services provider as part of the SC work programme.

Northern stocks

North Pacific albacore (CMM 2005-03)

Status and trends

52. SC7 noted that the ISC Albacore Working Group provided the following conclusions on the stock status of North Pacific albacore:

“Although there is uncertainty in the absolute estimates of biomass (total and SSB) and fishing mortality, the stock status and conservation advice based on the $F_{SSB-ATHL}$ reference point are relatively insensitive to these uncertainties as trends in SSB and recruitment are robust to the different plausible assumptions tested by the WG. Estimates of $F_{2006-2008}$ (current F) expressed as a ratio relative to several potential F -based reference points (F_{MAX} , $F_{0.1}$, F_{MED} , $F_{20-50\%}$) are less than 1.0 (Table 7-1, Report of ISC11) and SSB is currently around the long-term median of the stock and is expected to fluctuate around

the historical median SSB in the future assuming constant $F_{2006-2008}$ and average historical recruitment. The ratio $F_{2006-2008}/F_{SSB-ATHL}$ is 0.71, which means current F is well below the fishing mortality that would lead SSB to fall below the SSB-ATHL threshold.

Table NPALB1: Potential reference points and estimated F-ratio using $F_{current}$ ($F_{2006-2008}$), associated spawning biomass and equilibrium yield. $F_{SSB-ATHL}$ is not an equilibrium concept so SSB and yield are given as median levels.

Reference point	$F_{2006-2008}/F_{RP}$	SSB (mt)	Equilibrium yield (mt)
$F_{SSB-ATHL}$	0.71	346,382	101,426
F_{MAX}	0.14	11,186	185,913
$F_{0.1}$	0.29	107,130	170,334
F_{MED}	0.99	452,897	94,080
$F_{20\%}$	0.38	171,427	156,922
$F_{30\%}$	0.52	257,140	138,248
$F_{40\%}$	0.68	342,854	119,094
$F_{50\%}$	0.91	428,567	99,643

53. The working group concluded that overfishing is not occurring and that the stock is not likely to be in an overfished condition, (e.g. $F_{20-50\%} < 1.0$), although biomass-based reference points have not been established for this stock.

54. SC7 considered the $F_{SSB-ATHL}$ reference point to be a limit reference point.

Management advice and implications

55. SC7 noted the following conservation advice from ISC.

The ISC noted that $F_{2006-2008}$ is significantly below $F_{2002-2004}$ and provided the following recommendations on conservation advice:

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

Pacific bluefin tuna (CMM 2010-04)

Status and trends

56. SC7 noted that no stock assessment was conducted for Pacific bluefin tuna in 2011; therefore, the stock status description and management recommendations from SC6 are still current.

Management advice and Implications

57. SC7 recalled previous SC advice that it was important to reduce fishing mortality on Pacific bluefin tuna to 2002–2004 levels or below, particularly on juveniles in the 0–3 age classes and requested that the Northern Committee continue to monitor fishing mortality on age 0–3 fish.

North Pacific swordfish

Status and trends

58. SC7 noted that no stock assessment was conducted for North Pacific swordfish in 2011; therefore, the stock status description and management recommendations from SC6 are still current. SC7 noted that the last ISC assessment concluded that this stock is not overfished and overfishing is not occurring, and that current catch levels are sustainable. Continued monitoring of exploitation rates in the area north of 20°N is required to ensure that the stock remains well above B_{MSY} . SC7 noted that the Northern Committee has scheduled an assessment for this stock for 2013.

Management advice and implications

59. SC7 noted that at SC6, ISC concluded that both swordfish stocks in the North Pacific are healthy and above the level required to sustain recent catches. No management advice was provided. Therefore, the advice from SC6 should be maintained, pending a new assessment or other new information.

60. SC7 recommended that the Commission task the Northern Committee with providing the 2013 assessment to SC9 at its completion, for review.

MANAGEMENT ISSUES THEME

Terms of Reference

Recommendations

61. SC7 recommended that the Commission adopt the TOR for the Management Issues theme as outlined in Attachment F.

Limit reference points for the WCPFC

Recommendations

62. SC7 provided the following recommendations:
- a) SC7 recommended that the Commission note the working papers on the identification and evaluation of candidate limit reference points (LRPs) presented to SC7.
 - b) SC7 recommended that the Commission adopt a working definition for LRPs based on the following principles:
 - they define a state of the fishery that is considered to be undesirable and which management action should avoid;
 - the probability of breaching an LRP should be very low;
 - management actions should be taken before the fishery falls below or is at risk of falling below an LRP.
 - c) SC7 recommended that the Commission adopt the hierarchical approach (as outlined in SC7-MI-WP-03) to identify key LRPs for key target species in the WCPFC as follows:

Level	Condition	LRPs
Level 1	A reliable estimate of steepness is available	F_{MSY} and B_{MSY}
Level 2	Steepness is not known well, if at all, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated.	$F_{X\%SPR_o}$ and either $X\%SB_o$ or $X\%SB_{current, F=0}$
Level 3	The key biological and fishery variables are not well estimated or understood.	$X\%SB_o$ or $X\%SB_{current, F=0}$

- d) SC7 recommended that due to a high degree of uncertainty in the steepness parameter for yellowfin tuna and bigeye tuna, the Commission adopt a fishing mortality-based LRP based on a spawner-per-recruit level of $F_{X\%SPR_o}$ and a biomass based LRP based on a depletion level of either $X\%SB_o$ or $X\%SB_{current, F=0}$ for these species in the WCPFC.
- e) SC7 recommended that due to a high degree of uncertainty in the steepness parameter and uncertainties in some life history and fishery parameters for other key target species in the WCPFC, that the Commission adopt either an $X\%SB_o$ or an $X\%SB_{current, F=0}$ reference level as a biomass-based LRP for these species.
- f) SC7 recommended that SPC-OFP, using the most recent stock assessment models for South Pacific albacore, bigeye, skipjack, and yellowfin tunas undertake further analyses to evaluate the consequences of:
- o different levels of spawning-potential-per-recruit, $X\%SPR_o$ (where X is in the range 20–50% in 10% increments) to be associated with the adopted fishing mortality-based LRP;
 - o using either a $X\%SB_o$ or a $X\%SB_{current, F=0}$ biomass-based LRP (range of X of 10–40%); and
 - o adopting an SPR-based LRP for key target species other than yellowfin and bigeye tunas.
- g) Noting the progress made by ISC in developing reference points, SC7 recommended to the Commission that the Northern Committee consider similar analyses for the three stocks that they assess including for North Pacific albacore a comparison of these to the $F_{SSB-ATHL}$ reference point identified by the Northern Committee.
- h) SC7 recommended that the results of these further analyses be presented to, and reviewed by, the Management Objectives Workshop to be held in early 2012 and workshop conclusions be reported to SC8 for comment before consideration by the Commission.
- i) SC7 noted that once adopted, these reference points will need to be implemented along with harvest control rules. SC7 recommended that development of these harvest control rules should be included in the SC work plan and budget. Such harvest control rules must give adequate recognition to the fact that these are multi-species fisheries as well as the provisions of the Convention.
- j) SC7 recommended that the Commission hold open the consideration of other reference points (both target and limit) to reflect management objectives as they are identified and defined for other management related issues such as the impact of fishing on bycatch species and the ecosystem, as well as economic and social objectives. These could include empirical as well as model-based reference points.
- k) SC7 requested that SPC-OFP prepare a paper for the Management Objectives Workshop to identify and evaluate candidate target reference points for skipjack, including empirical reference points such as those based on CPUE as well as possible target reference points derived from stock assessment models.

Review of CMM 2008-01

Recommendations

63. SC7 recommended that TCC and the Commission note the following conclusions based on analyses presented in SC7-MI-WP-01 and SC7-MI-WP-05 and an updated version of WCPFC-2010/15 when reviewing the implementation of CMM-2008-01:

- a) that the number of days reported with any activity related to a drifting FAD was 13.5% in 2009 and 5.1% in 2010 during the FAD closure periods. Trends in FAD usage and associated catch information indicate that the FAD closure has been effective in reducing FAD use by the purse-seine fishery;
- b) the limits placed on purse-seine operations have not adequately constrained total purse-seine effort, with total effort in 2009 and 2010 estimated to be 25% and 32% (respectively) higher than 2001–2004 levels and the total purse-seine catch of bigeye during 2010 the eleventh highest on record;
- c) purse-seine catches of bigeye tuna (between 20°N and 20°S) declined in 2010 by 21.0% from 2009 and increased by 1.3% from the 2001–2004 average;
- d) closing areas to purse-seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation; and
- e) the provisional longline catch in 2010 was 30% lower than 2001–2004 levels. However, this estimate is based on incomplete data, and is despite an increase in fleet size. Furthermore, reductions in catch may not necessarily correspond to reductions in fishing mortality.

64. SC7 recommended that SPC-OFP update the projection results presented in SC7-MI-WP-02 and the results be presented to TCC7 and WCPFC8. These projections are to be based on the procedures outlined in the table and subsidiary notes below.

Factor	Options	Dimensions
Model runs	Base case model	1
Species	bigeye, skipjack, yellowfin	3
Recruitment	Recent average and SRR	2
Longline catch	1.2, 1.1, 1.0, 0.9, 0.8 times 2010 catches	5
Purse seine total effort (excluding Indonesia/Philippines excluding archipelagic waters)	2009 (low); 2010 (high)	2
FAD/unassociated set effort split (outside FAD closure)	2009 (high FAD use); 2010 (low FAD use)	2
Purse-seine FAD effort (including Indonesia/Philippines excluding archipelagic waters)	1.2, 1.1, 1.0, 0.9, 0.8, times total effort (with redistribution)	5
Indonesia/Philippines archipelagic waters fisheries	2010 catch and effort	2
Other fisheries (e.g. pole-and-line and Japanese coastal purse-seine)	1.2, 1.1, 1.0, 0.9, 0.8 times 2010 effort	5
Closures of purse-seine fishery	Two-month closure, three-month closure	2
CMM 2008-01 exemptions	With exemptions, without exemptions	2
	TOTAL RUNS	24,000

65. SC7 requested the following specific outputs in addition to those typically provided:

- projected stock status in relation to $20\%SB_o$ and $20\%SB_{2021, F=0}$;
- projected fishing mortality in relation to $F_{30\%SPRo}$ and $F_{40\%SPRo}$.

66. In addition, for a small subset of model runs, it is recommended that stochastic projections be undertaken and the probability of exceeding the above reference points be calculated.

Management Objectives Workshop

Recommendations

67. SC7 recommended that the WCPFC Secretariat, when drafting TOR for the Commission for the Management Objectives Workshop, take into consideration the TOR cleared by SC7 (see Attachment G).

68. SC7 recommended that the Commission take into consideration the previous recommendations made at SC6 relating to the Management Objectives Workshop, in particular i) that an independent international expert(s) be invited to the workshop to provide expert guidance on the use of reference points and other issues of relevance to identifying fisheries management objectives; and ii) that in order to assist with the success of the workshop, some preparatory scientific work (e.g. as identified in paragraph 334, f) and k), under Agenda Item 4.2) would need to be undertaken.

ECOSYSTEM AND BYCATCH MITIGATION THEME

Sharks

Recommendations

69. SC7 is concerned about the steep declining standardized catch rates and size trends of oceanic whitetip shark caught by longline and purse-seine fisheries in the WCPO. This species should be prioritized for further investigation in the second year of the Commission's Shark Research Plan in order to provide a better understanding of fishery impacts on this species.

70. SC7 recommended that WCPFC8 consider mitigation measures for oceanic whitetip sharks in the Convention Area and blue sharks in the North Pacific on the basis of existing information, both presented to SC7 and available from other studies.

71. The current Shark Research Plan is scheduled to conduct a stock assessment on oceanic whitetip sharks and silky sharks for SC8 and on blue sharks for SC9.

72. Recognizing the considerable body of work on shark catch mitigation including non-retention and live-release, deeper hook deployment on longliners (for epipelagic species), use of circle hooks, and prohibition on targeting, finning and wire leaders, SC7 further recommended that SC8 consider investigations into the effectiveness of mitigation measures for sharks.

73. SC7 recommended that WCPFC adopt the process for designating WCPFC key shark species for data provision and assessment.

Seabirds

Recommendations

74. SC7 noted that no management recommendations were formulated, and so management recommendations from SC6 are still current.

75. SC7 encouraged further research and the exchange of information intersessionally with a view toward evaluating the effectiveness of CMM 2007-04 at SC8.

Sea turtles

76. No issues on sea turtles were discussed.

Other species and issues

Guidelines for the release of encircled animals

Recommendations

77. SC7 recommended:
- a) avoiding any mortality of whale sharks and cetaceans by fishing activities;
 - b) the development of best practice guidelines for the release of encircled whale sharks without injury while considering the safety of the crew;
 - c) the development of best practice guidelines for the release of encircled cetaceans without injury while considering the safety of the crew; and
 - d) that the guidelines mentioned in b and c above be developed by an electronic discussion group led by the convener of the Ecosystem and Bycatch theme. The results from this group should be forwarded from SC to TCC7 for further consideration by WCPFC8.

FAD bycatch mitigation

Recommendations

78. SC7 noted the importance of food security issues and that these should be considered in the strategic research plan of the SC. It was suggested that the starting points be:
- a) a preliminary assessment of the volumes of food fish discarded in regional tuna fisheries, especially in tropical fisheries near developing states (conducted by an agency such as SPC); and
 - b) a proposal for the WCPFC to look further at the impact of tuna fishing on key food stocks, noting that Resolution 2005-03 identified mahi mahi, rainbow runner and wahoo as important for sustainable livelihoods.

DATA AND STATISTICS THEME

Data gaps

Data gaps of the Commission

Recommendations

79. SC7 recommended that SC7-ST-WP-01 be forwarded to the TCC, so that the Compliance with Conservation and Management Measures Working Group can consider it as a priority input to the development of the Compliance Monitoring Scheme.

80. SC7 recommended that CCMs consider the implications of adding text in “Scientific data to be provided to the Commission” – Section 5 (the provision of aggregated size data) to be consistent with the requirement to provide information on the statistical methods used to produce other types of fishery data (i.e. Section 1 – Annual catch estimates and Section 4 – Aggregated catch and effort data). CCMs are requested to report their progress on this issue to SC8. The recommended text to be added in Section 5 is:

“The statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data.”

81. SC7 recommended that CCMs consider the implications of adding text in “Scientific data to be provided to the Commission” to ensure that scientists are provided with information on changes in the way fishing takes place; information that is not captured in the available data. CCMs are requested to report their progress on this issue to SC8. The recommended text to be added to Sections 3, 4 and 5 in this document is:

“Information on operational changes in the fishery that are not an attribute in the data provided are to be listed and reported with the data provision.”

82. SC7 noted delays in the provision of complete data sets by the April 30th deadline in accordance with WCPFC data rules “Scientific data to be provided to the Commission”. CCMs are encouraged to develop better processes to provide data to WCPFC earlier than the 30 April deadline, to allow for earlier development of stock assessments and sufficient time for CCMs to consider them in advance of SC meetings.

83. SC7 noted the importance of historical data to reduce uncertainties in the scientific work of the Commission, and recommended that CCMs consider ways to improve the submission of historical data, and its use for scientific purposes.

84. SC7 encouraged the WCPFC Secretariat to cooperate with other tuna RFMOs to establish a common format for reporting on data gaps, as recommended at the Kobe III meeting.

85. SC7 noted the catch attribution issues relating to Chinese longline catches in Kiribati waters and the under-reported catches stemming from 2009 and 2010 by these Chinese vessels licensed to fish in Kiribati. SC7 encouraged China to resubmit its data for 2009 and 2010. SC7 noted that Kiribati has not been provided with complete records for these data, by China, but would submit it to the Commission if it was provided to Kiribati. China claims to have met all of its data reporting obligations according to the agreement between Kiribati and China. Noting the influence of the unclaimed bigeye catches (approximately 4,000 mt in 2009) on the bigeye assessment and projection outcomes for WCPFC8, SC7 forwarded this to the TCC for its consideration. SC7 further noted that any projections produced would be more accurate with these data included.

86. SC7 noted the increase of Chinese vessels in the WCPFC Convention Area from waters beyond the WCPO. SC7 further noted that Kobe II recommendations state that tuna fishing vessels should not be transferred between different RFMO areas, unless in accordance with the rules of that RFMO.

Species composition of purse-seine catches

Recommendations

87. SC7 noted the importance of this work and so recommended a no-cost extension of Project 60 through 2012. The SC will review the financial status of the project at SC8.

88. SC7 requested that the scope of work for Project 60 be amended to include the provision of a plan for improving the availability and use of purse-seine catch composition data, applying the results from the project. This plan should form the basis for the recommended review of the future of the project to be conducted at SC8. This plan should be available for consideration by the Commission at WCPFC8.

89. SC7 noted inconsistencies among fleets in the reporting of skipjack and yellowfin+bigeye on purse-seine logsheets, and considering the importance of accurate purse-seine catch composition data for scientific purposes, recommended that SC7-ST-WP-02 be referred to TCC.

Data issues with ISC

Recommendations

90. SC7 noted the progress made in reconciling data holdings between ISC and WCPFC, as reported in SC7-ST-IP-10.

Regional Observer Programme

Recommendations

91. SC7 noted SC7-ST-IP-08 and the progress made in auditing the ROPs.

West Pacific East Asia Oceanic Fisheries Management Project

Recommendations

92. SC7 noted the progress made through the WPEA OFM Project as outlined in SC7-ST-IP-12, and supported the continuation of this work.

Tagging initiatives

Recommendations

93. SC7 adopted SC7-ST-WP-04, the Summary Report of the Fifth Steering Committee Meeting for the PTTTP.

COOPERATION WITH OTHER ORGANIZATIONS

The status of cooperation and relations

94. Some members requested that the MOU between WCPFC and ISC be updated as a matter of priority, with progress on this matter to be made before WCPFC8.

FUTURE WORK PROGRAMME AND BUDGET

Strategic Research Plan of the Scientific Committee

95. SC7 reviewed the draft Strategic Research Plan provided by the informal small group (ISG) and adopted it (Attachment I).

Review of the Scientific Committee work programme

96. SC7 agreed to refine the list of SC work programme that was established at SC3 (Attachment O of the SC3 Summary Report) intersessionally and review it at SC8.

Development of 2012 work programme and budget, and projection of 2013-2014 provisional work programme and indicative budget

97. The indicative science services provider budget for 2012 is USD 792,000.

98. Annex 1 of the 2012 MOU with the science services provider may contain additional activities, including:

- indicator papers for bigeye, yellowfin or skipjack tunas for those years when a stock assessment is not conducted; and
- possible production of stock status indicators for South Pacific swordfish, noting that this may be confirmed at WCFPC8 when data available for this work may be better evaluated.

99. SC7 identified the following four assessments to be conducted by the science service provider and presented to SC8:

- A stock assessment for South Pacific albacore.
- A stock assessment for southwestern Pacific striped marlin.
- Stock assessments for oceanic whitetip and silky sharks.

100. SC7 identified several high priority projects in 2012, including:

- a) The peer review of the bigeye tuna stock assessment. SC7 obligated USD 30,000 in the 2011 budget to conduct the peer review.
- b) Scientific support for the Management Objectives Workshop to identify and evaluate candidate LRPs (SPR and biomass). SC7 obligated USD 20,000 in the 2011 budget (scoping the use of reference points) for this project.
- c) Scientific support for the Management Objectives Workshop to identify and evaluate candidate target reference points, especially for skipjack. SC7 requested the Commission to carry over the USD30,000 in the 2011 budget and obligate USD 30,000 in the 2012 budget. (Technical support for the Management Objectives Workshop) for this project.
- d) The development of harvest control rules for the Management Objectives Workshop. SC7 proposed USD 30,000 in the 2012 budget for this project.
- e) Bigeye aging and maturity project requires an allocation of USD 55,000 for 2012.

101. SC7 recommended that the SC work programme and budget for 2012 and indicative budget for 2013 and 2014, be as follows:

Table 1. List of Scientific Committee work programme titles and budget for 2012, and indicative budget for 2013–2014, which require funding from the Commission’s core budget (in USD).

Research Activity / Project with priority	2012	2013	2014
Project 14. WPEA OFM	25,000	25,000	25,000
Project 35. Refinement of bigeye parameters	55,000	70,000	75,000
Project 42. Pacific-wide tagging project	10,000	10,000	10,000
Technical support for Management Objectives Workshop (target reference points)	carried over (30K)		
Harvest control rules	30,000	30,000	
SUBTOTAL	120,000	135,000	110,000
UNOBLIGATED BUDGET	76,000	83,000	91,000
SPC-OFP BUDGET	792,000	871,200	958,320
GRAND TOTAL	988,000	1,089,200	1,159,320

ADMINISTRATIVE MATTERS

Peer review of stock assessments

102. SC7 agreed that the peer review of the 2011 bigeye tuna assessment should be conducted in 2012 in a way to contribute to future bigeye assessments:

- a) The peer review panel would be selected and contracted early enough so that 2011 assessment results (possibly including all the input data, modeling software, output of basic runs as well as all the sensitivity runs) can be given to the panel for advanced reviewing;
- b) In 2012, the panel will hold a workshop for approximately two days on peer review of the 2011 assessments, and a further three days on reviewing and advising on various aspects of subsequent assessments;
- c) Regarding the participants in the workshop, SC7 decided to limit attendance to peer review panel members and scientists directly involved in the bigeye assessments;
- d) The peer review panel should send the draft report of its results to SPC for review and response. Once it is finalized, the report and response from SPC should be submitted to the WCPFC Executive Director, in advance of SC8 where it will be considered.
- e) The peer review panel should be composed of three independent scientists that have significant expertise and experience in all aspects of stock assessments, preferably in relation to tuna stock assessments. The reviewers should not be directly involved with current WCPFC bigeye assessments. The peer review contract may be offered to individuals. The WCPFC Secretariat will approach IATTC to request the provision of a reviewer.
- f) The selection procedure of reviewers and timeframe are:
 - o Each CMM may recommend one candidate through their official WCPFC contacts by 15 October 2011.
 - o The Chair and Vice-Chair of the Commission, the SC Chair and the Executive Director will select five candidates for short listing, and circulate the shortlist with their curriculum vitae to all official WCPFC contacts by 1 November 2011.
 - o The official WCPFC contacts will rank the five candidates with scores 1 (most preferred) to 5 (less preferred) and submit these rankings to the WCPFC Science Manager by 20 November 2011.

- g) If any of the three individuals are unable to undertake the review, the shortlisted candidate with the next lowest score will be invited to join the peer review panel. The peer review panel should be finalized by 15 January 2012.
- h) The peer review panel would be composed of three reviewers in total and the total allocated budget is USD 30,000.
- i) SC7 adopted the draft peer review process for the Commission's consideration and endorsement (Attachment J).

Future operation of the Scientific Committee

103. SC7 adopted the following recommendations:
- a) Hold the Data and Statistics theme before the Stock Assessment theme.
 - b) Add blocks of time to the indicative schedule where draft recommendations developed by the theme convenors are reviewed and adopted.
 - c) A small group (led by the Management Issues theme convenor) to review intersessionally the option of moving agenda items presently within the Stock Assessment theme on discussion and adoption of management advice and implications for each species to an agenda item within the Management Issues theme.
 - d) SC8 to retain the process adopted for SC7 that important papers within the Biology, Methods, and Fishing Technology themes are to be presented either at the SPC Pre-Assessment Workshop or at the SC meeting within the most appropriate Theme. SC8 is to decide on the future need for retaining the Biology, Methods, and Fishing Technology themes.
 - e) A review of the time allocated to each theme to be undertaken when the indicative schedule for SC8 is prepared.
 - f) A document on the "Guidelines for Theme Convenors and SC Chairs" is to be drafted intersessionally. This task will be led by the SC Chair in consultation with the SC Vice-Chair and theme convenors.

Next meeting

104. SC8 is provisionally scheduled for 7–15 August 2012, with the venue to be determined intersessionally and agreed on at WCPFC8.

Selection of officers

105. P. Maru will end her first term as Vice-Chair of the SC in December 2011. SC7 deferred the selection of a new Vice-Chair to WCPFC8.

ADOPTION OF THE REPORT

106. SC7 adopted its Summary Report.

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

**Scientific Committee
Seventh Regular Session**

**Pohnpei, Federated States of Micronesia
9–17 August 2011**

SUMMARY REPORT

AGENDA ITEM 1 – OPENING OF THE MEETING

1.1 Welcome address

1. The Chair of the Scientific Committee, N. Miyabe (Japan), welcomed delegates to the meeting of the Seventh Regular Session of the Scientific Committee (SC7), which took place in Pohnpei, Federated States of Micronesia from 9–17 August 2011. The list of participants is appended as Attachment A.
2. G. Hurry, Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC), gave welcoming remarks.
3. The Honourable John Ehsa, Governor of Pohnpei, gave the keynote speech (Attachment B).
4. The following countries attended the session as WCPFC Members, Cooperating Non-Members, and Participating Territories (CCMs): Australia, China, Cook Islands, European Union (EU), Federated States of Micronesia (FSM), Fiji, French Polynesia, Indonesia, Japan, Kiribati, Korea, Marshall Islands (RMI), Nauru, New Caledonia, New Zealand, Palau, Papua New Guinea (PNG), Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States of America (USA), Vanuatu and Vietnam. The following CCMs were unable to attend: American Samoa, Belize, Canada, Commonwealth of the Northern Mariana Islands, Ecuador, El Salvador, France, Guam, Kiribati, Mexico, Niue, Panama, Senegal, Thailand, and Wallis and Futuna.
5. Birdlife International, Greenpeace, Inter-American Tropical Tuna Commission (IATTC), International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), International Sustainable Seafood Foundation (ISSF), Pacific Islands Forum Fisheries Agency (FFA), Secretariat of the Pacific Community (SPC), Pew Charitable Trust (PEW), Parties to the Nauru Agreement (PNA), Southeast Asian Fisheries Development Center (SEAFDEC), and United Nations Development Programme (UNDP) attended as observers.
6. Key matters considered by SC7 and its thematic groups — Ecosystem and Bycatch Mitigation (EB), Management Issues (MI), Data and Statistics (ST), and Stock Assessment (SA) — included:
 - a) a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
 - b) a review of the status of stocks of bigeye tuna, yellowfin tuna, skipjack tuna and South Pacific albacore tuna in the WCPO;
 - c) a review of the most recent information and assessments for tuna and billfish stocks in the North Pacific Ocean;

- d) a review of research on the status and assessment of key pelagic shark stocks in the WCPO;
- e) bycatch mitigation issues associated with seabirds, sharks, other animals, and the report of Kobe Joint Technical Working Group on Bycatch;
- f) issues associated with the data available to the Commission, and initiatives to address data gaps;
- g) the status of the West Pacific East Asia Oceanic Fisheries Management (WPEA OFM) Project, the Japan Trust Fund (JTF), and the Pacific Tuna Tagging Project (PTTP);
- h) developing a Strategic Research Plan 2012–2016;
- i) recommendations for the 2012 SC Work Programme and Budget; and
- j) functioning and structure of future SC meetings.

1.2 Meeting arrangements

7. The Secretariat outlined the meeting schedule and administrative arrangements.
8. SC7 endorsed the convenors and co-convenors for the following theme sessions:
 - a) Stock Assessment: J. Brodziak (USA) and N. Miyabe (Japan)
 - b) Management Issues: R. Campbell (Australia)
 - c) Ecosystem and Bycatch: P. Dalzell (USA) and J. Amoe (Fiji)
 - d) Data and Statistics: Pamela Maru (Cook Islands)
9. During SC7, there were side sessions for a tutorial of the tuna management simulator (TUMAS) and the steering committee meetings for WPEA OFM Project, PTTP and JTF.
10. Informal small groups were convened to address matters related to:
 - a) developing the terms of reference and an indicative budget for the peer review of the 2011 stock assessment for bigeye tuna;
 - b) developing the Strategic Research Plan 2012–2016;
 - c) preparing the scientific terms of reference for a Management Objective Workshop; and
 - d) formulating recommendations for the 2012 SC work programme and budget, and projecting the 2013–2014 provisional work programme and indicative budget.

1.3 Issues arising from the Commission

11. The Commission's Science Manager introduced SC7-GN-WP-03 (Issues arising from the Commission), and highlighted key issues and tasks to be addressed by SC7.

1.4 Adoption of agenda

12. The provisional agenda was adopted after the addition of a new agenda item — 10.5 (Selection of SC officers) — in order to consider the new Vice-Chair and theme convenors (Attachment C).

1.5 Reporting arrangements

13. SC7 agreed to adopt a Summary Report on the last day of the meeting, with the SC's recommendations to the Commission approved during the course of the meeting (following each thematic discussion) whenever possible. An Executive Summary, which would serve as the basis for the report, advice and recommendations of the SC to the Commission, would be prepared by the Secretariat following the meeting.

14. A list of abbreviations and acronyms used in this report, and a list of documents for SC7 are included as Attachment D and Attachment E, respectively.

1.6 Intersessional activities of the Scientific Committee

15. The Science Manager presented a brief report on the SC’s intersessional activities for the last 12 months (SC7-GN-IP-01), highlighting the outputs and services of the Commission’s science services provider (SPC’s Oceanic Fisheries Programme, or SPC-OFP), publication of the SC6 Summary Report, WPEA OFM Project and JTF activities, and progress of the SC work programme.

AGENDA ITEM 2 – REVIEW OF FISHERIES

2.1 Overview of the western and central Pacific Ocean fisheries

16. P. Williams (SPC-OFP) and C. Reid (FFA) co-presented an “Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions — 2010” (SC7-GN-WP-01). The provisional total Western and Central Pacific Fisheries Commission (WCPFC) Convention Area tuna catch for 2010 was estimated at 2,414,994 mt, the second highest annual catch recorded, and 80,000 mt lower than the previous record in 2009 (2,494,112 mt). During 2010, the purse-seine fishery accounted for an estimated 1,820,844 mt (75% of the total catch), the pole-and-line fishery an estimated 171,604 mt (7%), the longline fishery an estimated 239,853 mt (10%), and the remaining catch (7%) was taken by troll gear and a variety of artisanal gear types, mostly in eastern Indonesia and the Philippines. The Convention Area tuna catch (2,414,994 mt) for 2010 represented 84% of the total Pacific Ocean catch of 2,875,909 mt, and 60% of the global tuna catch (the provisional estimate for 2010 is 4,017,660 mt, which is the lowest in eight years).

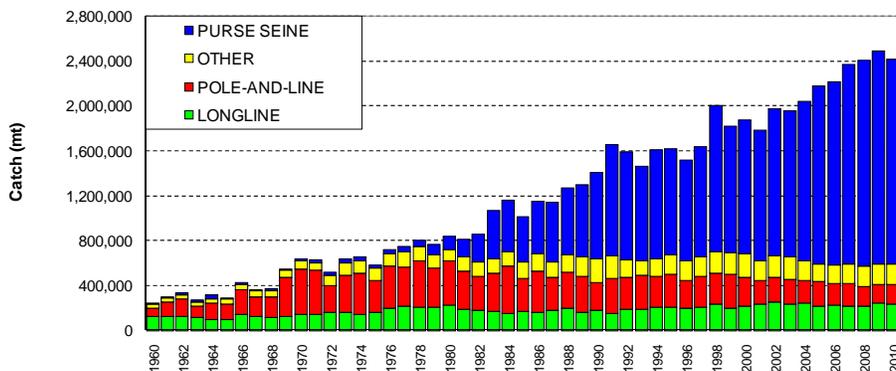


Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area, by longline, pole-and-line, purse seine and other gear types.

17. The 2010 Convention Area catch of skipjack (1,706,166 mt – 71% of the total catch) was the second highest recorded and 115,000 mt less than the previous record catch of 2009 (1,821,770 mt). The Convention Area yellowfin catch for 2010 (470,161 mt – 19%) was more than 50,000 mt higher than the 2009 catch level, but still 70,000 mt lower than the record catch taken in 2008 (541,262 mt). The Convention Area bigeye catch for 2010 (108,997 mt – 5%) was the lowest since 1996, mainly due to a drop in 2010 provisional estimates for the longline fishery. The 2010 Convention Area albacore catch (129,670 mt – 5%) was the second highest on record, with very good catches from the longline fishery.

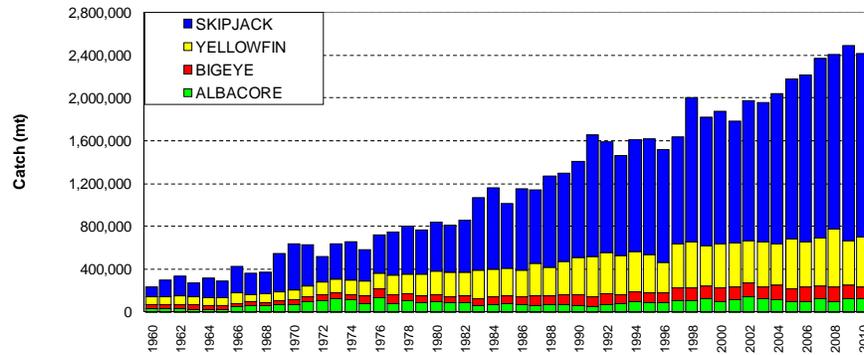


Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area.

18. The provisional 2010 purse-seine catch of 1,820,844 mt was the third highest on record for this fishery, at more than 80,000 mt lower than the record attained in 2009. The 2010 purse-seine skipjack catch (1,476,819 mt) was the second highest on record, but significantly lower (130,000 mt) than the record catch in 2009; the proportion of skipjack tuna in the logsheet-reported total catch (81%)¹ was in line with the average for recent years. The 2010 purse-seine catch of yellowfin tuna (300,339 mt – 16%) rebounded (by 54,000 mt) from the relatively low catch of 2009, but was still significantly lower than the record catch taken in 2008 (391,152 mt). The provisional catch estimate for bigeye tuna for 2010 (43,389 mt) was the third highest on record but may be revised once all observer data for 2010 have been received and processed.

19. The 2010 pole-and-line catch (171,604 mt) was a slight improvement (6,000 mt) on the 2009 catch level, which was the lowest annual catch since the mid-1960s. The Japanese distant-water and offshore (110,612 mt in 2010) fleets, and the Indonesian fleets (60,415 mt in 2007), account for most of the Convention Area pole-and-line catch. Catches by the Japanese distant-water and offshore fleets in recent years have been the lowest for several decades and this is no doubt related to the continued reduction in vessel numbers (in 2009 and 2010 reduced to only 96 vessels, the lowest on record). The Solomon Islands fleet recovered from low catch levels experienced in the early 2000s (only 2,773 mt in 2000 due to civil unrest) to reach a level of 10,448 mt in 2003. This fleet ceased operating in 2009, but there are expectations of it resuming activities in 2011.

20. The provisional Convention Area longline catch (239,853 mt) for 2010 was the fourth highest on record, at around 17,000 mt lower than the highest on record attained in 2002 (256,582 mt). The Convention Area albacore longline catch (104,482 mt – 44%) for 2010 was the highest on record, 12,000 mt higher than the previous record (92,539 mt in 2009). In contrast, the provisional bigeye catch (58,324 mt – 24%) for 2010 was the lowest since 1996, but may be revised upwards when final estimates are provided. The yellowfin catch for 2010 (76,067 mt – 32%) was slightly higher than the average catch level for this species over the period 2000-2010.

21. The 2010 troll albacore catch (2,141 mt) was slightly higher than the catch in 2009, which was the lowest since 1986, and was apparently due to poor catches experienced by the New Zealand domestic fishery. The New Zealand troll fleet (136 vessels catching 1,834 mt in 2010) and the United States troll fleet (6 vessels catching 307 mt in 2010) typically account for most of the albacore troll catch, with minor contributions coming from fleets from Canada, the Cook Islands and French Polynesia when their fleets are active (which was not the case in 2010).

¹ However, recent studies using observer data (e.g. Lawson 2007, 2010; Hampton and Williams 2011a) show that the logsheet-reported catch, mainly for associated sets, should contain higher quantities of yellowfin and bigeye tunas, which have been misreported as skipjack tuna.

Economic overview of WCPO tuna fisheries

Purse-seine fishery

22. It was noted that Bangkok, Thailand, skipjack prices averaged around USD 1,220/mt in 2010 — an increase of 11% from 2009 — and further increased in 2011, averaging over USD 1,600/mt over the period January to July to be 28% higher than over the same period in 2010. At Yaizu, purse-seine caught skipjack prices were steady in Japanese yen terms at JPY 124/kg but as a result of the depreciation of the US dollar against the Japanese yen, prices rose by 6% on 2009 levels to USD 1,410/mt. It was also noted that Bangkok prices over the period January 2007 to July 2011 averaged USD 1,320/mt — 63% higher than the average over the period 2002–2006. With respect to yellowfin prices, Bangkok prices averaged around USD 1,560/mt in 2010 — an increase of 4.5% from 2009 — and further increased in 2011, averaging over USD 2,050/mt over the period January to July to be 32% higher than over the same period in 2010. At Yaizu, prices rose 18% to JPY 252/kg. The value of the purse-seine fishery in 2010 was estimated to be USD 2,480 million, an increase of 5% on 2009 and the second highest on record. This was driven by a 39% increase in the value of the yellowfin catch to USD 500 million while the value of the skipjack catch remained steady at around USD 1.9 billion.

Pole-and-line fishery

23. It was noted that the value of the pole-and-line fishery in 2010 remained steady at around USD 340 million.

Longline fishery

24. It was noted that longline-caught yellowfin and bigeye prices were generally higher in 2010, continuing a recent trend of increasing prices. Longline-caught yellowfin prices at Yaizu averaged JPY 634/kg (USD 7.22/kg) up 3% (10%) from 2009, while fresh yellowfin import prices from Oceania averaged JPY 895/kg (USD 10.20/kg) up 6% (13%) from 2009. Prices for frozen bigeye imports into Japan in 2010 were JPY 968/kg (USD 11.02/kg) up 8% (15%) from 2009 levels. It was noted that the Bangkok albacore market price (10 kg and more, cost and freight) averaged around USD 2,500/mt over 2010 similar to that seen over 2009, with prices in the first half of 2011 rising significantly to around USD 3,000 at the end of June. The estimated delivered value of the longline tuna catch in the Convention Area for 2010 is USD 1,487 million. This represents a marginal increase of USD 27 million (or 2%) on the estimated value of the catch in 2009 with the value of the albacore and yellowfin catch increasing by USD 35 million (14%) and USD 24 million (4%), respectively, while the value of the bigeye catch declined by USD 32 million (5%).

Discussion

25. It was requested that in the future, if the SC considers that the adjusted catch figures represent the best available estimates of the catch, that this report use the adjusted catch figures, which are currently only reflected in the annex of SC7-GN-WP-01. It was also suggested that it may be worth including a small section in the report to document relevant environmental changes over time and that the report include an additional figure demonstrating the percentage of total purse-seine catch by school type.

26. It was noted that the increasing trend in prices of yellowfin and bigeye tuna from the longline and pole-and-line fisheries has largely been due to changes in the Japanese yen:US dollar exchange rates. However the SC was advised that other factors, such as increasing fuel prices, also impact the market price of tuna.

27. It was also noted that the impacts of the March 2011 Japanese tsunami upon the price structure in Japanese markets are likely to become more evident this year. Some CCMs considered it significant that the paper showed reductions in the total catch of the fishery, particularly from purse-seine fishing. It was suggested that the reduction in the total catch from the fishery in 2010 — particularly from purse-seine fishing, along with the large decrease in the number of sets on fish aggregation devices (FADs) and the associated decline in skipjack catch per unit of effort (CPUE) — may represent evidence of fishery changes that have occurred largely as a result of conservation and management measure (CMM) 2008-01. However, further research to fully understand recent declines in skipjack catches in the face of increased purse-seine effort would be useful. Some members expressed concern about the recent increased catch of albacore outside, but close to the exclusive economic zones (EEZs) of South Pacific Island countries, whose longline fisheries are dependent on this species.

2.2 Overview of Eastern Pacific Ocean fisheries

28. K. Schaefer (IATTC Secretariat) presented a summary of the fisheries and assessments of major stocks of tuna exploited in the EPO in the 2010 review of EPO fisheries (SC7-GN-WP-02). The fishing capacity of the purse-seine fleet fishing in the EPO has increased over the last 10 years, but stabilized in mid-2006. The reported nominal longline effort has fluctuated between about 300 and 100 million hooks set annually between 1981 and 2005, and declining since then. Total tuna catches increased starting in 1996, peaked in 2003, and declined in 2010 to a level of about 15 years previously.

29. Yellowfin tuna catches have remained fairly stable since the mid-1980s, except for a peak in 2001 through 2003 followed by a substantial decline in 2006 through 2008, followed by a slight increase in 2009 and 2010. The 2010 catch on dolphin-associated schools is similar to the average of the past 15 years. In contrast, catches of yellowfin in unassociated schools have been decreasing over the past 10 years. The current stock assessment method used for yellowfin is STOCK SYNTHESIS III. Since 2004, recruitment has been relatively low, although not quite as low as it was from 1977 through 1983. The spawning stock size is below the level corresponding to maximum sustainable yield (MSY), but fishing mortality rates are slightly below those corresponding to the MSY level. The current stock status is considerably more pessimistic if a stock recruitment relationship is assumed.

30. The status of the skipjack stock has been evaluated using eight different data- and model-based indicators. The purse-seine catch has been increasing significantly since 1994; in 2008, it was above the upper reference level, but in 2010 it was close to the 1975–2010 average. Except for a large peak in 1999, the catch per days fished on floating objects has been relatively stable since 1992. The biomass and recruitment have been increasing over the past 10 years, although both of these indices decreased in 2010. The exploitation rate has been increasing over the past 20 years with a peak in 2002 and above average rates since that year. The main concern with the skipjack stock is the above-average exploitation rate.

31. There have been substantial historical changes in the EPO bigeye fishery. Beginning in 1994, purse-seine catches increased substantially by targeting tunas associated with drifting FADs in the equatorial EPO. Longline catches have been significantly less during the past 15 years as compared with the previous 20-year period. The current stock assessment method used for bigeye is STOCK SYNTHESIS III. Recruitment estimates have been above average since around 2001. Recent estimates indicate that the bigeye stock may not be overexploited because spawning biomass ratio levels are above those corresponding to the MSY, but that overfishing may be taking place. The current status of the stock is considerably more pessimistic if a stock recruitment relationship is assumed.

32. A tuna conservation resolution was adopted by IATTC in June 2011, for the three-year period 2011–2013. This includes an EPO-wide closure for purse-seine (>182 mt) fishing of 62 days in each of those years, along with a 30-day closure of a core offshore FAD fishing area. There is a special provision for class 4 vessels (182–272 mt), which permits 30 days of fishing during the EPO closure provided an

observer is aboard. For longline vessels (>24 m), the resolution includes fixed bigeye catch limits for China, Japan, Korea, Chinese Taipei, and other CPCs² not to exceed 500 mt or their respective catches in 2001, whichever is greater.

Discussion

33. SC7 was advised that a decline in the 2010 skipjack catch was due to relatively low recruitment in this period. Annual skipjack catches in the EPO have commonly varied by a factor of three. It is believed that this is due to variations in recruitment that are linked to environmental factors. Research has been conducted to look at the influence of environmental factors on survival of early life history stages of yellowfin tuna at the IATTC Panama laboratory, although the results of this research have not yet been used to quantitatively assess recruitment impacts. Other research has indicated that El Niño periods are followed by higher yellowfin recruitment.

34. Concern was expressed regarding the use of a steepness value of 1 in the base case EPO yellowfin and bigeye tuna assessments, and it was suggested that a more realistic value could be applied following appropriate reproductive ecology studies or that the assessments might use steepness values determined for related teleost species. SC7 was advised that IATTC applied a steepness value of 1 due to a lack of empirical evidence for a more appropriate value. The question of whether it is appropriate or not to apply differing values of steepness to the same species in the EPO and the WCPO was deferred to the stock assessment theme session. SC7 was advised that the decrease in longline catches in the EPO from 2003 to 2010 is largely due to a dramatic decrease in nominal fishing effort by the large industrial fishing fleets, especially those of Japan.

35. One CCM recommended that in their annual stock assessment papers to the SC, SPC might provide a similar figure to Figure B4 (of SC7-GN-WP-02) as this would facilitate better understanding of fishery impacts on the stock.

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

Australia

36. Australian commercial fisheries for highly migratory species in the WCPFC Convention Area are managed as part of the Eastern Tuna and Billfish Fishery (ETBF) (a mainly longline fishery with a small minor line component) and the Eastern Skipjack Fishery (a purse-seine fishery). The majority of fishing occurs in the longline sector of the ETBF and as such, is the focus of the annual report.

37. Total catches reported in logbooks for the ETBF decreased from 5,403 mt in 2009 (5,271 mt longline, 132 mt minor line) to 5,034 mt in 2010 (5,031 mt longline, 2.8 mt minor line). This is a decline from a peak of 8,229 mt in 2002. Longline fishing effort has fallen from a peak of 12.40 million hooks in 2003 to 7.84 million hooks in 2010. The decrease in fishing effort from 2003 levels is the result of the strength of the Australian dollar, increased operating costs, the surrender of permits under the structural adjustment component of the recent Australian government “Securing Our Fishing Future” package, as well as the introduction of hook limits in 2009. In 2011, catch limits were introduced for albacore, bigeye and yellowfin tuna, for striped marlin and for swordfish. Fifty-four vessels reported longlining in the WCPFC Convention Area during 2010. Forty-eight of these caught swordfish south of 20°S. Longline logbook catches of albacore tuna decreased from 1,344 mt in 2009 to 725 mt in 2010. Longline catches of bigeye tuna decreased from 509 mt in 2009 to 436 mt in 2010. In contrast, longline catches of yellowfin

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

tuna increased from 1,183 mt in 2009 to 1,310 mt in 2010. Longline catches of swordfish decreased from 1,111 mt in 2009 to 916 mt in 2010, including 884 mt caught south of 20°S. Longline catches of striped marlin decreased from 326 mt in 2009 to 244 mt in 2010. Longline catches of skipjack decreased from 10 mt in 2009 to 3 mt in 2010. There were four minor line vessels in 2010 actively targeting tuna and billfish species. The number of vessels reportedly using minor line has steadily decreased from a peak of 52 vessels in 2001. This is partly due to the surrender of 49% of permits under the structural adjustment component of the Australian Government “Securing Our Fishing Future” package. Annual minor line effort decreased from 168 lines in 2009 to 13 lines in 2010. In the 2009–2010 fishing season, there were no active vessels in the Eastern Skipjack Fishery.

38. The Australian Fisheries Management Authority (AFMA) observer programme has deployed observers on domestic longliners since 2001 as part of a programme to test the efficacy of seabird mitigation devices. Since July 2003, observers have been deployed more broadly across the fishery with the aim of collecting additional fishery data, including information on fishing gear and the size and species composition of catches. In 2010, observers monitored 284,731 hooks in the longline fishery (3.6% of the total number of hooks deployed). AFMA introduced quota-based management in the form of individual transferable quotas into the ETBF in February 2011 for the 2011–2012 fishing season, which began 1 March 2011. This provides for total allowable catches for the five main target species.

Belize

39. Belize’s longline tuna fishing fleet operating in the WCPFC Convention Area has shown a steady decrease in its catch and effort from 2004 to 2010. There has been a reduction, from 30 vessels fishing exclusively in 2004 to 6 vessels in 2010. All six of these vessels were licensed exclusively for operation in the WCPFC Convention Area. Belize also has two refrigerated carriers currently operating in the WCPFC Convention Area. Due to the reduction in fishing effort, all of Belize’s catches have decreased compared with earlier years. There has been a 96% reduction in overall catches, from 3445.99 t in 2003 to 140.10 mt in 2010. However, this reduction is as a result of five vessels being laid up for most of the year due to socio-economic costs. Albacore was the main target species from 2003 to 2006. However, catches of yellowfin tuna exceeded those of albacore in 2007 and up to 2009. Bigeye tuna catches exceeded that of yellowfin tuna in 2010. The average size of Belize’s vessels has also risen from 191 gross tonnage (GT) in 2003 to 497 GT in 2008, and 576 GT in 2010. The majority of the vessels operating during the period 2003–2006 were between 51GT and 200 GT. In 2010, six of vessels were over 500 GT.

40. Blue marlin is the most common non-tuna bycatch in Belize’s longline fishery, followed by striped marlin and blue shark. Large reductions in longline effort have resulted in the reduction in catches of major bycatch species. Belize did not receive any reports of seabird or sea turtle interactions by its vessels in 2010. In 2008, Belize introduced measures to mitigate the impact of fisheries for highly migratory fish stocks on seabirds and sea turtles, and advised the Secretariat of the measures currently being used by Belizean vessels. Fishing vessel owners and operators are required to submit data relating to their fishing operations based on a format for such reporting and in compliance with the WCPFC’s reporting guidelines. For the purposes of ensuring compliance, surveillance is conducted on a regular basis or as a result of an investigation. In the future, Belize intends to re-expand its longline fishing fleet to 10 fishing vessels, which will fish exclusively in the Convention Area and within the limits set by the WCPFC.

Canada

41. Catch, effort and catch per unit of effort (CPUE) data for Canadian albacore (*Thunnus alalunga*) fishery in the WCPFC Convention Area for 2010 are summarized in this document. The Canadian tuna fishery is a troll fishery that uses jigs, and targets albacore exclusively. The Canadian fishery was inactive within the WCPFC Convention Area in 2010, with no effort or catch reported in statistical zones within

the Convention Area in either the north or south Pacific Oceans. Annual albacore tuna catches by the Canadian troll fleet in the Convention Area between 2002 and 2008 have ranged from 83 mt in 2005 to 453 mt in 2003, and effort has ranged from 56 vessel-days in 2007 to 408 vessel-days in 2002. Both catch and effort by the Canadian fleet in the WCPFC Convention Area have declined since 2002. Two Canadian scientists participated in and chaired two ISC-Albacore Working Group workshops in 2010.

China

42. China has two types of tuna fisheries operating in the WCPFC Convention Area: longline and purse-seine. The longline fishery consists of ice fresh tuna longline and deep frozen tuna longline. In 2010, total tuna catch from the longline fishery and the purse-seine fishery was estimated to be 31,806 mt and 53,716 mt, respectively. There are 244 longline vessels and 12 purse-seine vessels operating in these two fisheries. Catches by the Chinese deep longline fishery for bigeye are exported to Japan for sashimi, and longline catches of albacore are sold for cannery products. Purse-seine catches of skipjack are also sold for cannery products. During 2010, four observers were trained and dispatched to Chinese longline vessels in the high seas areas of the central and eastern Pacific Ocean. The first observer trip collected fishery data and biological data from 26 August 2010 to 19 December 2010, covering the areas 10°21'N to 9°46'S, and 178°58'E to 152°15'W. The second trip was taken from 25 September 2010 to 17 January 2011, covering the areas 3°46'S to 9°26'S, and 149°52'W to 154°19'W. The third trip was taken from 2 October 2010 to 13 January 2011, covering the areas of 6°00'N to 10°49'S, and 169°05'W to 146°50'W. The fourth trip was taken from 13 October 2010 to 19 February 2011, covering the areas of 4°38'N to 14°45'S, and 178°01'E to 130°07'W. Size data for bigeye tuna, yellowfin tuna and swordfish has been submitted to WCPFC. Data coverage of catch and effort was 100%, and 100% logbook coverage collection for the longline fishery has been carried out, which will promote China's data collection quality.

Cook Islands

43. The majority of Cook Islands vessel catches are taken within the Cook Islands' EEZ, with less than 4% taken beyond the EEZ in 2010. Total effort for the WCPFC Convention Area is approximately 6 million hooks, with 5.5 million hooks of effort attributed to the Cook Islands' EEZ. Total raised catch estimates for 2010, in the Convention Area is 3,156.6 mt. Albacore remains the primary catch species, accounting for 75% of the total 2010 catches. The total albacore catch estimate for 2010 is 2,423 mt. Total catches for yellowfin and bigeye in 2010 are 319.2 mt and 192 mt, respectively. The majority of catches are taken in the northern Cook Islands by the fleet based out of Pago Pago, American Samoa. Forty-one longline fishing vessels were licensed to fish within the Convention Area in 2010. Thirty-seven licenses were issued for vessels fishing within national waters, and three licenses were issued with the sole authorisation to fish on the high seas within the Convention Area. An observer training workshop was held in early 2011 to improve observer data coverage in the northern Cook Islands fishery and the Convention Area.

Ecuador

44. No summary available or provided.

El Salvador

45. El Salvador has a coast that borders the Pacific Ocean. El Salvador's tuna industry fleet consists solely of its four-vessel purse-seine fleet. The main catches of tuna take place in the EPO. This report represents a summary of the information handled by the General Directorate for Fisheries and Aquaculture on the catches made by the tuna fleets under the Salvadorean flag, specifically in the area of the WCPFC. This information comes from the records obtained in collaboration with IATTC, under the

onboard observer programme and vessel monitoring system (VMS), where the vessels *Monterocio* y *Montelucia* are permanently monitored by our Directorate. Therefore, El Salvador, a non-member state, is working to maintain the level of compliance and cooperation of all measures that the Commission sets out, and is searching for better management of resources.

European Union

46. There are two EU-Spain fishing fleets operating in the Pacific Ocean: a purse seine fleet that targets tropical tunas, and a surface longline fishery that targets swordfish. In 2010, four EU-Spain purse-seine vessels, all over 1,500 GT, fished in the WCPFC Convention Area. Data from observers of the Agreement on the International Dolphin Conservation Program and, in the case of two trips of one of the vessels, data from logbooks (100% coverage) indicate a total landed catch of 29,468 mt: 4,911 mt of bigeye tuna, 20,517 mt of skipjack tuna and 4,040 mt of yellowfin tuna. Effort, aggregated catches, discards and bycatch data are also presented.

47. During 2010, five EU-Spain longline vessels targeting swordfish fished in the WCPFC Convention Area. The gear used is the monofilament surface longline (Florida style modified), using an average of around 1,100 hooks per set. The average characteristics of the vessels involved in the fishery were the same as in previous years: 291.8 GT, 861.8 horse power and 40.8 m in length. The 2010 swordfish landings, bycatch and effort distribution are provided. Estimates of landings available for 2010 indicate a total swordfish catch of 994 mt from the WCPFC Convention Area (381 mt from the Convention Area east of 150° W).

Federated States of Micronesia

48. The current estimate of the total catch by FSM purse-seine and longline vessels (national fleet) within the WCPFC Convention Area for 2010 is 24,014 mt. Skipjack, yellowfin and bigeye tunas were the key target species, accounting for 97% of the catches, with the remaining 3% consisting of non-target species. In 2010, FSM's fleet consisted of 7 purse-seine vessels and 23 longline vessels. By species composition, skipjack accounted for 81% (19,395 mt) of the total catch, with yellowfin accounting for 13% (3,264 mt), bigeye 5% (1,094 mt), and other species accounting for 1% (261 mt). In general, catch from the domestic fleet within the Convention Area has increased 15% over 2009, primarily by the purse-seine fleet; however, the catch from the longline fleet has decreased compared with 2009's catch.

49. At present, data for the artisanal fishery are not available as these fall within the states' responsibility. The total FSM EEZ catch in 2010 by all gear types is recorded as 155,753 mt (96% by purse-seine, <2% by longline, >2% pole-and-line), comprising 87% skipjack, 7% yellowfin tuna, 2% bigeye tuna, and 4% other species. Japan accounted for 30% of the catch, followed by the Federated States of Micronesia Arrangement (FSMA) at 23%, and Chinese Taipei at 18%, making them the three main purse-seine fleets with the most effort operating within the zone in 2010. The total longline EEZ catch is reported as 2,831 mt with bigeye tuna accounting for 57%, yellowfin tuna accounting for 40%, and other species accounting for 3%. By flag, Japan accounted for 41% of the total longline catch followed by FSM 25%, Chinese Taipei 25%, and China 9%.

50. In terms of effort, both purse-seine and longline effort within FSM's EEZ increased slightly in 2010, compared with 2009. In contrast, the domestic purse-seine effort within the WCPO area increased slightly, whereas the domestic longline fleet catch decreased slightly, compared with 2009. The FSM observer programme operated with a pool of 74 observers in 2010. FSM's National Observer Programme made 385 successful placements, with 1 trip on a longline vessel, 3 trips on pole-and-line vessels, and 381 trips on purse-seine vessels. The increase in the number of observer trips by the FSM National Observer Programme is mainly due to the increased number of employed fisheries observers recruited in 2009 and

2010 for monitoring FAD closure periods, 100% observer coverage, and catch retention measures by the WCPFC.

51. Port sampling coverage for 2010 was 97% (about the same as for 2009) for purse-seine vessels and 81% for longline vessels. There were 166 purse-seine vessels transshipping in FSM's port in 2010 with a total volume of 146,220 mt of tuna trans-shipped, with skipjack accounting for 97% and a mix of yellowfin and bigeye tunas accounting for 3%. Pohnpei remains the most active port in FSM. The majority of purse-seine vessels unloading in FSM were from Chinese Taipei, accounting for 79 transshipments, followed by Korea with 35 transshipments, China with 19, FSMA with 18, FSM with 11, and 4 by the US unloading in 2010. In total, 486 longline unloadings were reported in 2010 for a total of 1,981 mt. This catch comprised 43% bigeye tuna, 24% yellowfin tuna, 19% billfish and 14% other bycatch species. Most of the unloaded volume by longline vessels was by FSM-flagged vessels (46%), followed by Chinese Taipei (39%) and China (15%).

Fiji

52. In the early 1990s, when fishing activity was relatively low, albacore accounted for about 50% of the tuna catch but increased to around 70–80% from 1995 onwards. Yellowfin catches throughout the years have remained at 15–25% of total tuna catches, with the highest catch recorded in 2004. Bigeye tuna has generally comprised around 8% of the total catch. 2010 catches of these three tuna species totalled 9,955 mt.

53. The nominal CPUE for albacore increased steadily from 1.03 fish per 100 hooks in 2003 to 1.93 fish per 100 hooks in 2006 before dropping to 1.47 fish per 100 hooks in 2010. Bigeye nominal CPUE appears relatively stable over the time series. Yellowfin nominal CPUE remained consistent at or around 0.2 fish per 100 hooks in 2005 and 2006 before increasing to an average of 0.33 fish per 100 hooks in recent years.

54. The national observer records for the interaction rates of species of special interest showed a higher level of interaction in 2009 compared with previous years. This is attributed to improved reporting by the national observer programme. In 2010 there were five loggerhead sea turtles, three hawksbill turtles, and six leatherback turtles observed caught by the fishery.

French Polynesia

55. In 2010, French Polynesia's commercial tuna fleet comprised 61 longline vessels (ranging from 13 m to 24 m) operating only within French Polynesia's EEZ, and 368 small boats (5 m to 11 m) using artisanal gear (e.g. pole-and-line, handline, trolling) and operating inside the territorial waters. The overall nominal catch for these fleets in 2010 is estimated at around 8,770 mt, with albacore accounting for 47% of the catch, yellowfin tuna accounting for 11%, skipjack accounting for 13%, and bigeye tuna accounting for 5%. Effort and total catch by the longline fleet has decreased since 2005 after a steady increase at the beginning of this fleet in the early 1990s. In contrast, the trends for the artisanal nearshore fishery show a slow and steady increase that is partly driven by the increase of the population. Since 2006, all sharks except mako sharks are fully protected inside the entire French Polynesia EEZ. It is also planned to include mako. Accidental catches of sea turtles and seabirds by longline vessels are extremely rare.

Indonesia

56. The number of active fishing vessels operating in Indonesia's EEZ (Fisheries Management Area No. 716/IEEZ of Sulawesi Sea and 717/IEEZ of Pacific Ocean) in 2010 by fishing gear were 156 purse-seine vessels, 166 longline vessels, 18 pole-and-line vessels, and 92 vessels with other gear (troll and gill net). Fishing boats varied in size from 10 GT to 500 GT.

57. Nominal catches for the three species in the Fisheries Management Areas 716 (IEEZ Sulawesi Sea) and 717 (IEEZ Pacific Ocean) in 2010 were 105,296 mt: 75,656 mt (71.85 %) for skipjack, 26,283 mt (24.96%) for yellowfin and 3,357 mt (3.19%) for bigeye. Catch proportions by gear was 15,262 mt (14.49 %) for longline; 32,586 mt (30.94 %) for purse-seine; 33,811 mt (32.11%) for pole-and-line; 1,685 mt (1.60 %) for handline; and 21,952 mt (20.85 %) for other gear types.

58. Species composition based on fishing gear was in the range of 10–25% for bigeye tuna and 75–90% for yellowfin tuna in the longline catch; 65–80% for skipjack, 20–30% for yellowfin and 2–5% for bigeye in the purse-seine catch; 80–90% for skipjack, 5–15% for yellowfin and 2–5% for bigeye in the pole-and-line catch; and 96–98% for yellowfin and 2–4% for bigeye in large tuna handline catch. There was a high variability of species composition caught by troll and other gear types, which require further observation. This species composition estimation was obtained as preliminary conclusion from the “2nd Indonesia Tuna Fisheries (WCPFC Area) Annual Catch Estimates Workshop”, using Research Center for Fisheries Management and Conservation (RCFMC)-WCPFC port sampling results.

59. RCFMC and WCPFC in the frame of WPEA OFM project are continuing the port sampling program in Bitung and Kendari. The port sampling activities implemented in 2010 took 597 samples among 2,288 total landings observed in Bitung, and took 362 samples among 1,775 landings in Kendari. Up until June 2011, 200 samples were taken from port sampling out of 972 total landings observed in Bitung and 76 samples were taken out of 565 landings observed in Kendari.

Japan

60. This paper describes recent trends in the Japanese tuna and billfish fisheries (e.g. longline, pole-and-line, purse-seine and other miscellaneous coastal fisheries) in the WCPFC Convention Area, including fleet size, catch and fishing effort statistics. The total number of commercial longline vessels (larger than 10 GT) was 433 in 2010. This was 11 vessels (2%) less than that in 2009. Total number of pole-and-line vessels (larger than 20 GT) was 92 in 2010, which was five vessels (5%) less than that in 2009. For the purse-seine vessels, the number of vessels over 200 GT was 37 in 2010, which was the same number as that in 2009. Of the 37 vessels over 200 GT, the number of vessels allowed to operate in tropical waters was 35 in 2010 and has stabilized since 1995.

61. The total 2010 Convention Area catch of tunas (Pacific bluefin, albacore, bigeye, yellowfin and skipjack) by the Japanese fishery was still provisional and estimated to be 432,657 mt. This corresponds to 104% of the 2009 total tuna catch (414,299 mt). In 2010, the total tuna catch by the purse-seine fishery was 250,427 mt (58% of the total), and was 110,720 mt (26%) by the pole-and-line fishery, 59,252 mt (14%) by the longline fishery, and the remaining (3%) by the other gear types.

62. Japan has conducted several research activities in relation to biological and stock assessment studies on tuna, billfish and other bycatch species in the Convention Area in 2010, such as a tagging study for tropical tunas and sharks, several research cruises to sample Pacific bluefin tuna larvae, and a research cruise to investigate ways to reduce the catch of juvenile bigeye during purse-seine fishing. In addition, bycatch species-related research was conducted, including tori-line experiments using commercial longline vessels to mitigate seabird interactions and experimental use of circle hooks to reduce hooking mortality of sea turtles.

Kiribati

63. Kiribati's tuna fishery is composed of foreign fishing fleets licensed to fish for tuna within Kiribati's EEZ, and the artisanal fishery, which is important for providing food security for local people. The major gear types used to fish for tuna in Kiribati's waters are purse-seine and pole-and-line, which

mainly target skipjack and yellowfin tuna. Longlining is also employed by foreign fleets targeting bigeye tuna. Artisanal boats, often less than 7 m in length, fish within 12 nm of the islands of Kiribati. These small boats use troll and handline methods for catching shallower tuna species such as skipjack and yellowfin. In 2010, Kiribati licensed 527 foreign fishing vessels, including support vessels such as refrigerated carriers and tankers. Fees collected from these foreign fishing vessels contributed to 44% of the total revenue, and are largely responsible for subsidizing the Kiribati government budget that year.

64. Kiribati has flagged vessels active within the WCPFC Convention Area. The number of national fleets increased from one in 2008 to eight in 2010 due to an influx of foreign fishing vessels changing their flag to Kiribati. Consequently, the total catches of Kiribati's fleet improved to over 25,000 mt, which is five times greater than the average catch for the last 13 years (1994–2008). Tunas remain the most important resource to Kiribati and, therefore, the sustainable development and management of this resource is critical for the country. Kiribati is keen to work in collaboration with other nations to ensure the sustainable management of this resource.

Korea

65. Korea has purse-seine and longline fisheries for tunas and billfishes in the WCPFC Convention Area. In 2010, 29 purse-seine vessels and 122 longline vessels were engaged in fishing, catching 277,312 mt and 28,513 mt, respectively. While the number of vessels increased, the catch from both fisheries decreased. Purse-seine catches were higher in Region 3 in 2010 than in Region 4, where it was higher in 2009. Longline catches were higher in Region 4 in 2010 than in 2009. With regard to the species composition of the purse-seine catch, skipjack catches were lower in 2010 than in 2009, while yellowfin tuna and bigeye tuna catches were higher in 2010 than in 2009. In longline catches, there was no apparent change in species composition from the previous year. In 2010, the logsheet coverage rates were 95.4% for purse-seine fishing and 71.2% for longline fishing. The longline bycatch of key shark species was reported in logsheet data in 2010. No scientific observation was carried out for the longline fishery in 2010, due to a national observer systematic reason. Data collection and reporting was improved in accordance with recent CMMs. A pilot research study on the species composition of purse-seine catches at a cannery site was conducted in 2010.

Mexico

66. No summary available or provided.

Nauru

67. Nauru's EEZ is a major purse-seine fishing ground in the Convention Area, and in 2010 produced 106,420 mt worth of tuna catches, the second highest on record for the EEZ. About 75% of the total catch consisted of skipjack tuna. The total yellowfin catch was 24,003 mt, the highest in a single year for the stock. Effort in 2010 also increased by over 40% and this concluded what was a very productive year for the fishery. The number of fishing vessels decreased slightly to 182 purse-seine vessels; in addition to these, 4 longline vessels also operated within the EEZ during the year.

New Caledonia

68. Fishing for tuna and associated species by New Caledonian vessels started in 1981 with a pole-and-line fishery (less than three vessels) operating for only three years (1981: 228 mt; 1982: 998 mt; 1983: 492 mt). Longline vessels started operating at the same time, and it took almost 20 years before this domestic fleet had significant activity. In 2010, 20 domestic longline vessels fished within New Caledonia's EEZ. No licenses have been issued to foreign vessels since early 2001. A 12% increase in the catch was reported last year. The 2010 annual catch of 2,860 mt was mainly composed of albacore tuna,

which is the target species of all the vessels, and accounts for 68% (1,939 mt) of the total catch. Yellowfin was second most commonly caught fish at 505 mt (18%). Striped marlin (65 mt) and swordfish (8 mt) are caught as bycatch in this fishery. Shark catches have been decreasing since 2006, due to the increasing use of monofilament branch lines.

69. In 2010, port sampling and observer activities carried out under the SciFish project reached 52% and 9% coverage, respectively, for longline sets. The objectives of these activities are to collect information to be checked with other data sources, and to provide accurate data for stock assessments. Through the ZoNéCo programme, New Caledonia also continues to participate in regional efforts to improve the knowledge of tuna behavior, in particular the South Pacific albacore, as the species of major interest for its fishery.

New Zealand

70. Since 2002, skipjack (23,622 mt in 2010), which are nearly all taken by purse seine, have comprised the greatest part of New Zealand's catch of all tuna species, both within and beyond New Zealand fisheries waters. Yellowfin (770 mt in 2010) makes up most of the balance, and is mostly taken outside of New Zealand waters. Yellowfin are rarely part of the purse-seine catch within New Zealand fisheries waters because the domestic purse-seine fishery targets only free schools of skipjack. The second most important component of New Zealand's domestic fisheries is albacore (2,290 mt), which are taken mostly by troll gear, but are also landed as target and bycatch by the longline fishery. The domestic longline fleet targets both bigeye and southern bluefin tuna, and more recently swordfish, but the greatest part of the catch consists of albacore. Almost 143 mt of striped marlin are caught annually by the recreational fleet, with 80 mt tagged and released and 63 mt retained. Most highly migratory species caught in New Zealand waters are exported; the destination of exports varies depending on the species.

71. New Zealand has four Class-6 purse-seine vessels fishing offshore in the EEZs of Pacific Island States and in high seas areas of the equatorial WCPO. These vessels have also fished domestically from time to time along with up to seven smaller-capacity, domestic-based purse-seine vessels. The number of purse-seine vessels has declined from 11 vessels in 2005 to 7 vessels in 2010. The New Zealand longline tuna fleet consists of domestically owned and operated vessels (mostly between 15 m and 25 m in length) and a limited number of foreign-owned vessels that operate under charter. The number of longline vessels operating in New Zealand has declined from 151 vessels in 2002 to 44 in 2010.

72. Blue shark is the most common non-tuna bycatch species in the longline fishery followed by Ray's bream and moonfish. Reductions in longline effort since 2002 have resulted in reductions in catches of major bycatch species to their lowest levels in 2008, but there has been a subsequent increase.

73. Longline vessels fishing for tuna or swordfish in New Zealand fishery waters are required to use tori lines, and may only set their lines at night unless using approved line weighting. New Zealand longline vessels fishing on the high seas south of 30°S must use two mitigation measures as specified in CMM 2007-04. New Zealand longline vessels have been provided with turtle dehooking and mitigation equipment. Because the purse-seine fishery in New Zealand fishery waters is based on free schools of skipjack, bycatch is minimal (e.g. 1% by mass). No interactions with non-fish bycatch (e.g. seabirds, turtles, and marine mammals) have been observed in the purse seine fishery.

74. New Zealand has an observer programme and two active domestic port sampling programmes for highly migratory species. In 2010, 19% of the longline effort (hooks) was observed, and almost 9% of the New Zealand purse-seine sets were observed; in addition, seven troll trips were observed. A considerable amount of research is directed at tunas, tuna-like and bycatch species in New Zealand. Fishers and fish receivers are required to furnish returns (monthly reports) to the Ministry of Fisheries. New Zealand has

four data collection systems in place to collect catch and effort data. New Zealand also has a system for collecting information on non-fish bycatch from fishers.

Niue

75. No summary available or provided.

Palau

76. No summary available or provided.

Panama

77. No summary available or provided.

Papua New Guinea

78. PNG's tuna fishery consists of both the purse-seine and longline sectors with a small, but important handline sector. The longline and handline sector is a citizen-only activity and all vessels fish exclusively in the waters under PNG national jurisdiction. The purse-seine sector is a mix of both domestic and foreign access vessels. The domestic sector comprises PNG-flag vessels and PNG-chartered vessels that support processing facilities onshore in PNG. While PNG-flagged vessels fish primarily in PNG waters, but occasionally in the adjacent high seas, the chartered vessels fish both within and outside of PNG waters. Foreign vessels under access arrangements fish within PNG's EEZ (but not territorial or archipelagic waters) whenever there are fish to catch.

79. The 2010 total catch within PNG waters was 702,969 mt, a 55% increase from the 2009 catch of 453,129 mt. The increase in total catch is attributed to the increase in total fishing effort relative to the increase in number of fishing vessels, mainly purse-seine vessels. The catch contribution was 78.7% by foreign vessels that fish under access arrangements, 16.7% from PNG-chartered vessels (locally based foreign) and 4.1% from PNG-flagged vessels. A small amount of the catch (~0.5% or 3,120 mt) comes from the longline sector. Almost all of the catch from PNG-flagged vessels was caught inside of PNG waters as result of closure of neighboring high sea pockets. The catch by PNG-chartered vessels outside of PNG waters was 63,397 mt and was taken mainly in the waters of other PNA member countries.

80. In total, 256 vessels were active in PNG waters in 2010: 32 were longline and handline vessels and 224 were purse-seine vessels. Nine of the 224 vessels were PNG-flagged, 39 were PNG-chartered, and 176 were foreign vessels fishing under access arrangements. The total purse-seine effort in 2010 by foreign vessels was 15,796 days fishing and searching inside national waters, an 18% increase from 13,348 days in 2009. Longline effort also increased from 36,574 lines (with 100 hooks per line) in 2009 to 62,605 lines (100 hooks per line) in 2010. Catch by purse-seine vessels in PNG were mainly on free schools, which accounted for about 72% of the total catch. The remaining 28% was associated with FADs (drifting = 11.9%, anchored = 8.2%), logs (7.8%) and mammals (0.5%). About 82% of the free school catch was by foreign vessels; 100% of the associated catch was by PNG-flagged and PNG-chartered vessels.

81. Data collection in PNG is comprehensive with greater than 80% catch and effort data coverage for all fleets. For size and species composition data, PNG runs a port sampling programme as well as an observer programme that covers the vessels based out of PNG, and foreign vessels fishing within the PNG fisheries zone. The PNG observer programme has over 200 men and women, and its aim is to "beef up" this strength to 400 observers over the next three to four years. On average, observer coverage on

vessels fishing within PNG waters (2004–2009) ranges from 30% on foreign vessels to 83% on PNG-flagged vessels. PNG-chartered vessels have a 58% observer coverage on average.

82. PNG is striving towards building its fishing industry; therefore, fishing licenses are linked to onshore investment. At full capacity PNG is looking to process within PNG all fish caught in PNG waters. The rights to fish in PNG will also be linked to onshore investment in the near future.

Philippines

83. The Philippines expresses its strong commitment to promote effective management in order to achieve the long-term conservation and sustainable use of highly migratory fish stocks in the WCPO in accordance with the 1982 Law of the Sea Convention, the UN Fish Stocks Agreement, and the WCPF Convention. In giving effect to the provisions of the WCPF Convention, the Philippines upholds that CMMs developed by the Commission, including CMM 2008-01 on the conservation and management of bigeye and yellowfin, would need to embody the principles and measures adopted under the Convention.

84. Ongoing research activities of the National Stock Assessment Program (NSAP) have continued to collect data on species composition, length frequency, and vessel catch and effort information on key tuna landing sites around the country. The WPEA OFM Project, which started in January 2010 and is funded by UNEP-GEF-WCPFC, will help strengthen national capacities and international cooperation on priority transboundary concerns relating to the conservation and management of highly migratory fish stocks in the western Pacific Ocean and Southeast Asia (Indonesia, Philippines and Vietnam).

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

86. BFAR regularly conducts observer training (twice a year). There are currently 106 trained observers ready to board vessels, especially those vessels intending to fish during the FAD closure period (1 July to 30 September 2010). The VMS has already been operationalized, although on a limited scale, but the BFAR is in close collaboration with the industry to increase coverage.

87. The provisional catch estimates for the three species of concern to the WCPFC in 2010 are: skipjack – 228,178 mt; yellowfin – 147,276 mt and bigeye – 11,645 mt (BAS 2009). Although much lower catch estimates were obtained during the 4th Annual Tuna Catch Estimates Review Workshop: skipjack – 131,448 mt; yellowfin – 75,638 mt and bigeye – 4,432 mt. The discrepancies between the two estimates could be due to the difficulties in estimating the diverse municipal fisheries, and could be explained as possible bias in the probability surveys due to very low coverage. The Philippines, through the BFAR-National Fisheries Research and Development Institute, and other concerned agencies, together with the tuna industry, is making considerable efforts to improve data collection and to strengthen its national capacity and international cooperation on transboundary concerns in relation to the sustainable conservation and management of highly migratory fish stocks.

Republic of the Marshall Islands

88. The tuna fishery in the Republic of the Marshall Islands (RMI) comprises foreign-flagged purse-seine, pole-and-line and longline vessels and RMI-flagged purse-seine and longline vessels. Most of the foreign-flagged longline vessels operate in support of domestic development activities and are based locally. As part of RMI's ongoing domestic development aspirations, four additional purse-seine vessels were introduced into the national fleet while the longline fleet remained at four vessels.

89. During 2010, the estimated total catch of RMI's purse-seine fleet operating throughout the WCPO was just over 56,800 mt, an increase of around 24% compared with the previous year although the new vessels only entered the fishery during the second half of the year. Furthermore, provisional estimates from the national longline fleet, which fished primarily in RMI's EEZ, indicate just under 450 mt of catch.

90. Overall catch estimates from licensed foreign fleets operating in RMI's EEZ in 2010 amounted to just over 25,400 mt with 69% of the catch attributed to the purse-seine fleets and a majority of the catch comprising skipjack tuna. Unfortunately, there has been no observer coverage on longline vessels since the 100% purse-seine coverage came into effect. There is, however, an observer training scheduled for late 2011 that will hopefully reverse the situation. RMI observers did manage to undertake 176 trips totalling around 5,268 sea days on both national and subregional trips.

Samoa

91. Samoa's tuna fishery comprises a troll fishery and a longline fishery. Both fisheries operate within Samoa's EEZ of approximately 120,000 km², and involve vessels ranging from 9 m to over 20 m in length. Over 103 mt of skipjack was landed from the troll fishery in 2010, an increase of over 21% from the 85 mt landed in 2009. Yellowfin tuna constitutes around 10% of the troll catch, which is a slight increase from the 2009 catch. Other pelagic species, including dolphinfish, barracudas, kawakawas and rainbow runners, are also caught by the troll fishery, but to a lesser degree, making up the rest of the 2010 troll catch.

92. A decline of more than 10% in albacore catches was observed from the longline fishing fleet in 2010 compared with the amount caught in 2009. An estimated 7 mt of swordfish was landed in 2010, the highest recorded over the past six years. Yellowfin, bigeye and skipjack tunas all show decreasing catches in 2010 relative to 2009 catches. The increase in the number of troll fishing vessels is mostly attributed to the number of new *alia* fishing vessels that were constructed and distributed to affected areas after the September 2009 tsunami. An increase in the number of longline vessels was observed in 2010 from 2009. This increase is mainly attributed to the increased number of *alia* fishing vessels participating in the fishery, which in previous years, were either engaged in full-time bottom fishing or trolling, or were out of operation.

93. Samoa is in the final process of developing its sea turtle and shark plans. Both of these plans are scheduled to be approved in 2011. Port sampling activities and catch logsheets continue to provide the main data for the estimation of annual catches and effort levels for the domestic longline fleet.

Senegal

94. No summary available or provided.

Solomon Islands

95. The Solomon Islands' tuna fishery is very important as it contributes significantly towards the national economy as well as the social wellbeing of the people. However, management of the fishery is quite complex as it consists of various fleets with diverse gear and vessel sizes, as well as many species. In 2010, more than 400 vessels were licensed to operate in Solomon Islands' EEZ. These include 180 purse-seine vessels, 216 tuna longline vessels, 13 shark longline vessels, and 16 pole-and-line vessels. The fleet composition is dominated by foreign fleets, which operate more than 98.6% of the vessels, and the domestic fleet with only 1.4%.

96. The provisional total annual catch estimate within the Solomon Islands' EEZ for 2010 is approximately 128,842 mt, with skipjack dominating the catch at about 95,229 mt followed by yellowfin tuna at 23,136 mt, albacore at 6,357 mt and bigeye tuna at 2,140 mt. From the total catch estimated, more than 89% were landed outside of the Solomon Islands and approximately 11% landed locally. The Government of Solomon Islands is trying to turn this figure around by encouraging investors to invest more in the value adding and processing sector. As such, the government has taken the initiative by acquiring two proposed processing sites on Guadalcanal, and one on Malaita. The government recognizes that the economic and social benefits for the people of the Solomon Islands could be maximized if a larger proportion of the catch is processed locally.

Chinese Taipei

97. There are three Taiwanese tuna fishing fleets operating in the WCPFC Convention Area: a large-scale tuna longline fleet, a distant-water purse-seine fleet, and small-scale tuna longline fleet. In 2010, total catches of the main tuna and tuna-like species for these three fleets were 24,246 mt for the large-scale tuna longline fleet, 198,851 mt for the distant-water purse-seine fleet, and 45,783 mt for small-scale tuna fleet. In 2010, 31 observers (including 25 on large-scale tuna longline vessels and 6 on distant-water purse-seine vessels) were deployed in the Pacific Ocean.

Thailand

98. No summary available or provided.

Tokelau

99. No summary available or provided

Tonga

100. Tongan commercial fisheries for highly migratory species continued operations with only a longline fleet in 2010, as in previous years. However, the fishery continued to be affected by various factors, particularly economic problems impacting fishing companies. In 2010, only five fishing vessels had valid licenses to fish within Tonga's EEZ, compared with seven vessels in 2009. Tonga has continued to operate its tuna fishery with a full domestic longline fleet since 2005, and mainly operates within Tonga's EEZ, but sometimes farther to the high seas south of Tonga.

101. The tuna fishery total catch in quantity and value for 2010 further declined from 2009, and became the lowest in the history of this fishery in Tonga, peaking over the last five years in 2007. The continuous annual reduction in tuna fishery production is due to various reasons, including a considerable reduction in fishing effort (number of hooks) by 83.8% compared with 2007. This is consistent with the decline in the number of active fishing vessels. The decline in catches is also attributed to the opening of the beche-de-mer fishery in 2008, in which some tuna fishing companies switched to beche-de-mer fishing. Furthermore, variations in environmental and oceanographic conditions have also had significant impacts on the fishery.

102. For the five years prior to 2008, total catch rates (CPUE) for the fishery continued increasing and then declined in 2009 and again in 2010. It is evident that the trend for total CPUE was attributed to the decline in CPUEs for albacore and yellowfin for the last three years. Albacore maintained the highest percentage composition in the total catch of 2010, with high percentage of yellowfin (29%) and bigeye (14%). Catch composition indicates that most longline vessels, and the structure of the fleet, were targeting bigeye and yellowfin tuna for the fresh fish market, with a high proportion of the catch consisting of albacore tuna. Dolphin fish and moon fish dominated the bycatch composition. From

observer reports, the Tonga tuna fishery has no impact on species of special conservation interest (e.g. turtles, marine mammals and seabirds).

103. Tonga Fisheries Division continued to work closely with SPC's Oceanic Fisheries Programme on issues regarding the status of tuna resources within Tonga's EEZ relative to the whole stock in the WCPO. The total tuna harvested by the Tongan fleet in 2010 was negligible with regard to posing any major impact on the whole stock in the region and the WCPO. Despite the ample room for improvement and development of tuna fleet in Tonga, high operation costs have restricted the operation of fishing vessels mainly to areas near the main fishing port, Nuku'alofa.

104. The Tonga research programme for tuna, such as data collection and observer deployment, has continued to greatly improve in 2010. Port sampling coverage increased from 86% in 2009 to 91% in 2010, and observer coverage remained at 12% (as in 2009). At the same time, measures and resolutions of the Commission are being implemented and monitored by Tonga Fisheries Division.

Tuvalu

105. 2010 was a good year with respect to the development and review of national fisheries policies and legislation. There was a small increase in investment through licensing and, thereby, revenues earned, and an expansion of the domestic fleet. Key trends of tuna fisheries in Tuvalu for 2010 include: i) an increased number of Tuvalu-flagged vessels from one to three; ii) purse-seine effort by the national fleet doubled, as has the catch in 2010 relative to 2009; iii) skipjack dominated purse-seine catches, followed by yellowfin tuna; iv) Tuvalu's two flagged longline vessels commenced operations at the end of the first quarter in 2010, and fishing occurred mainly in areas outside of Tuvalu's EEZ; v) longline efforts and catches decreased for longline activities in 2010 within Tuvalu's EEZ; vi) record high numbers of fishing licenses were issued for purse-seine, longline and pole-and-line fishing for 2010; vii) pole-and-line activities were lowest in 2010; and viii) artisanal catches showed improvements in 2010 with yellowfin dominating.

106. Challenges remain with respect to having sufficient resources to ensure the implementation of data collection, management, analyses and reporting. Furthermore, logsheet reporting and reporting from Tuvalu-licensed fishing vessels remains poor, although in contrast, observer coverage and VMS reporting appear to be making good progress. Tuvalu intends to seek direct budgetary support from the government's national budget, or if that is unsuccessful, seek alternative funding support from elsewhere. Tuvalu has benefitted from routine assistance from SPC and FFA with respect to an update of the TUFMAN database and with ongoing training of local staff in data management and the maintenance of a national database.

USA

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

108. Overall trends in total landings by USA and USA-associated participating territory fisheries in the WCPFC statistical area in 2010 are dominated by catches by the purse-seine fishery. Preliminary 2010 purse-seine estimates total 215,587 mt of skipjack tuna, 25,686 mt of yellowfin tuna, and 4,251 mt of bigeye tuna. USA purse-seine landings in 2009 have been revised upwards to 283,219 mt from last year's preliminary estimate. Longline landings in 2010 decreased after peaking in 2007. Bigeye and albacore landings by longline vessels declined from record highs in 2007 to 4,067 mt for bigeye and 4,273 mt, for albacore in 2010. Excluding landings by USA participating territories (i.e. American Samoa), longline landings of bigeye tuna declined to 3,576 mt in 2010 from 5,381 mt in 2007. These bigeye tuna landings by the USA longline fishery in the North Pacific Ocean were in 2009 and 2010 below the limit of 3,763 mt established in USA fishery regulations (74 FR 63999, December 7, 2009) pursuant to the provisions of CMM 2008-01. Longline landings of swordfish in the North Pacific Ocean decreased to 1,022 mt in 2010, down from their peak of 1,428 mt in 2007. Small-scale (tropical) trollers and handliners operating in nearshore waters represented the largest number of USA-flagged vessels but contributed only a small fraction of the landings. The longline fleet was the next largest fleet, numbering 147 in 2010, while there were 37 purse-seine vessels.

109. The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries Service) conducted a wide range of research on Pacific tuna and associated species at its Southwest and Pacific Islands Fisheries Science Centers, and in collaboration with scientists from other organizations. NOAA Fisheries Service conducts fishery monitoring and sociocultural research on tunas, billfishes, and animals caught as bycatch in those fisheries. In 2010, the International Billfish Angler Survey continued to provide fishery-independent information on billfish catch and angler effort in a variety of recreational fisheries across the Pacific. Shark CPUE in the Hawaii-based longline fishery was summarized from observer data. Socioeconomic studies included market impact of longline bigeye closure, consumer preference surveys, catch shares economics, and analyses of time-area closures in the longline fishery. Stock assessment research was conducted almost entirely in collaboration with members of the WCPFC and the ISC.

110. The stock assessment work is not described in this report (Brodziak and Ishimura, 2010, 2011; Brodziak and Piner 2010; Lee et al. 2011). NOAA Fisheries Service biological and oceanographic research on tunas, billfishes, and sharks addressed fish movements, habitat preferences, post-release survival, feeding habits, abundance, maturity, and age and growth. Research on North Pacific albacore focused on otolith analysis for age and growth, and archival tagging for migration and stock structure. Tagging projects also continued for billfish, sharks and bigeye tuna. Bycatch mitigation studies in the longline and gill net fisheries focused on sea turtles, pelagic sharks and false killer whales.

Vanuatu

111. Vanuatu is a member of the regional fisheries management organizations (RFMOs) such as IATTC, ICCAT, IOTC and WCPFC. Vanuatu's membership in these RFMOs has enabled Vanuatu's fishing fleet to fish these RFMOs' waters for tuna and other highly migratory fish species. Vanuatu's fleet comprises 18 purse-seine vessels and 76 longline vessels. Catch and effort coverage for the Vanuatu fleet has been good but the size data coverage is uncertain due to a lack of observers onboard vessels, particularly distant-water longline vessels, and also due to a lack of unloading data sought from landing ports.

112. Within Vanuatu's EEZ, the only foreign fleet with high catch and effort data coverage is the Taiwanese fleet. Catch estimates for Vanuatu's EEZ acquired from SPC have shown that less fish were caught in 2008 and 2010, which may have been due to climatic effects. In the period 2006–2010, annual catch estimates of the Vanuatu fleet active in the WCPFC Convention Area have generally been stable as was the fishing effort (sets) and the number of fish per 100 hooks, whereas for purse-seine vessels, there were more sets on unassociated schools than associated schools. The purse-seine fleet's total catches have

declined from 37,907 mt in 2009 to 23,721 mt in 2010, comprising in 2010: 93% skipjack, 7% yellowfin and 0.2 % bigeye. Unraised and provisional 2010 data show that catches of all major tuna species have increased to around 15,092 mt of skipjack, 871 mt yellowfin and 35 mt of bigeye. Some of these purse-seine vessels fished under the FSM Arrangement “home party” criteria (such as PNG), and therefore may have been included in PNG fleet catch statistics. The major tuna species caught by the longline fleet catch were albacore (50%) and yellowfin (14%). Unraised and provisional estimates for the longline fleet in 2010 were 6,071 mt for albacore, 985 mt for bigeye, and 402 mt for yellowfin; however, if these are raised, they could be higher.

113. Data for Vanuatu’s EEZ were based on unraised logsheet data. Fishing within Vanuatu’s EEZ was conducted by foreign fleets from China, Fiji and Taiwan. The number of Taiwanese vessels has dropped but Chinese and Fijian fleets have increased rapidly, based on the number of licenses issued in 2009–2010. In 2009, Vanuatu had 100% observer coverage on locally based foreign fishing vessels, and 100% port sampling coverage during port unloadings and transshipments.

114. Vanuatu’s observer programme started in 2008. Since then there has been 100% observer coverage for the locally based foreign fishing vessel and 100% sampling operation coverage for unloadings and transshipments in port. There have been 18 transshipments in port since 2008.

Vietnam

115. There are three main fisheries in Vietnam targeting tuna and tuna-like species. These fisheries are tuna longline, gill net and purse-seine fisheries that mostly catch bigeye, yellowfin and skipjack tuna species in Vietnamese waters. Over the past few years, the data collection system for Vietnamese tuna fisheries has been insufficient and, thus, total catches of tuna and other related species are not available. However, since 2010, under the framework of the WPEA OFM project funded by the Global Environment Facility (GEF) throughout WCPFC as an executive implementation, tuna longline fishery data collection systems have been developed and implemented at three main provinces in Vietnam (Binh Dinh, Phu Yen and Khanh Hoa) since July 2010. The total number of longline vessels estimated was around 1,000, and these vessels produced annual total combined catches of bigeye and yellowfin tuna species of more than 11,000 tons in 2010.

116. Moreover, observer trips on tuna longline vessels have been carried out in 2010 with of the assistance of both WPEA OFM and World Wildlife Fund-Vietnam. The main aims of these observer trips are to provide scientific data for stock assessment and trials for replacing “J” hooks with circle hooks. Twelve observer trips were conducted in 2010, which initially provided useful scientific data sources for cross-checking with collected data under the WPEA OFM project.

117. In 2010, the Vietnamese government also paid more attention to the assessment and management of tuna fisheries in Vietnam. Under these considerations, the Ministry of Agriculture and Rural Development has allocated a five-year project to investigate and assess marine resources in Vietnamese waters. The project will begin implementation in 2011, with a high priority in the first year given to assessing large pelagic species, especially tuna and tuna-like species. Tuna fisheries data and information will also be collected using both fisheries independent and dependent data in the framework of this project.

Wallis and Futuna

118. No summary available or provided.

Discussion

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

120. Concern was expressed over the failure of the EU to report operational longline data for its fleet operating in the WCPO.

121. In response to an enquiry as to why New Zealand was concerned over the status of their domestic yellowfin fishery, New Zealand indicated that recent data from their domestic recreational and commercial longline fisheries indicate that recent yellowfin catches have declined consistently since 2001 and are at historic lows. New Zealand is concerned that this may be due to potential range contraction of the yellowfin stock or due to the high level of regional fishing effort to the north and east of New Zealand. Australia noted that in contrast to this trend in New Zealand, the year 2011 is proving to be an exceptional catch year for yellowfin tuna off its east coast.

122. In response to an enquiry, New Zealand indicated that its longline fishery takes a very small bycatch of Pacific bluefin tuna and New Zealand has a small recreational fishery for that species. New Zealand indicated that some Pacific bluefin size data are available from these fisheries.

123. A concern was raised that the recent observer coverage of 3.6% in Australia's Eastern Tuna and Billfish Fishery (ETBF) would make the estimation of turtle interactions highly uncertain. Australia acknowledged this problem and indicated that it is actively investigating potential solutions, including the use of onboard mounted cameras as a means to collect much of the same data currently collected by observers. Australia noted that as envisaged under the ETBF sea turtle mitigation plan approved by WCPFC6, a working group was formed to further consider sea turtle interactions in that fishery. Approximately AUD 25,000 was used to provide additional sea turtle release equipment to longline fishers.

2.4 Reports from regional fisheries bodies and other organizations

124. There were no reports provided by regional fisheries bodies or other organizations.

AGENDA ITEM 3 – STOCK ASSESSMENT THEME

125. N. Miyabe (Japan) and J. Brodziak (USA) served as conveners of this theme, with S. Harley, S. Bishop, S. Nicol, H. Kiyofuji, T. Lawson, S. Teo, P. Dalzell, D. Itano, D. Bromhead, T. Beeching and H. Kiyofuji serving as rapporteurs.

3.1 WCPO bigeye tuna

126. Two working papers addressed the review of Project 35 (SC7-SA-WP-01) and the bigeye tuna stock assessment (SC7-SA-WP-02).

3.1.1 Review of research and information

a. Review of Project 35

127. S. Nicol (SPC) presented "Bigeye tuna age, growth and reproductive biology (Project 35), Revision.1" (SC7-SA-WP-01), which reported on the completion of Project 35, a two-year pilot study (in Region 3) of the WCPO stock assessment for bigeye tuna to determine the sampling requirements for implementing a Pacific-wide bigeye tuna age, growth and reproductive biology project in the WCPO.

128. The study collected 282 gonads and 313 otoliths. Matching gonads and otoliths were only collected for 120 individuals. The maturity ogive for females was estimated from 100 gonads. The estimated length at 50% maturity was 105.9 cm, which was consistent with other estimates of the female maturity ogive from the WCPO. The inclusion of the maturity ogive in the 2011 assessment model for bigeye altered the $SB_{current}/SB_{MSY}$ by 4% and the $F_{current}/F_{MSY}$ by 2%. The results of the pilot study suggest that variation in the maturity ogive may have greater influence on a Pacific-wide assessment of bigeye than it has on the WCPO assessment. It was recommended that greater priority be given to understanding variation at the ocean basin scale rather than within the regions of the WCPO.

129. A comparison of daily and annual ageing techniques for bigeye tuna indicated that annual ageing methods are appropriate; however, additional validation of methods should be included in future studies. Variation in growth was detected between regions using growth curves derived from otoliths and MULTIFAN-CL. The inclusion of the growth curve in the 2011 assessment model for bigeye altered the $SB_{current}/SB_{MSY}$ by 38% and the $F_{current}/F_{MSY}$ by 26%. The implementation of the age and growth component for the full Pacific-wide study was recommended as a higher priority than the reproductive biology component. To implement the Pacific-wide study on age and growth, a minimum sample size of approximately 2,500 otoliths is required to be collected from 8 strata of 32° longitude x 20° latitude (approx. 300 per strata).

130. Training modules and standards have been developed and implemented within the Pacific Island Regional Fisheries Observer programmes, providing the capacity for observer-based collection of biological samples across all fisheries in the WCPO. Collection of otoliths from fresh-fish longline vessels is likely to be restricted to sampling at ports. Coordination between observers, vessels, agents and processing facilities allows otoliths to be matched with gonads, fishing and sample details of the individual. In addition to the collection of samples by observers, a budget of approximately USD 90,000 per year for three years would be required to implement the full study.

Discussion

131. SC7 noted the importance of research on the life history characteristics of tuna, in particular bigeye tuna given its current stock status. SC7 noted, with appreciation, the contribution of such a wide range of organizations, including industry, in the successful implementation of the pilot study and also the active contribution of three Pacific Island scientists in the research project. It was considered that the effective inclusion of scientists from within the region in this project should be encouraged in the development of future research into tunas.

132. The results of the research were consistent with findings from IATTC assessments that stock assessment results can be sensitive to assumed biological parameters, in particular growth, but also maturity profiles. SC7 noted that comparisons between the maturity results of the pilot study and other studies needed to carefully consider the methodologies used in the studies.

133. There was general support for continuation of this work and SC7 provided the following guidance for project design:

- that there should be an emphasis on the central equatorial region (150°W–170°W) for future sampling, but that sampling across the WCPO (30°N–30°S) should be done;
- for this central equatorial region, there may be some value in collecting additional samples for maturity studies, but that up to 300 samples might be needed;
- consideration be given to a simulation-based approach to get a better understanding of the potential impact of regional patterns in growth and implications for stock status; and
- the importance of providing training to fishery observers on the collection of biological samples; and a detailed breakdown of the proposed budget should be given to allow the cost of particular activities and sampling in particular areas.

134. SC7 requested that SPC include the new ageing estimates in the assessment figures that compare estimated growth with tagging and direct ageing data.

b. Review of 2011 stock assessment

Summary of SC7-SA-WP-02 (Stock assessment of bigeye tuna in the WCPO)

135. N. Davies (SPC) presented “Stock assessment of bigeye tuna in the WCPO”. Excerpts from the Executive Summary of this paper are provided below, as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

136. This paper presented the 2011 assessment of bigeye tuna in the WCPO. This assessment is supported by several other analyses that are documented separately, but should be considered when reviewing this assessment as they underpin many of the fundamental inputs to the models. These include evaluation of paired spill and/or grab sample trials leading to observer-based species composition estimates with spill sampling correction for purse-seine catch histories and size compositions (Lawson 2011; Lawson and Sharples 2011), reviews of catch statistics of component fisheries (Williams 2011; Williams and Terawasi 2011), standardized CPUE analyses of operational-level Japanese longline catch and effort data (Hoyle and Okamoto 2011), standardized CPUE analyses of Taiwanese longline CPUE (Chang et al. 2011), an analysis of tag reporting rates for the Regional Tuna Tagging Project (RTTP) and Pacific Tuna Tagging Programme (PTTP, Hoyle 2011), and the guidance of the Pre-assessment Workshop held in April, 2011 (SPC 2011).

137. The assessment includes a series of model runs that describe stepwise changes from the 2010 assessment (Run 3d) to develop a new — reference case model (Run3j – Ref.case) and then a series of — one-off sensitivity models that represent a single change from the Ref.case model run. A subset of key model runs was taken from the sensitivities that represent a set of plausible model runs and were included in a structural uncertainty analysis (grid) for consideration in developing management advice.

138. Besides updating input data, the main developments to the inputs compared with the 2010 assessment were: including tagging data from the 2007–2010 PTTP; standardized CPUE time series derived from operational-level, catch-effort data for Japanese longline fisheries; weighting the Japanese longline size frequency data according to the estimated population relative abundance within regions; adjusting purse-seine size frequency data using spill samples to correct for grab sample bias; and including more reliable size composition data for Philippines and Indonesian domestic purse-seine catches in offshore waters. The main developments to model structural assumptions were to define a separate Indonesian Philippines-based domestic purse-seine fishery that operates beyond the national archipelagic waters and to the east of 125°E longitude.

139. During the Pre-assessment Workshop held in April 2011 (SPC 2011), the key assumptions from the base case model from the 2010 assessment were reviewed in light of the developments proposed for the Ref.case model for the 2011 assessment. These and the alternative assumptions in the other key model runs are provided below.

Component	2010 assessment (Run 3d)	2011 assessment (Run 3j)	2011 alternatives
Longline CPUE	Aggregate indices	Operational indices, temporal weighting of standardized effort	- Exclude all CPUE prior to 1975 - Aggregate indices
Steepness	Estimated	Fixed = 0.8	0.65, 0.95, and estimated
Purse-seine catches	Spill sample corrected	Spill sample corrected (including size data)	Grab sample (SBEST)
Tagging data	Excluded PTTP	Included PTTP	Exclude PTTP
Longline size data	Down-weighted	Full weight	Down-weighted
Natural mortality	Base	Base	Increased for juveniles

140. In comparing the 2011 Ref.case model results with the 2010 assessment, the decision to fix steepness at a more plausible value (0.8) to that estimated in recent assessments must be considered. Whereas, the Ref.case estimates of stock status are not dissimilar from 2010 base-case model estimates, the 2011 model most comparable to an update of the 2010 base-case model was Run15, in which steepness was estimated, and which provided a more optimistic stock status. This difference indicates the effects of the new inputs (in particular operational CPUE indices). When comparing $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ between a straight-forward update of the 2010 model (Run2b) and Run15, the values are 1.49 and 1.33 versus 1.13 and 1.54, respectively.

141. The main conclusions of the current assessment (based on the median of uncertainty grid estimates and sensitivity model runs) are as follows:

- a) The estimated increasing trend in recruitment from recent bigeye assessments appears to have been addressed to a small extent in the current assessment, but remains an issue in Region 3 and is primarily the result of conflict (disagreement) among the various data sources, in particular between longline CPUE indices and reported catch histories, and between and within some of the size composition datasets. The current assessment has identified some of these conflicts and includes some model runs that begin to address them.
- b) As in previous assessments, recruitment in almost all models is estimated to have been high during 1995–2005. As suggested in the 2010 assessment, an analysis is presented that estimates the stock recruitment relationship (with steepness fixed) for this latter period and applied it in the yield analyses. If one considers recruitment estimates in the second half of the time series to be more plausible and representative of the overall productivity of the bigeye stock, the results of this analysis (Run21) could be used for formulating management advice. In this case, $F_{current}/F_{MSY}$ was 1.58 and $SB_{current}/SB_{MSY}$ was 0.61, indicating that we would conclude that the stock is overfished and overfishing is occurring under this productivity assumption. The main reason for the much lower estimate of $SB_{current}/SB_{MSY}$ is that SB_{MSY} is approximately doubled because of the higher levels of recruitment being used to estimate it.
- c) Total biomass and spawning biomass for the WCPO are estimated to have declined to about half of their initial levels by the mid-1970s, with total biomass remaining relatively constant since then ($B_{current}/B_0 = 44\%$), while spawning biomass has continued to decline ($SB_{current}/SB_0 = 35\%$). Declines are larger for models that exclude the early periods of the CPUE time series.

- d) When the non-equilibrium nature of recent recruitment is taken into account, we can estimate the level of depletion that has occurred. It is estimated that spawning potential is at 26% of the level predicted to exist in the absence of fishing considering the average over the period 2006–2009, and that value is reduced to 23% for the 2010 spawning potential levels.
- e) The attribution of depletion to various fisheries or groups of fisheries indicates that the purse-seine and other surface fisheries have an equal or greater impact than longline fisheries on the current biomass. The purse-seine and Philippines and Indonesian domestic fisheries also have substantial impact in Region 3 and to a lesser extent in Region 4. The Japanese coastal pole-and-line and purse-seine fisheries are also having a significant impact in their home region (Region 1). For the sensitivity analysis with lower purse-seine catches, longline fisheries are estimated to have a higher impact.
- f) Recent catches are well above the MSY level of 74,993 mt, but this is mostly due to a combination of above-average recruitment and high fishing mortality. When MSY is re-calculated — assuming recent recruitment levels and recent mix of fisheries persist — catches are still around 7% higher than the re-calculated MSY (131,400 mt). **Based on these results, we conclude that current catch levels are unlikely to be sustainable in the long term, even at the recent (high) levels of recruitment estimated for the last two decades.**
- g) Fishing mortality for adult and juvenile bigeye tuna is estimated to have increased continuously since the beginning of industrial tuna fishing. For all of the model runs, $F_{current}/F_{MSY}$ is considerably greater than 1. For the grid median, the ratio is estimated at 1.42, indicating that a 30% reduction in fishing mortality is required from 2006–2009 levels in order to reduce fishing mortality to sustainable levels. Using the Ref.case, if we consider historical levels of fishing mortality, a 39% reduction in fishing mortality from 2004 levels is required, and a 28% reduction from average 2001–2004 levels. Larger reductions in fishing mortality are indicated when lower values of steepness are assumed. **Based on these results, we conclude that overfishing is occurring in the bigeye tuna stock.**
- h) The reference points that predict the status of the stock under equilibrium conditions are $B_{F_{current}}/B_{MSY}$ and $SB_{F_{current}}/SB_{MSY}$. The model predicts that biomass would be reduced to 65% and 60% of the level that supports MSY. In terms of the reduction against virgin biomass, the declines reach as low as 15% of spawning potential. Current stock status compared with these reference points indicate that current total biomass and spawning biomass are higher than associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.34$ and $\frac{SB_{current}}{SB_{MSY}} = 1.37$). The structural uncertainty analysis indicates a 13% probability that $SB_{current} < SB_{MSY}$. **Based on these results above, and the recent trend in spawning biomass, we conclude that bigeye tuna is approaching an overfished state. We note however, that if recent recruitment is assumed to represent the true productivity of the bigeye stock (Run21), then the higher levels of B_{MSY} and SB_{MSY} implied would mean that bigeye tuna is already in an overfished state ($B_{current}/B_{MSY} = 0.67$ and $SB_{current}/SB_{MSY} 0.61$).**
- i) Analysis of current levels of fishing mortality and historical patterns in the mix of fishing gear indicates that MSY has been reduced to less than half its levels prior to 1970 through the harvesting of small juveniles. Because of that and overfishing, considerable potential yield from the bigeye tuna stock is being lost. **Based on these results, we conclude that**

MSY levels would rise if mortality of small fish was reduced, which would allow greater overall yields to be sustainably obtained.

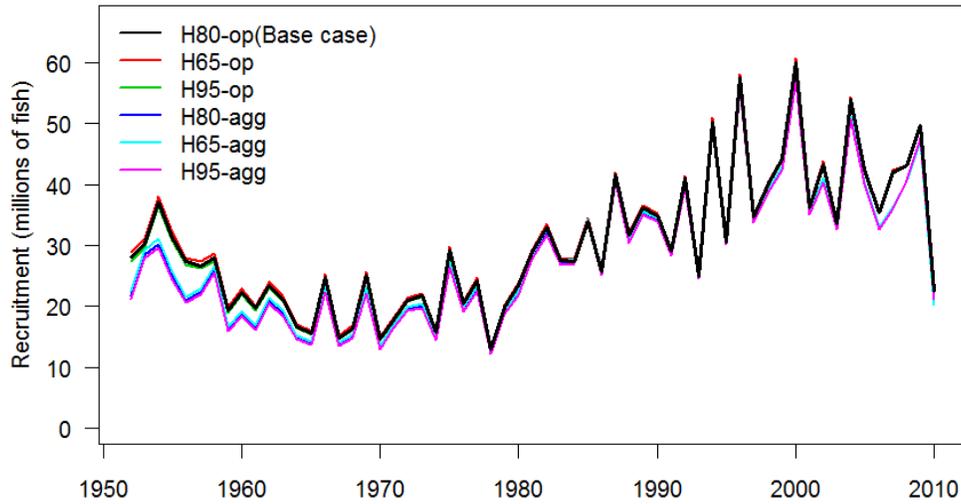


Figure BET1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the base-case model (Run 3j – H80-opp [black line]) and the five combinations of steepness and longline CPUE series.

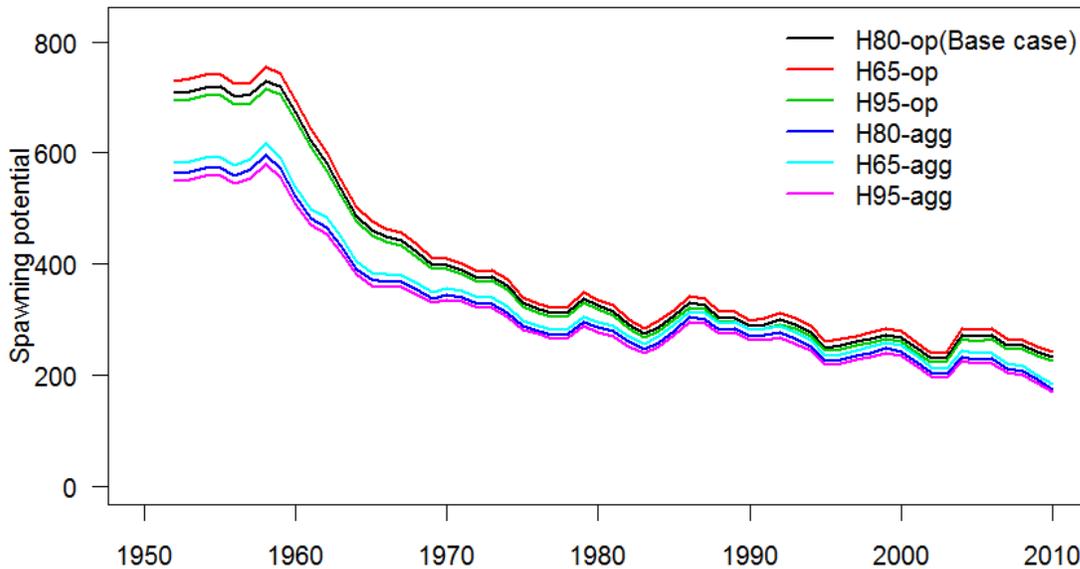


Figure BET2: Estimated annual average spawning potential for the WCPO obtained from the base-case model (Run 3j – H80-opp [black line]) and the five combinations of steepness and longline CPUE series.

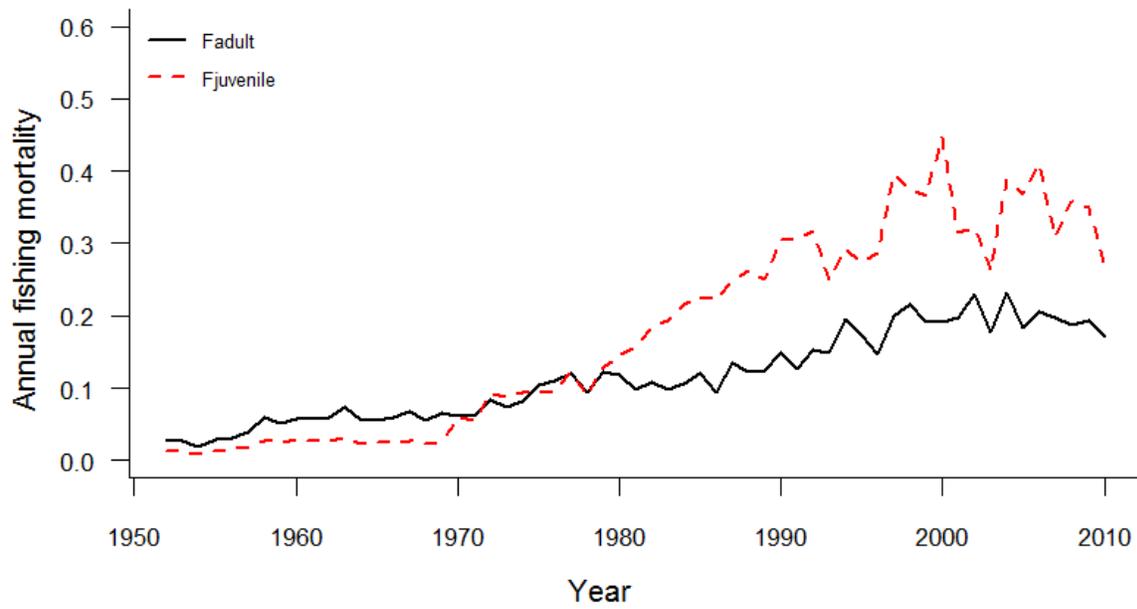


Figure BET3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base-case model (Run 3j - H80-op).

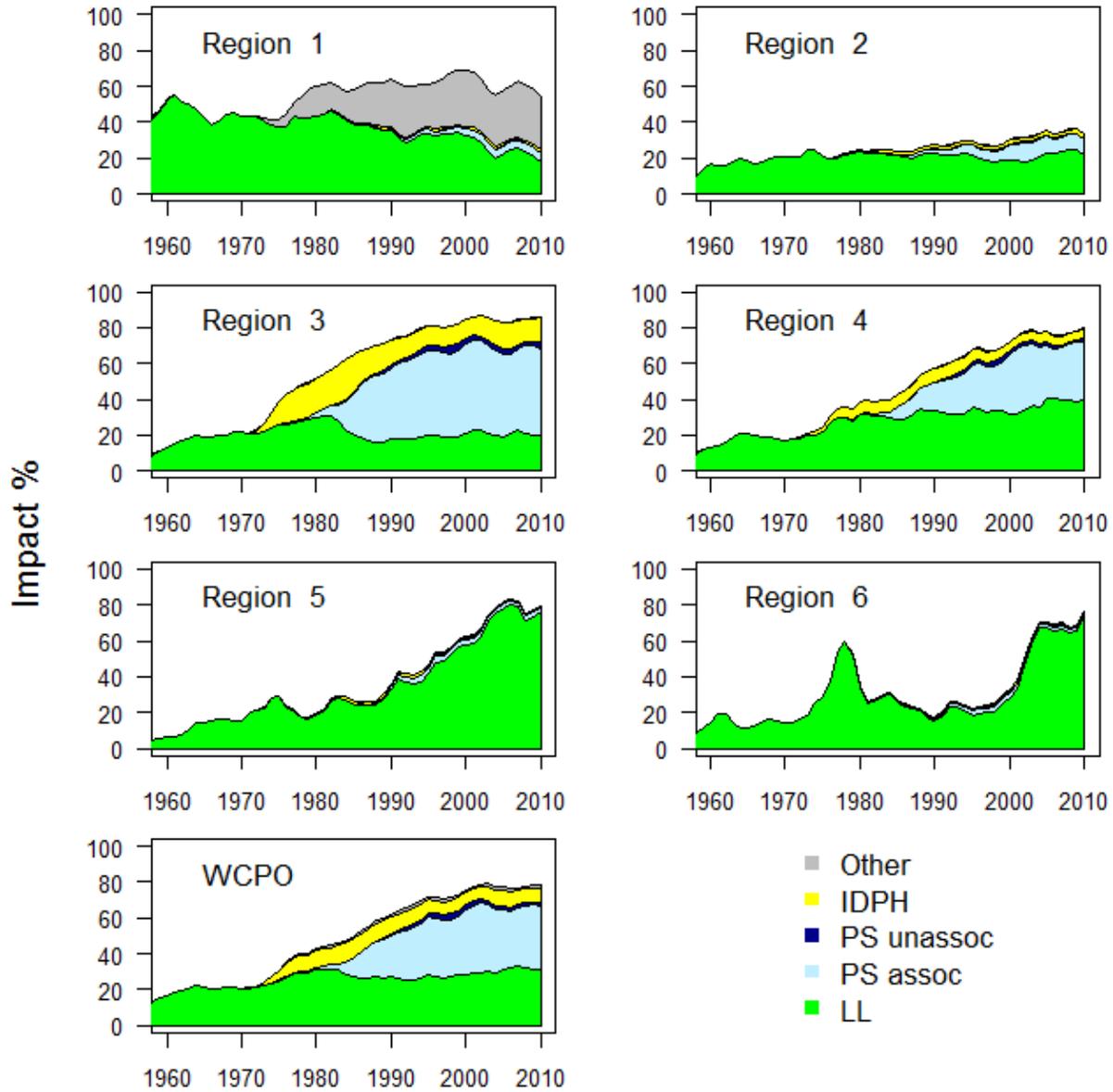


Figure BET4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base case model). LL = all longline fisheries; IDPH = Indonesian and Philippines domestic fisheries; PS assoc = purse-seine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

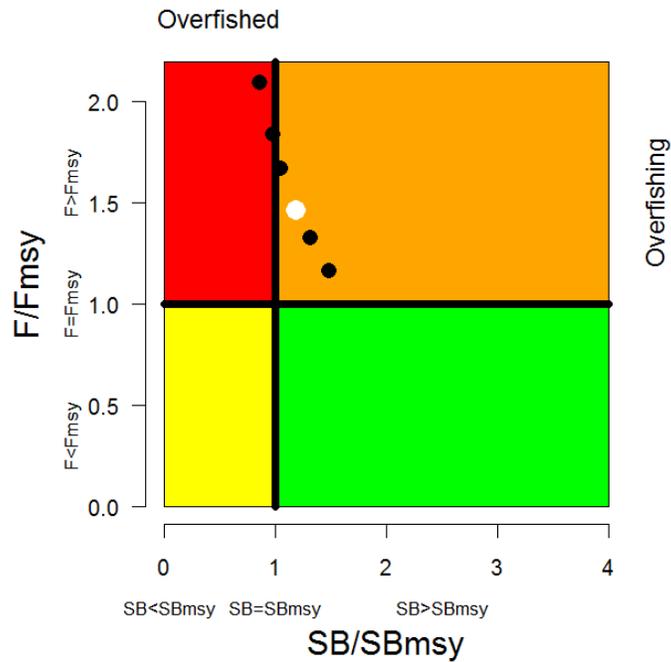
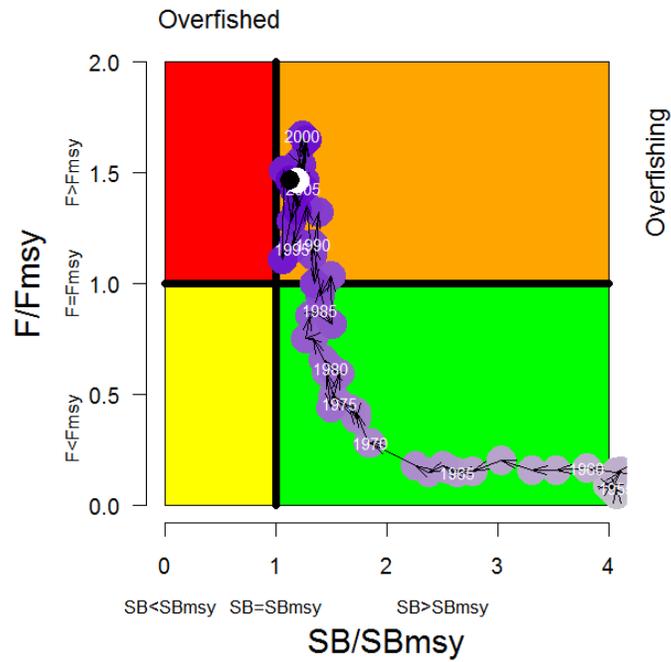


Figure BET5: Temporal trend in annual stock status relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base case (top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the base case (white circle) and the five combinations of steepness and longline CPUE series. See Table BET1 to determine the individual model runs.

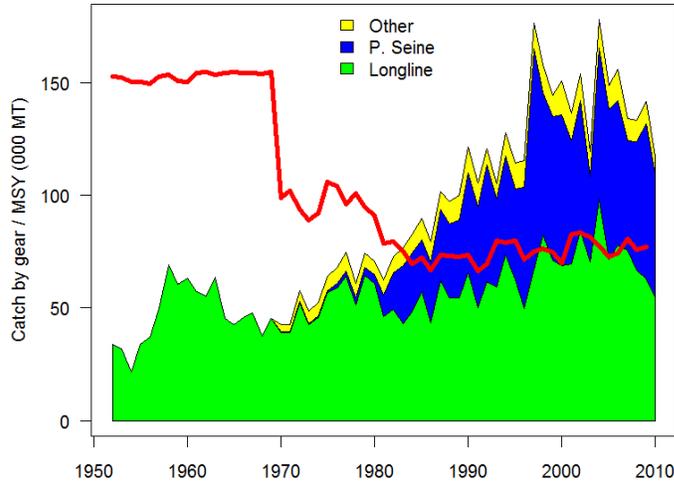


Figure BET6: History of annual estimates of MSY compared with catches of three major fisheries. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small bigeye.

Table BET1. Estimates of management quantities for selected stock assessment models from the 2011 base-case model (Run 3j – H80-op) and the five combinations of steepness and longline CPUE series. For the purpose of this assessment, “current” is the average over the period 2006–2009 and “latest” is 2010.

	H80-op (Base- case)	H65-op	H95-op	H80-agg	H65-agg	H95-agg
$C_{current}$	141,160	141,365	141,029	141,561	141,805	141,356
C_{latest}	116,868	117,118	116,712	117,558	117,843	117,320
MSY	76,760	70,080	83,720	74,120	68,360	80,360
$C_{current}/MSY$	1.84	2.02	1.68	1.91	2.07	1.76
C_{latest}/MSY	1.52	1.67	1.39	1.59	1.72	1.46
F_{mult}	0.68	0.54	0.86	0.60	0.48	0.75
$F_{current}/F_{MSY}$	1.46	1.84	1.16	1.67	2.10	1.33
SB_0	739,900	810,000	698,500	688,400	762,000	644,200
SB_{MSY}/SB_0	0.29	0.33	0.24	0.29	0.33	0.24
$SB_{current}/SB_0$	0.35	0.33	0.36	0.30	0.29	0.32
SB_{latest}/SB_0	0.31	0.30	0.32	0.26	0.24	0.26
$SB_{current}/SB_{MSY}$	1.19	0.98	1.49	1.05	0.86	1.32
SB_{latest}/SB_{MSY}	1.08	0.89	1.36	0.88	0.72	1.10
$SB_{curr}/SB_{curr_{F=0}}$	0.23	0.23	0.22	0.20	0.20	0.19
$SB_{latest}/SB_{latest_{F=0}}$	0.21	0.22	0.21	0.17	0.18	0.17
Steepness (h)	0.80	0.65	0.95	0.80	0.65	0.95

Table BET2. Comparison of WCPO bigeye tuna reference points from the 2011 reference case model and the range of the six models in Table BET1; the 2010 base-case model (steepness estimated as 0.98) — shown in parentheses is the alternative 2010 run (steepness assumed as 0.75); ranges of six sensitivity analyses in the 2009 assessment; and the base model and sensitivity analyses from the 2008 assessment.

Management quantity	2011 assessment base-case (uncertainty)	2010 assessment Run3d (Run4b)	2009 assessment	2008 assessment
Most recent catch	116,868 mt (2010)	126,769 mt (2009)	134,315 mt (2008)	143,059 mt (2007)
MSY	76,760 mt (68,360–83,720)	73,840 mt (65,640 mt)	Range: 52,120–67,800 mt	Base case: 64,600 mt Range: 56,800–65,520 mt
$F_{current}/F_{MSY}$	1.46 (1.16–2.10)	1.41 (1.97)	Range: 1.51–2.55	Base case: 1.44 Range: 1.33–2.09
$B_{current}/B_{MSY}$	1.25 (0.96–1.48)	1.39 (1.09)	Range: 1.11 ~ 1.55	Base case: 1.37 Range: 1.02–1.37
$SB_{current}/SB_{MSY}$	1.19 (0.86–1.49)	1.34 (0.97)	Range: 0.85–1.42	Base case: 1.19 Range: 0.76–1.20
$Y_{F_{current}}/MSY$	0.89 (0.34–0.99)	0.94 (0.56)	Range: 0.12–0.92	Base case: 0.94 Range: 0.50–0.97
$B_{current}/B_{current, F=0}$	0.29 (0.25–0.30)	0.23 (0.24)	Range: 0.18–0.29	Base case: 0.26 Range: 0.20–0.28
$SB_{current}/SB_{current, F=0}$	0.23 (0.19–0.23)	0.17 (0.18)	Range 0.11–0.19	Not available

Discussion

142. SC7 expressed its appreciation to the bigeye tuna assessment team for the 2011 stock assessment and then discussed several aspects of the assessment.

Input data

143. SC7 noted several improvements in the inputs for the 2011 assessment, in particular the inclusion of longline indices based on operational-level data from Japanese vessels, PTP tagging data, and a revised approach for generating longline size data represented improvements from the 2010 assessment.

144. Operational CPUE indices in particular had significant impact on the new assessment and SC7 recognized the collaborative work between SPC and Japan and encouraged further analyses of these data. SC7 noted that the revised indices separated the offshore and distant-water fleets, but that this separation was not possible for the early years in the series. Including additional years would allow a more full comparison between operational and aggregate data. It was also noted that there was a large spike in CPUE in the final time period for Region 2 indices, which was based on very low levels of effort and was given low weight in the assessment.

145. SC7 requested that future assessments provide tables of estimated annual purse-seine catches by species and estimation method, preferably separated for associated and unassociated sets.

146. SPC noted that with 100% observer coverage of the purse-seine fleet that it should be possible to obtain improved estimates of purse-seine discards (see SC7-ST-IP-01), which could be included in future stock assessments.

Recent patterns in fishing mortality

147. Most CCMs noted that the estimated fishing mortality for 2010, in particular that for juvenile bigeye tuna, declined in 2010 (Fig. BET3). Other participants felt that these estimates were uncertain and, therefore, did not feel confident providing extra emphasis on them.

Biological inputs

148. There was discussion about the way in which the current assessment attempted to incorporate sex-specific information from observed sex ratios in the natural mortality and maturity schedules. SPC explained that the current assumption was that trends in the sex ratio by length were driven by sex-specific differences in natural mortality related to the timing of maturity. Recent biological studies on southern albacore tuna suggest that growth can vary by sex in tunas, and that further investigation of sex-specific growth in tropical tunas is warranted to test this assumption. It was noted that this pattern will require further consideration of the mechanisms driving the strong patterns in sex ratios by length that are observed.

Impact of the operational CPUE indices

149. SC7 noted that the new operational longline indices had a significant impact on the bigeye assessment with more optimistic stock status conclusions compared with that derived from the index using aggregated longline data. There was considerable discussion as to the reasons for this difference.

150. SPC explained that operational indices actually give a stronger decline in Regions 3 and 4 than those estimated for aggregate CPUE indices. Consequently, the more optimistic stock status conclusions may seem counter-intuitive. What was observed in the assessment was that the operational indices resulted in increased recruitment in the early part of the time series and the overall average recruitment level was increased. This higher recruitment resulted in a larger overall stock size and, therefore, lower fishing mortality (for the fixed catches).

Impact of recruitment trend on reference points

151. SC7 noted that SPC had undertaken two model runs that provided different interpretations of the pattern of low recruitment from 1950–1990 and high recruitment in the past 20 years. Run 5, which excluded pre-1975 longline CPUE, and Run 21 (the stock recruitment relationship and the related MSY reference points estimated over the period 1989–2010), which assumed that the most recent period (since 1989) better reflected the productivity of the stock.

152. There was considerable discussion of Run 21. SC7 noted that the concept was raised at SC6 (paragraph 231 ii) and discussed in detail at the Pre-assessment Workshop, but that it was the first time that the results from such a run had been presented to the SC. SPC explained that Run 21 represents an alternative assumption about the productivity of bigeye that aims to address the inconsistency between productivity assumptions that SC6 requested that SPC use for projections (i.e. recent average recruitment) and productivity assumptions assumed in the assessment model — most notably that the estimated MSY, B_{MSY} and $SB_{F=0}$ are much higher under this alternative assumption, resulting in lower estimates of $B_{current}/B_{MSY}$ and $SB_{current}/SB_{MSY}$.

153. SC7 concluded that Run 21 presents an interesting concept that is worthy of consideration in future assessments, and requested that further details (e.g. what the assumptions in this run mean in terms of the implied productivity of the stock) of the assumptions and implementation of this run be provided with these assessments. It was further noted that currently there was no hypothesis for potential environmental drivers that could explain the estimated pattern of recruitment for bigeye tuna.

Model runs to characterize stock status and management advice

154. SC7 considered all of the model runs that had been undertaken in the assessment to determine those model run(s) that should be used to characterize the status of the stock and the management advice. SC7 made a distinction that while a range might be used to characterize the uncertainty in stock status, it was preferred that only a single set of values be used for developing management advice. SC7 considered that while it is possible to average results across several models to provide management advice, it was preferred to use a single model run.

155. SC7 discussed the major sources of uncertainty as included in the structural uncertainty grid to determine those model options that represent plausible alternative assumptions that should be considered. SC7 recognized both the importance of steepness and the inherent uncertainty in our knowledge of the likely true values. It was considered important to account for this uncertainty. SC7 also noted the difference that the operational CPUE indices had made to the stock status estimates, but recognized that this was the first year that these data were used in the reference model.

156. Following the discussion, SC7 decided that for characterizing the uncertainty in stock status, six model runs should be used, reflecting the combination of three levels of steepness (0.65, 0.80, 0.95) and two longline CPUE series (operational and aggregate indices). For the provision of management advice SC7 decided to use the reference case (Run 3j) which assumed a steepness of 0.8 and used operational longline CPUE indices (See Table BET1)

3.1.2 Provision of scientific information

a. Stock status and trends

157. The bigeye assessment in 2011 is comparable to recent assessments (Table BET2) although there is a range of data updates and a few changed structural assumptions. The primary differences include a revised structure of the fisheries based in Indonesia and Philippines; the incorporation of recent PTPP tagging data; the use of standardized longline CPUE derived from operational-level data; and purse-seine size frequency data corrected for grab sample selectivity bias using experimental spill sample data.

158. SC7 selected Run 3j, which had an assumed steepness of 0.8 and was based on standardized CPUE derived from operational-level longline data (hereafter referred to as the base-case) to represent the stock status of bigeye. To characterize uncertainty in the assessment, SC7 chose additional models based on alternate values of steepness and standardized CPUE derived from either operational or aggregate longline data (Table BET1), as follows:

Model	CPUE	Steepness
H80-op (base case)	Operational CPUE standardization	steepness = 0.8
H65-op	Operational CPUE standardization	steepness = 0.65
H95-op	Operational CPUE standardization	steepness = 0.95
H80-agg	Aggregate CPUE standardization	steepness = 0.8
H65-agg	Aggregate CPUE standardization	steepness = 0.65
H95-agg	Aggregate CPUE standardization	steepness = 0.95

159. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures BET 1–4.

160. $F_{current}/F_{MSY}$ is estimated at 1.46 (base case; range 1.16–2.10), indicating that overfishing is occurring for the WCPO bigeye tuna stock and that in order to reduce fishing mortality to F_{MSY} , the base case indicates that a 32% reduction in fishing mortality is required from 2006–2009 levels (Fig. BET5). Considering historical levels of fishing mortality, a 39% reduction in fishing mortality from 2004 levels is required and a 28% reduction from average 2001–2004 levels (consistent with the aim of CMM2008-01).

161. The base case indicates that the current total and spawning biomass are higher than the associated MSY levels ($B_{current}/\tilde{B}_{MSY} = 1.25$ and $SB_{current}/\tilde{SB}_{MSY} = 1.19$). However, two of the alternate models found that $SB_{current}/\tilde{SB}_{MSY} < 1.0$ with a range across the six models considered of 0.86–1.49. Therefore, there is a possibility that bigeye tuna is currently in an overfished state.

162. An analysis of historical patterns in the mix of fishing gear types indicates that MSY has been reduced to less than half its level prior to 1970 through the increased harvesting of juveniles (Fig. BET6). Recent overfishing could result in further losses in potential yields in the future (refer to Table BET2).

b. Management advice and implications

163. SC7 recommended a minimum of 32% reduction in fishing mortality from the average levels for 2006–2009 to return the fishing mortality rate to F_{MSY} . This recommended level of reduction is equivalent to a minimum 39% reduction of the 2004 level in fishing mortality, and a 28% reduction of the average 2001–2004 levels.

164. It is too early to quantitatively conclude whether CMM2008-01 has reduced fishing mortality of bigeye tuna to the levels specified in the CMM. Data for 2009 and 2010 have been incorporated into stock assessments, but data for these years are incomplete and estimates of fishing mortality in the final year of the model (2010) are particularly uncertain.

165. The FAD closure introduced in 2009 contributed to the reduction of bigeye catches in 2009 and preliminarily in 2010 (Agenda Item 4.3a). Total purse-seine effort between 20°N and 20°S is 14% and 21% higher in 2009 and 2010, respectively, relative to 2004; and is 27% and 35% higher in 2009 and 2010, respectively, relative to the average of 2001–2004 (for flag-specific references, refer to Attachment B, CMM 2008-01).

166. Total purse-seine effort between 20°N and 20°S has increased by 6% from 2008 to 2010, corresponding to the implementation of CMM2008-01, and 2009 was a near-record high for associated

school effort despite the two-month FAD closure. This occurred because of an increase in days fished, the provisions and exemptions within CMM2008-01, and a variety of other reasons.

167. Longline catch in 2010 appeared to have been reduced by 34% from 2001–2004 levels and by 48% from 2004 (for flag-specific references, refer to Attachment F, CMM 2008-01). However this may be overestimated due to incomplete data for 2009 and 2010.

168. Reported catches since 2009 from the mix of surface fisheries in Indonesia and the Philippines declined by 33% in 2010; however, confirmation is required when more detailed data for 2010 are available, including purse-seine effort data.

169. Projections to 2021 indicate that fishing mortality would be reduced to close to the F_{MSY} level, and the stock would move to a slightly overfished state. However, these conclusions should be treated with caution because projections are based on incomplete data and the assumption that catch and effort levels in 2010 will be maintained.

170. Overfishing and the increase in juvenile bigeye catches have resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. SC7 concluded that MSY levels would increase if the mortality of juvenile bigeye was reduced.

171. SC7 noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation and depletion rates were highest in equatorial regions (Regions 3 and 4 in the stock assessment model), which accounts for 88% of the total bigeye tuna catch (2001–2010), and that the spawning biomass in these regions is estimated to have declined to about 17% of the level that is estimated to occur in the absence of fishing ($SB_{2010, F=0}$). The Commission may consider measures that utilize a spatial management approach.

172. Considering the incomplete submission of data, SC7 highlighted the importance of improving the timely provision of all data necessary for stock assessment purposes, and encouraged all CCMs to provide data in accordance with the WCPFC data rules for scientific data to be provided to the Commission.

173. SC7 recommended that the Commission should consider the results of updated projections at WCPFC8, and adopt further measures to secure additional reductions in fishing mortality above those expected from the current CMM, to ensure that fishing mortality is reduced to at least the F_{MSY} level, and remove the risk of the stock being overfished. Measures that reduce fishing mortality across a range of fish sizes (e.g. fishing gear) are likely to produce the best results.

3.2 WCPO yellowfin tuna

3.2.1 Review of research and information

Summary of SC7-SA-WP-03 (Stock assessment of yellowfin tuna in the WCPO)

174. J. Hampton (SPC) presented “Stock assessment of yellowfin tuna in the WCPO”. Excerpts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

175. This paper presents the 2011 assessment of yellowfin tuna in the WCPO. The assessment uses the stock assessment model and computer software known as MULTIFAN-CL. The yellowfin tuna model is age (28 age classes) and spatially structured (six regions) and the catch, effort, size composition and tagging data used in the model are classified by 24 fisheries and quarterly time periods from 1952 through 2010. The assessment included a range of model options and sensitivities that were applied to investigate key structural assumptions and sources of uncertainty in the assessment.

176. While the structure of the assessment model(s) was similar to the previous (2009) assessment, there were some substantial revisions to a number of key datasets, specifically longline CPUE indices, catch and size data, purse-seine catch and size data, and the configuration of the Indonesian and Philippines domestic fisheries. Cumulatively, these changes resulted in a substantial change in the key results from the 2009 assessment, reducing the overall level of biomass and the estimates of MSY, $B_{current} / \tilde{B}_{MSY}$ and $SB_{current} / \tilde{SB}_{MSY}$, while increasing the estimate of $F_{current} / \tilde{F}_{MSY}$. Overall, current models represent a considerable improvement to the fit to the key datasets compared with 2009, indicating an improvement in the consistency among the main data sources, principally longline CPUE indices and the associated length- and weight-frequency data.

177. The current assessment represents the first attempt to integrate tagging data from the recent PTPP. Model diagnostics indicate a relatively poor fit to these data compared with data from earlier tagging programmes, particularly for fish of older age classes and/or longer periods at liberty. For all model options, there was a positive bias in the model's prediction of the number of tags recovered from older fish, indicating that estimated exploitation rates for recent years were higher than observed directly from tag recoveries. This indicates a degree of conflict between tagging data and other key data sources, specifically longline CPUE indices and, to a lesser extent, longline size data. Consequently, the inclusion of the PTPP dataset in the model yields a rather more optimistic assessment (when contrasted with models that exclude these data).

178. The main conclusions of the current assessment are as follows:

- a) For all analyses, there are strong temporal trends in the estimated recruitment series. Initial recruitment was relatively high but declined during the 1950s and 1960s. Recruitment remained relatively constant during the 1970s and 1980s, declined steadily from the early 1990s, and then recovered somewhat over the last decade. Recent recruitment is estimated to be lower than the long-term average (approximately 85%).
- b) Trends in biomass are generally consistent with the underlying trends in recruitment. Biomass is estimated to have declined throughout the model period. The biomass trends in the model are principally driven by the time series of catch and generalized linear model (GLM) standardized effort from the principal longline fisheries. Over recent years, there has been considerable refinement of longline CPUE indices, largely a result of the use of operational-level data from the longline fishery, principally from the Japanese fleet. These data enable a number of factors to be incorporated within the analysis to account for temporal trends in the fleet's catchability.
- c) Refinement in the approach applied to process the longline size frequency data (length and weight data) has resulted in a more coherent trend in these data over the model period. As a result, there has been a substantial improvement in the fit to both the size frequency data and CPUE indices compared with recent assessments.
- d) There is considerable conflict between tagging data (principally from the PTPP) and the other key sources of data included in the model, primarily CPUE indices. The inclusion

of PTTP tagging data results in the estimation of a substantially lower level of fishing mortality, particularly for both younger age classes vulnerable to the purse-seine associated fishery (age classes 3–4) and older age classes (age classes > 9) vulnerable to the unassociated purse-seine fishery. The resulting assessment is more optimistic when PTTP tags are incorporated in the model. Further auxiliary analysis of PTTP tagging data are required to resolve the conflict between these key data sources.

- e) Fishing mortality for adult and juvenile yellowfin tuna is estimated to have increased continuously since the beginning of industrial tuna fishing. A significant component of the increase in juvenile fishing mortality is attributable to the Philippines and Indonesian surface fisheries, which have the weakest catch, effort and size data. Recent progress has been made in acquiring a large amount of historical length-frequency data from the Philippines and these data were incorporated in the assessment. However, there is an ongoing need to improve estimates of recent and historical catches from these fisheries and maintain the current fishery monitoring programme within the Philippines. Previous analyses have shown that the current stock status is relatively insensitive to the assumed level of catch from these fisheries, although yield estimates from the fishery vary in accordance to the assumed levels of historical catch. Therefore, improved estimates of historical and current catch from these fisheries are important in determining the underlying productivity of the stock.
- f) The ratios $B_t / B_{t,F=0}$ provide a time-series index of population depletion by fishery. Depletion has increased steadily over time, reaching a level of about 50–55% of unexploited biomass (a fishery impact of 45–50%) in 2006–2009. This represents a moderate level of stock-wide depletion although the stock remains considerably higher than the equivalent equilibrium-based reference point ($\tilde{B}_{MSY} / \tilde{B}_0$ of approximately 0.35–0.40). However, depletion is considerably higher in the equatorial Region 3 where recent depletion levels are approximately 0.30 for total biomass (a 70% reduction from the unexploited level). Impacts are moderate in Region 4 (37%), lower (about 15–25%) in Regions 1, 5 and 6 and minimal (9%) in Region 2. If stock-wide overfishing criteria were applied at the level of our model regions, we would conclude that Region 3 is fully exploited and the remaining regions are underexploited.
- g) The attribution of depletion to various fisheries or groups of fisheries indicates that the associated purse-seine fishery and Philippines and Indonesian domestic fisheries have the highest impact, particularly in Region 3, while the unassociated purse-seine fishery has a moderate impact. These fisheries also contribute to fishery impacts in all other regions. Historically, the coastal Japanese pole-and-line and purse-seine fisheries have had a significant impact on biomass levels in their home Region 1. In all regions, the longline fishery has a relatively small impact, less than 5%.
- h) For the most plausible range of models, the fishing mortality-based reference point $F_{current} / \tilde{F}_{MSY}$ is estimated to be 0.56–0.90; and on that basis, it can be concluded that **overfishing is not occurring**. The corresponding biomass-based reference points $B_{current} / \tilde{B}_{MSY}$ and $SB_{current} / \tilde{SB}_{MSY}$ are estimated to be above 1.0 (1.25–1.60 and 1.34–1.83, respectively) and, therefore, the stock is **not in an overfished state**. Stock status indicators are sensitive to the assumed value of steepness for the stock-recruitment relationship. A value of steepness greater than the default value (0.95) yields a more optimistic stock status, and estimates considerably higher potential yields from the stock.

Conversely, for a lower value of steepness (0.65), the stock is estimated to be approaching the MSY-based fishing mortality and biomass thresholds.

- i) The western equatorial region accounts for most of the WCPO's yellowfin catch. In previous assessments, there have been concerns that the stock status in this region (Region 3) might differ from the stock status estimated for the entire WCPO. A comparison between the results from the WCPO models and a model encompassing only Region 3 yielded very similar results, particularly with respect to stock status. Nonetheless, there appear to be differences in the biological characteristics of yellowfin tuna in this region that warrant further investigation.
- j) The estimates of MSY for the principal model options (480,000–580,000 mt) are comparable to the recent level of (estimated) catch from the fishery (550,000 mt). Further, under equilibrium conditions, the predicted yield estimates ($Y_{F_{current}}$) are very close to estimates of MSY, indicating that current yields are at or above the long-term yields available from the stock. Further, while estimates of current fishing mortality are generally below F_{MSY} , any increase in fishing mortality would most likely occur within Region 3 — the region that accounts for most of the catch. This would further increase the levels of depletion that is occurring within that region.
- k) The current assessment investigated the impact of a range of sources of uncertainty in the current model and the interaction between these assumptions. Nonetheless, there remains a variety of other assumptions in the model that should be investigated either internally or through directed research. Further studies are required to: i) refine our estimates of growth, natural mortality and reproductive potential, incorporating consideration of spatiotemporal variation and sexual dimorphism; ii) examine in detail the time-series of size-frequency data from the fisheries, which may lead to refinement in the structure of the fisheries included in the model; iii) consider size-based selectivity processes in the assessment model; iv) collect age-frequency data from the commercial catch in order to improve current estimates of the population age structure; v) continue to improve the accuracy of the catch estimates from a number of key fisheries, particularly those catching large quantities of small yellowfin; vi) refine the methodology and datasets used to derive CPUE abundance indices from the longline fishery; and vii) refine approaches to integrate the recent tag release and recapture data into the assessment model.

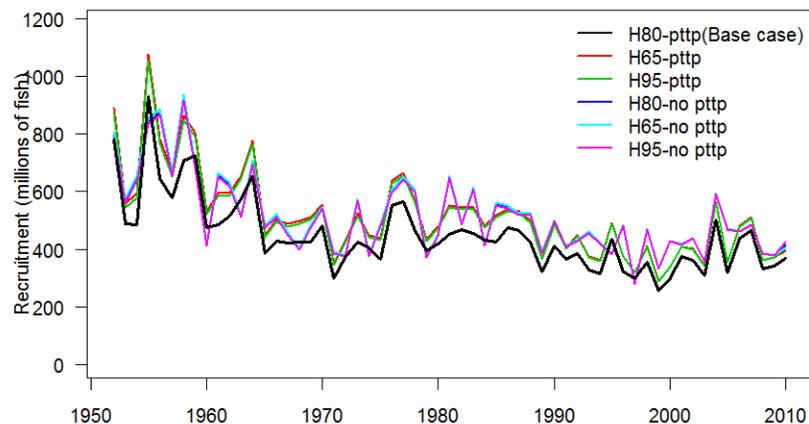


Figure YFT1: Estimated annual recruitment (millions of fish) for the WCPO obtained for the base case (LLcpueOP_TWcpueR6_PTTP – H80pttp) and the five combinations of steepness and tagging datasets included.

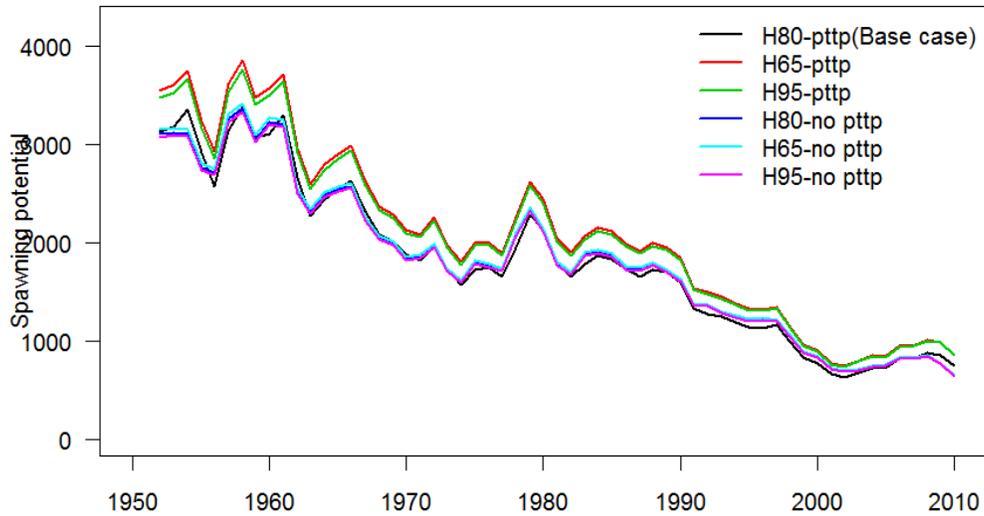


Figure YFT2: Estimated average annual spawning potential for the WCPO obtained from for the base case (LLcpueOP_TWcpueR6_PTTP – H80pttp) and the five combinations of steepness and tagging datasets included.

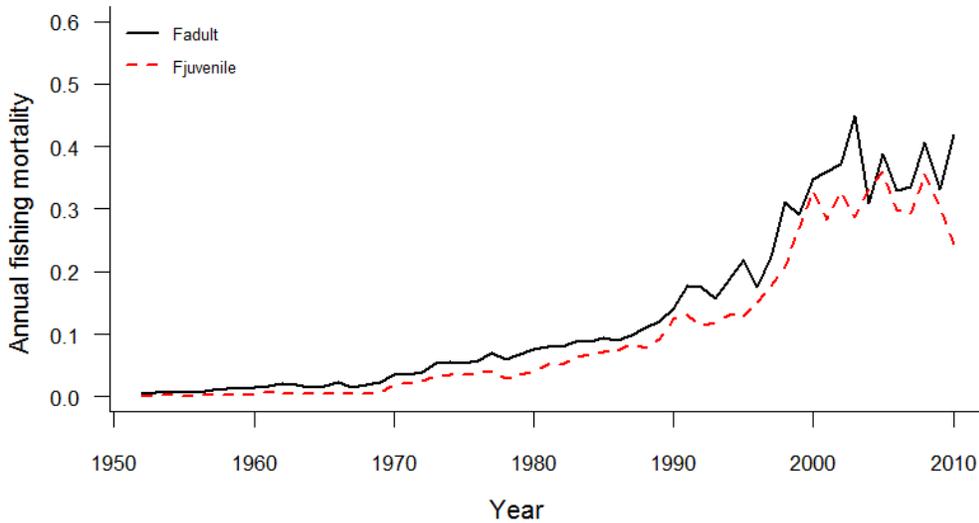


Figure YFT3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the base case model (LLcpueOP_TWcpueR6_PTTP – H80pttp).

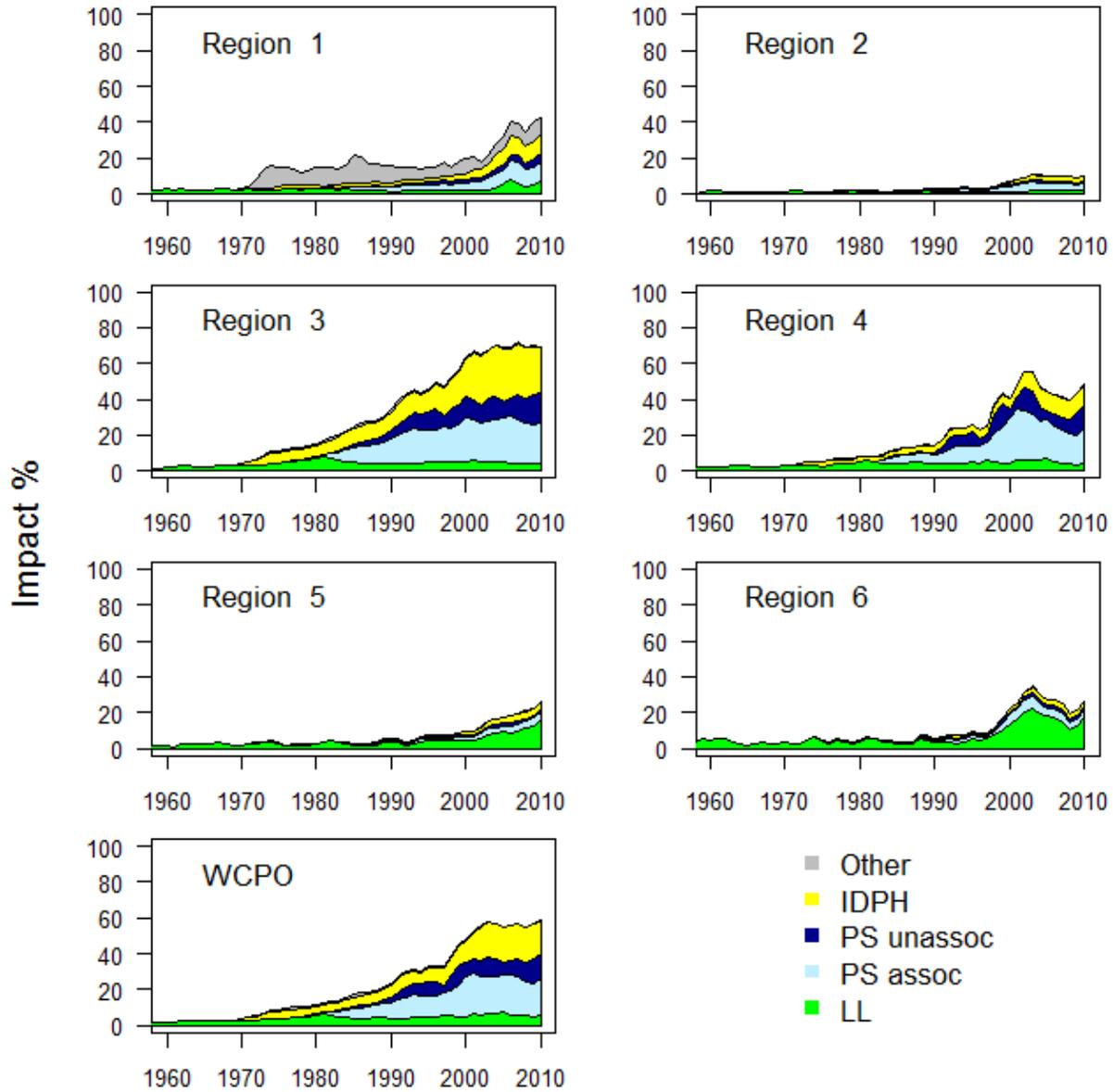


Figure YFT4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (base case model LLcpueOP_TWcpueR6_PTPP - H80pttp). L = all longline fisheries; IDPH = Indonesia and Philippines domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

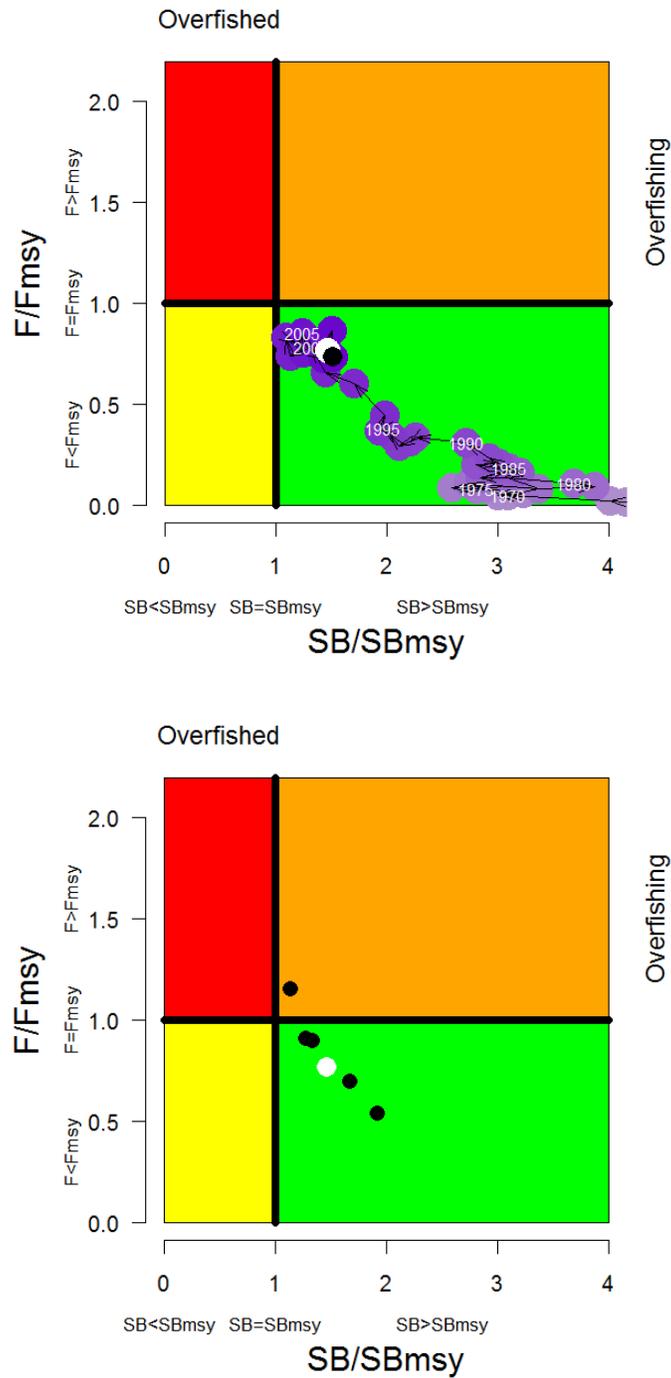


Figure YFT5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the base case model (LLcpueOP_TWcpueR6_PTTT – H80pttp, top) and $F_{current}/F_{MSY}$ and $SB_{current}/SB_{MSY}$ for the base case (white circle) and the five combinations of steepness and tagging datasets included. See Table YFT1 to determine the individual model runs.

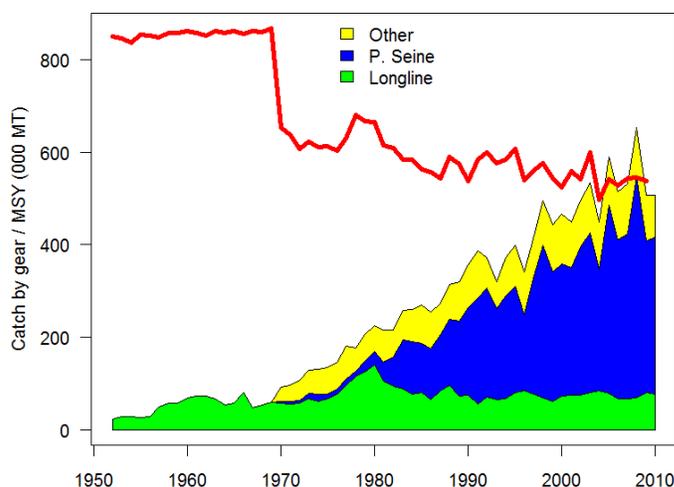


Figure YFT6: History of annual estimates of MSY compared with catches of three major fisheries. Declining MSY results from the change in selectivity of fishing gear and increases in catches of small yellowfin.

Table YFT1. Estimates of management quantities for selected stock assessment models from the 2011 base-case model LLcpueOP_TWcpueR6_PPTP (H80-pttp) and the five combinations of steepness and tagging datasets included. For the purpose of this assessment, “current” is the average over the period 2006–2009 and “latest” is 2010.

	H80-pttp (base case)	H65-pttp	H95-pttp	H80-no pttp	H65- no pttp	H95- no pttp
$C_{current}$	551,120	551,300	551,283	551,488	551,508	551,480
C_{latest}	507,100	507,443	507,358	508,329	508,398	508,286
MSY	538,800	498,000	644,800	493,600	432,000	551,200
$C_{current}/MSY$	1.02	1.11	0.85	1.12	1.28	1.00
C_{latest}/MSY	0.94	1.02	0.79	1.03	1.18	0.92
F_{mult}	1.30	1.10	1.84	1.11	0.87	1.44
$F_{current}/F_{MSY}$	0.77	0.91	0.54	0.90	1.15	0.70
SB_0	2,001,000	2,272,000	2,145,000	2,035,000	2,108,000	1,984,000
SB_{MSY}/SB_0	0.29	0.34	0.24	0.30	0.34	0.25
$SB_{current}/SB_0$	0.42	0.43	0.45	0.40	0.39	0.41
SB_{latest}/SB_0	0.37	0.38	0.40	0.32	0.31	0.32
$SB_{current}/SB_{MSY}$	1.47	1.28	1.92	1.34	1.14	1.67
SB_{latest}/SB_{MSY}	1.30	1.12	1.69	1.06	0.90	1.32
$SB_{curr}/SB_{curr_{F=0}}$	0.44	0.47	0.47	0.40	0.40	0.40
$SB_{latest}/SB_{latest_{F=0}}$	0.41	0.44	0.44	0.35	0.35	0.35
Steepness (h)	0.80	0.65	0.95	0.80	0.65	0.95

Table YFT2. Comparison of WCPO yellowfin tuna reference points from the 2011 reference case model (with uncertainty based on the six models in Table YFT1) with 2009 and 2007 assessments (across a range of models).

Management quantity	2011 assessment	2009 assessment	2007 assessment
Most recent catch	507,100 mt	539,481 mt (2008)	426,726 mt (2006)
MSY	538,800 mt (432,000–644,800)	Range: 493,600–767,200 mt	Base case: 400,000 mt Range: 344,520–549,200 mt
$F_{current}/F_{MSY}$	0.77 (0.54–1.15)	Range: 0.41–0.85	Base case: 0.95 Range: 0.56–1.0
$B_{current}/B_{MSY}$	1.33 (1.12–1.54)	Range: 1.38–1.88	Base case: 1.17 Range: 1.13 ~ 1.42
$SB_{current}/SB_{MSY}$	1.47 (1.14–1.92)	Range: 1.44–2.43	Base case: 1.25 Range: 1.12–1.74
$Y_{Fcurrent}/MSY$	0.97 (0.88–0.99)	Range: 0.76–0.98	Base case: 1.0 Range: 0.88–1.0
$B_{current}/B_{current, F=0}$	0.53 (0.48–0.55)	Range: 0.53–0.63	Base case: 0.51 Range: 0.51–0.58
$SB_{current}/SB_{current, F=0}$	0.44 (0.40–0.47)		

Discussion

179. SC7 expressed its appreciation to the yellowfin assessment team for the 2011 stock assessment and then discussed several aspects of the assessment.

180. SC7 noted that the results of the assessment are broadly similar to those of the last two assessments although there have been a number of important changes and that those changes are generally improving the model fit to key data series, which was welcomed. It was noted that the current conclusions regarding stock status suggest that current yellowfin harvest rates are sustainable. The question arose as to whether there were any indicators that suggest that management is required. In this regard, it was noted that F has been stable since 2000 and the catch has varied around the average level, with no real trend. Furthermore, in terms of reference points, a level of $SB_{current}/SB_0$ of 25–30% would be of concern, but the current level is well above that at 42% in the reference model. It would be of concern if $SB_{current}$ went below SB_{MSY} , but that the reference case estimate is 1.47.

Standardized CPUE

181. SC7 was informed that the standardized CPUE based on operational data for Region 6 was determined from data covering the Chinese Taipei fleet, which are available for the mid-1960s onward. While the CPUE determined from operational data covering the fleets of Chinese Taipei and Japan are comparable, the Japanese data were not used for the period prior to the mid-1960s in Region 6. It was also noted that the spatial area fished by the Japanese longline fleet in Region 3 has declined, which suggests that the standardized CPUE in Region 3 may no longer be representative.

Catchability in Regions 3 and 4

182. CCMs queried why, in relation to the “purse-seine associated” fishery in Regions 3 and 4, there is a steady increase in catchability through time, then a sharp decline. SC7 was informed that the increase may be due to increasing efficiency, but the reason for the decline is not clear. Interpreting catchability can be complicated as it also incorporates spatial patterns (often referred to as “availability”). Also, the “fleets” defined in the assessment are highly aggregated across flag states, and effort by flag state can change in time, which may affect overall catchability.

External review by the Center for Independent Experts

183. SC7 welcomed the highly positive results of the external review of the yellowfin tuna assessment and generally agreed with the main thrusts of reviewers’ comments. It also agreed with SPC’s response to the review, which suggests that the efforts of the reviewers may have been more effective if the reviewers had access to the full range of available background papers.

184. In response to a query as to what was learned from the independent review, SPC commented that it was gratifying that some of the same issues identified during the review were those previously identified by SPC. The review found that the modeling framework is sufficient, but that there is a need to improve the inputs, such as key data. SPC recognized the fundamental need to know the catch, particularly for the domestic fisheries of Indonesia and the Philippines, and the purse-seine catch. They highlighted the biological uncertainties, especially growth. In this regard, yellowfin otoliths already exist that could be used.

185. The reviewers noted the same points regarding operational CPUE and size as discussed in papers SC7–SA–IP–06 and SC7–SA–IP–07. Regarding the process, the reviewers had no contact with the assessment team, which perhaps ensured the objectivity of the review; but, as a result, the reviewers were not provided with some of the fundamental documents. Also, the review was done under Center for Independent Experts’ own terms of reference and not those of the SC’s. Both points should be taken into account for future external reviews.

Reproduction potential of older age classes

186. A question was raised as to why the assessment suggests a decline in the proportion mature for older age classes. SC7 was informed that the reason for the decline is because of the assumed higher mortality after sexual maturity for females (compared with males), so there are fewer females at older ages. Alternatively, growth may, in fact, be slower for female yellowfin at larger sizes, but the model currently does not model growth separately by gender. This may lead to underestimation of spawning potential at older sizes. It was suggested that modeling growth rates separately by gender should be examined in the future. In this regard, information currently exists on yellowfin fecundity at length, sex ratios at length, and there is limited information on different growth rates for males and females. The most useful information to be collected would be on length-at-age by sex; some otolith samples have already been collected, but not yet analyzed.

Lack of fit of tagging recoveries for older fish

187. Regarding the problem of bias in the number of tag recaptures for older fish, wherein the model over-estimates the number of recoveries, it was suggested that the lack of fit may be partially due to delays in the receipt of PTPP tag recoveries. As more recoveries are received, the lack of fit should diminish.

Conflict between trends in CPUE and biomass

188. SC7 noted that there is a conflict between the declining trend in CPUE and the different trends in biomass estimates during the RTTP and the PTTP. The decline in CPUE in Area 3 may be too steep. In this regard, the targeting of bigeye by longliners in Area 3, as well as relative tag reporting rates, may need to be examined.

Recruitment and environmental factors

189. Regarding the different levels of recruitment in the first and second halves of the time series (Fig. 42 in the assessment paper), it was asked whether this was due to environmental factors. SPC responded that the inclusion of work done by SPC on environmental factors in the assessment is one of many things to do. The plan is to expand the modeling framework to include changes in movement patterns driven by large-scale environmental changes. The assessment currently assumes that movement is static, but it is known that El Niño-Southern Oscillation (ENSO) influences movement, particularly longitudinally; until this is done, it may be that the changes in movement are affecting estimates of recruitment.

Differences in biological characteristics among areas

190. In paragraph 9 of the Executive Summary, it states that “there appear to be differences in the biological characteristics of yellowfin tuna in Region 3 that warrant further investigation”. One example of these differences is the difference in growth rates, as for bigeye. The maximum length of yellowfin in Region 3 is not as great as Region 2 or 4. The assessment currently estimates growth for all regions combined; however, the modal structure that is clear in the northern regions because of spawning seasonality may not be characteristic of the tropical regions. Another example is the spawning maturity schedule.

Other comments

191. It was noted that reduced availability of yellowfin in the southern region has been observed and that this should be explored in the future.

3.2.2 Provision of scientific information

a. Stock status and trends

192. The 2011 yellowfin assessment is comparable to recent assessments (Table YFT2) although there is a range of data updates and a few changed structural assumptions. The primary differences are a revised structure of the fisheries based in Indonesia and Philippines; the incorporation of recent PTTP tagging data; the use of standardized longline CPUE derived from operational-level data; and purse-seine, size-frequency data corrected for grab sample selectivity bias using experimental spill sample data.

193. SC7 selected the reference case (LLcpueOP_TWcpueR6_PTTP – H80), which had an assumed steepness of 0.8 and included recent PTTP tagging data (hereafter referred to as the base case) to represent the stock status of yellowfin. To characterize uncertainty in the assessment, SC7 chose additional models based on alternate values of steepness and with recent PTTP tagging data either included or excluded (Table YFT1), as follows:

Model	CPUE	Steepness
H80-pttp (base case)	PTTP data included	steepness = 0.8
H65-pttp	PTTP data included	steepness = 0.65
H95-pttp	PTTP data included	steepness = 0.95
H80-no-pttp	PTTP data excluded	steepness = 0.8
H65-no-pttp	PTTP data excluded	steepness = 0.65
H95-no-pttp	PTTP data excluded	steepness = 0.95

194. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures YFT 1–4.

195. For the base case, $F_{current}/F_{MSY}$ is estimated at 0.77, indicating that overfishing is not occurring for WCPO yellowfin tuna (Fig. YFT5). However, one of the alternate models found that $\frac{F_{current}}{F_{MSY}} > 1.0$, with a range across the six models considered of 0.54–1.15. Therefore, there is a possibility that overfishing is occurring for yellowfin tuna.

196. The base case indicates that the current total biomass and spawning biomass are higher than associated MSY levels ($\frac{B_{current}}{B_{MSY}} = 1.33$ and $\frac{SB_{current}}{SB_{MSY}} = 1.47$). None of the alternate models found that $\frac{SB_{current}}{SB_{MSY}} < 1.0$ with a range across the six models considered of 1.14–1.92. Therefore, yellowfin tuna is not considered to be in an overfished state. However, while the exploitation rates differ between regions, they continue to be highest in the western equatorial region.

197. An analysis of historical patterns in the mix of fishing gear types indicates that MSY has been reduced to approximately 60% of its levels prior to 1970 through the increased harvesting of juveniles (Fig. YFT6).

b. Management advice and implications

198. SC7 determined that the WCPO yellowfin appears to be capable of producing MSY. The stock is not experiencing overfishing and is not in an overfished state. Projections to 2021 indicate that fishing mortality is projected to remain below F_{MSY} and the spawning biomass will remain above SB_{MSY} .

199. However, SC7 noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation rates were highest in the western equatorial region (Region 3 in the stock assessment model), which accounts for ~81% of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 31% of the unexploited level ($SB_{2010,F=0}$).

200. SC7 recommended that there be no increase in fishing mortality in the western equatorial region.

201. The increase in catches of juvenile yellowfin has resulted in a moderate (~40%) reduction in the potential yield of the WCPO yellowfin stock. SC7 concluded that MSY levels would increase if the mortality of juvenile yellowfin was reduced.

3.3 Requests from CMM 2008-01

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

202. No new information was submitted.

3.4 WCPO skipjack tuna

3.4.1 Review of research and information

Summary of SC7-SA-WP-04 (Stock assessment of skipjack tuna in the WCPO)

203. S. Hoyle (SPC) presented “Stock assessment of skipjack tuna in the WCPO”. The excerpts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model runs selected by SC for the determination of current stock status and the provision of management advice.

204. This paper presents the 2011 assessment of skipjack tuna in the WCPO. The assessment uses the stock assessment model and computer software known as MULTIFAN-CL. The skipjack tuna model is age (16 quarterly age classes) and spatially structured. The catch, effort, size composition, and tagging data used in the model are grouped into 18 fisheries (a change from 17 fisheries used in the 2010 assessment) and quarterly time periods from 1972 through 2010.

205. The current assessment incorporates a number of changes from the 2010 assessment.

- a) Updated catch, effort, and size data.
- b) A revised standardized effort series for each region based on a new GLM analysis of catch and effort data from the Japanese distant-water, pole-and-line fishery.
- c) Adjustment of size-frequency data based on observer sampling of skipjack, bigeye, and yellowfin size and species compositions, and adjustment for grab sampling bias.
- d) Changes to the modeling of the Philippines and Indonesia purse-seine fisheries. These fisheries are separated into fishing activity in archipelagic waters, and fishing outside archipelagic waters to the east of longitude 125°E. Purse-seine effort to the east of 125°E is included in the main associated purse-seine fishery, apart from domestically based vessels, which are included in a new Philippines and Indonesia domestic purse-seine fishery.
- e) Inclusion of tag releases and recoveries from the recent SPC-PTTP tagging programmes, which increases tagging data in the assessment by 50%.
- f) Steepness, a parameter defining the shape of the stock recruitment relationship, was changed from 0.75 to 0.8 in the reference case, with alternative values of 0.65 and 0.95 included in sensitivity analyses.
- g) Growth parameters were fixed at their values estimated in 2010.

206. In addition to these changes, a large suite of additional models were run to aid the development of the final “reference case” model. This reference case model is used as an example for presenting model diagnostics, but the most appropriate model run(s) on which to base management advice will be determined by the SC. The sensitivity of the reference model to key assumptions (i.e. regarding the stock recruitment relationship, CPUE time series, purse-seine catch and size data, growth model, and PTTP tagging data) were explored via sensitivity analyses. The results of these analyses should also be considered when developing management advice.

207. A number of trends in key data inputs were noted as particularly influential for the assessment results. The large tagging dataset, and associated information on tag reporting rates, is relatively

informative regarding stock size. The relative sizes of fish caught in different regions are also indicative of trends in total mortality, mediated through growth, catch, and movement rates. The assessment is therefore very dependent on the growth model.

208. For the northern region, there was little contrast in the Japanese pole-and-line CPUE time series. However, both the southern region Japanese pole-and-line CPUE time series showed increases early in the time series and declines at the end, with greater decline in Region 2.

209. Overall, the main assessment results and conclusions are:

- a) Estimates of natural mortality are strongly age-specific, with higher rates estimated for younger skipjack.
- b) The model estimates significant seasonal movements between the western and eastern equatorial regions. The performance of the fishery in the eastern region has been shown to be strongly influenced by the prevailing environmental conditions with higher stock abundance and/or availability associated with El Niño conditions (Lehodey et al. 1997). This is likely to be at least partly attributable to an eastward displacement of the skipjack biomass due to the prevailing oceanographic conditions, although this dynamic cannot be captured by the parameterization of movement in the current model.
- c) Recruitment showed an upward shift in the mid-1980s and is estimated to have remained at a higher level since that time. This change in estimated recruitment is driven in the model by CPUE data and by the tagging data, given the relative tag return rates from the Skipjack Survey and Assessment Programme and RTTP. Recruitment in the eastern equatorial region is more variable, with recent peaks in recruitment occurring in 1998 and during 2004–2005 following strong El Niño events around those times. Conversely, the lower recruitment in 2001–2003 followed a period of sustained La Niña conditions. Recent recruitment is estimated to be at a high level, but is poorly determined due to limited observations from the fishery.
- d) Biomass trends are driven largely by recruitment and fishing mortality. The highest biomass estimates for the model period occurred in 1998–2001 and in 2005–2007, immediately following periods of sustained high recruitment within the eastern equatorial region (Region 3).
- e) The biomass trajectory is influenced by the underlying assumptions regarding the treatment of the various fishery-specific catch and effort datasets within the model. The Japanese pole-and-line fisheries are all assumed to have constant catchability, with any temporal trend in efficiency assumed to have been accounted for by the standardization of the effort series. CPUE trends are influential regarding the general trend in both recruitment and total biomass over the model period. In all regions there is a relatively good fit to observed CPUE data, with some deterioration when PTTP tagging data are introduced.
- f) The model also incorporates a considerable amount of tagging data that provides information concerning absolute stock size during the main tag recovery periods. Including PTTP tagging data in the model resulted in higher estimates of recent biomass and MSY. Initial analyses of the data suggest some conflict with inferences from the CPUE time series about trends in abundance. Further work on both data sources is recommended.

- g) Within the equatorial region, fishing mortality increased throughout the model period and is estimated to be highest in the western region in the most recent years. The impact of fishing is predicted to have reduced recent biomass by about 47% in the western equatorial region and 21% in the eastern region. For the entire stock, the depletion is estimated to be approximately 35%.
- h) The principal conclusions are that skipjack is currently exploited at a moderate level relative to its biological potential. Furthermore, estimates of $F_{current} / \tilde{F}_{MSY}$ and $B_{current} / \tilde{B}_{MSY}$ indicate that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state. These conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment. Fishing pressure and recruitment variability, influenced by environmental conditions, will continue to be the primary influences on stock size and fishery performance.
- i) For the model assumptions investigated, there was only moderate variation in the estimates of stock status. The most influential assumptions involved steepness and growth. There are insufficient data to estimate steepness reliably within the assessment model and many of the key management quantities are strongly influenced by the values assumed. Growth and its variation in space, through time, and among individuals is not well understood. However, only a limited range of assumptions was investigated in this assessment, and as a result the true level of uncertainty is likely to be under-estimated. A range of other assumptions in the model should be investigated either internally or through directed research. Further studies are required to i) refine our estimates of growth and reproductive potential, including spatiotemporal variation; ii) examine in detail the time series of size-frequency data from the fisheries, which may lead to refinement in the structure of the fisheries included in the model; iii) consider size-based selectivity processes in the assessment model; iv) continue to improve the accuracy of catch estimates from a number of key fisheries; v) refine the methods used to adjust catch and size data in the purse-seine fisheries; vi) refine the methodology and datasets used to derive CPUE abundance indices from the pole-and-line fishery; vii) refine approaches to integrate the recent tag release and recapture data into the assessment model; and viii) develop more formal and rigorous methods for prioritizing the many available research options.
- j) **Based on estimates of $F_{current} / \tilde{F}_{MSY}$ and $B_{current} / \tilde{B}_{MSY}$ from the reference model and associated sensitivity grid, it is concluded that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state.** These conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment. Although the current (2006–2009) level of exploitation is below that which would provide the maximum sustainable yield, recent catches have increased significantly and the mean catch for 2006–2009 of 1.5 million tonnes is equivalent to the estimated MSY at an assumed steepness of 0.8, but below the grid median estimate of 1.9 million tonnes. Maintenance of this level of catch would be expected to decrease the spawning stock size towards MSY levels if recruitment remains near its long-term average level. Fishing mortality and recruitment variability, influenced by environmental conditions, will both continue to affect stock size and fishery performance.

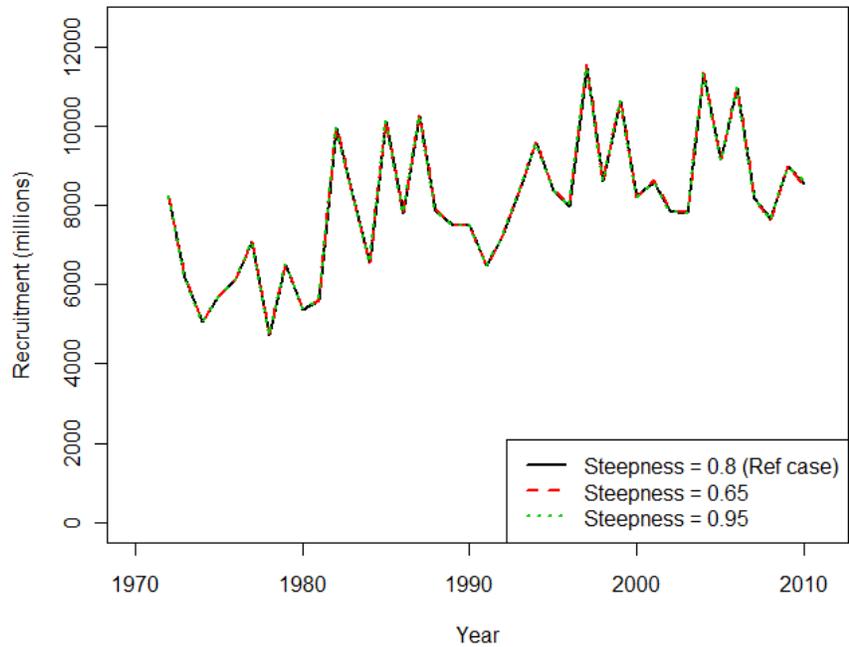


Figure SKJ1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference model (steepness = 0.8, black line) and the two alternative steepness values.

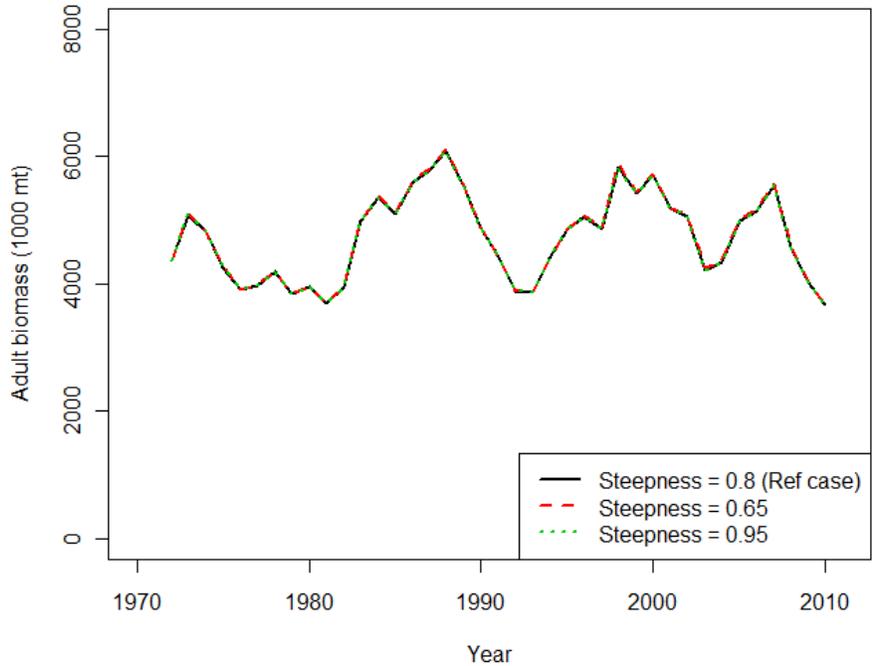


Figure SKJ2: Estimated average annual average spawning biomass for the WCPO obtained from the reference model and the two alternative steepness values.

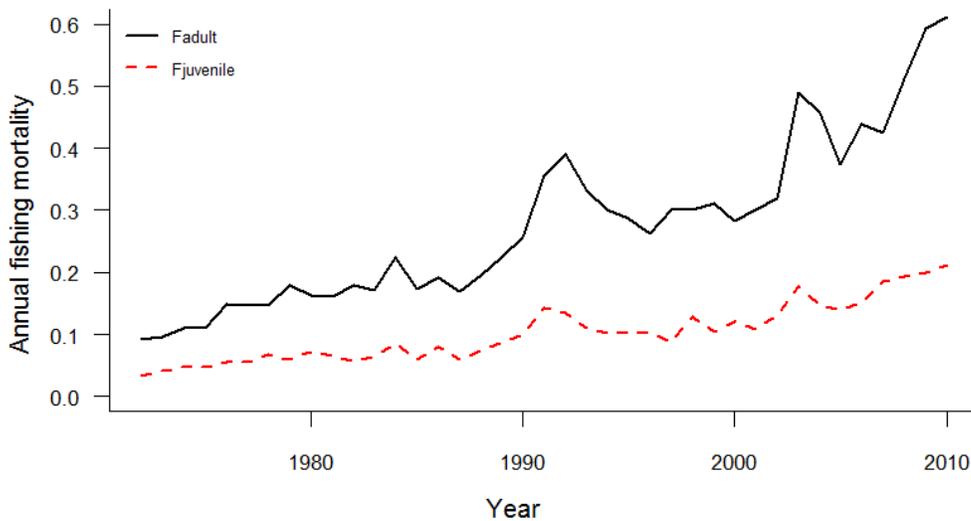


Figure SKJ3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model.

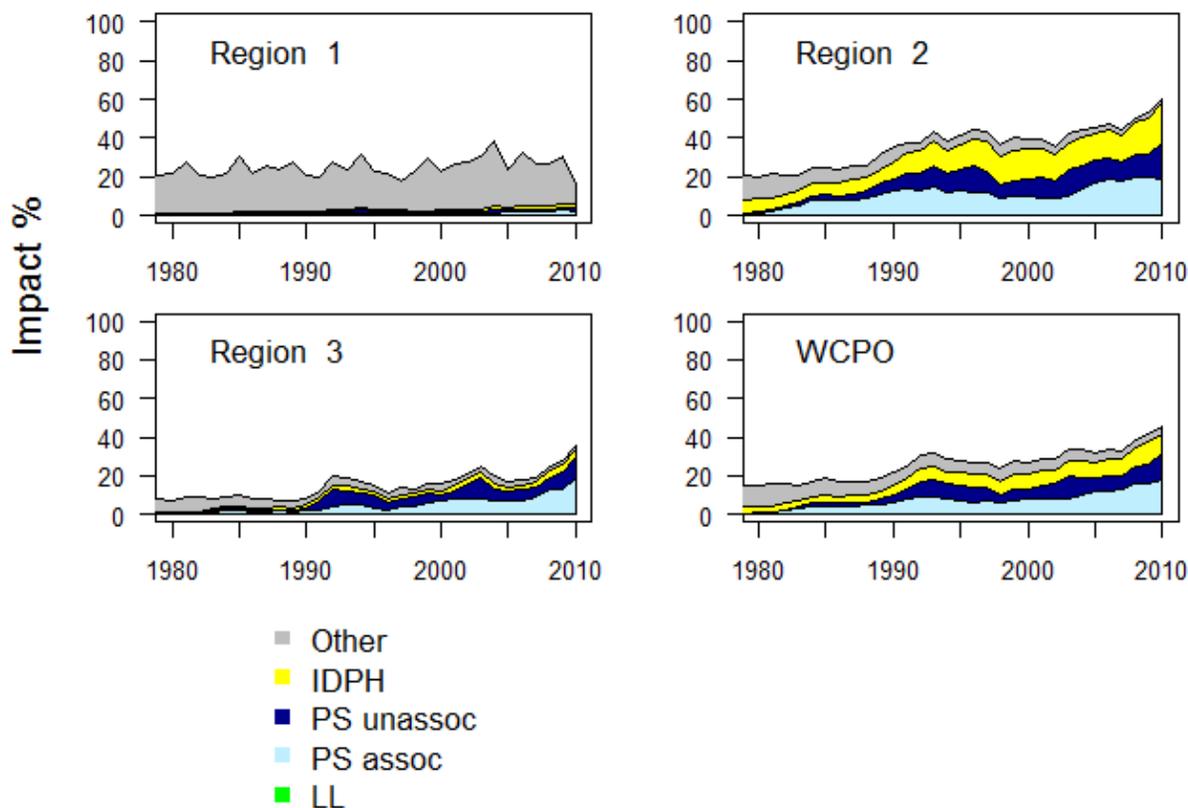


Figure SKJ4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t_{F=0}}$) by region and for the WCPO attributed to various fishery groups (reference case model). L = all longline fisheries; IDPH = Indonesia and Philippines domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

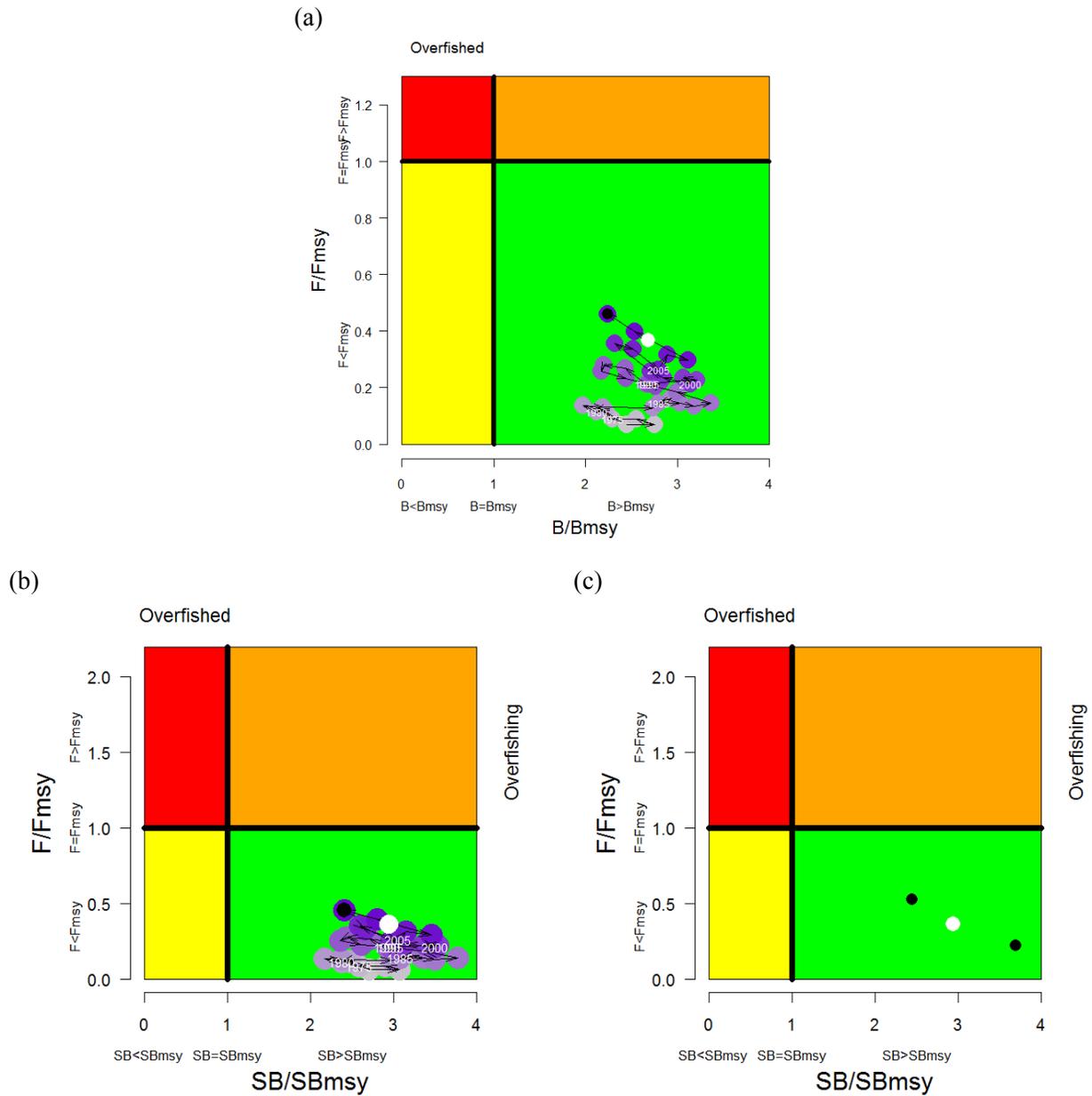


Figure SKJ5: Temporal trends in annual stock status, relative to B_{MSY} or SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points. Figures are provided for the reference case model (a, b, and the white circle in c) and the two alternative steepness values (black circles in c). See Table SKJ1 for the individual model runs.

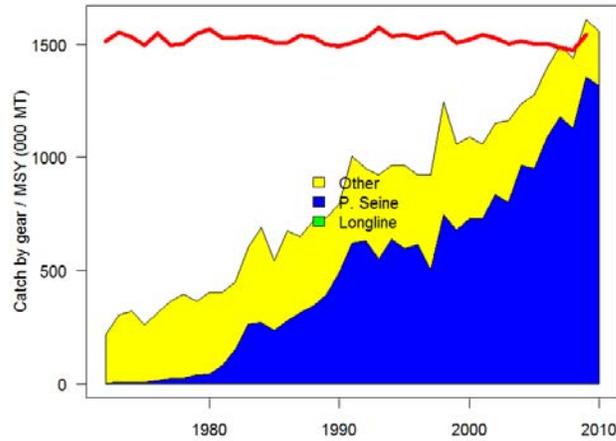


Figure SKJ6: History of annual estimates of MSY compared with catches of three major fisheries.

Table SKJ1. Estimates Estimates of management quantities from the 2011 reference case model and two alternate models using steepness values of 0.65 and 0.95 respectively. For the purpose of this assessment, “current” is the average over the period 2006–2009 and “latest” is 2010.

	H80 (base case)	H65	H95
$C_{current}$	1,484,702	1,484,729	1,484,894
C_{latest}	1,556,643	1,556,596	1,556,924
MSY	1,503,600	1,274,000	1,818,000
$C_{current}/MSY$	0.99	1.17	0.82
C_{latest}/MSY	1.04	1.22	0.86
F_{mult}	2.71	1.9	4.46
$F_{current}/F_{MSY}$	0.37	0.53	0.22
SB_0	5,787,000	5,940,000	5,888,000
SB_{MSY}/SB_0	0.27	0.32	0.22
$SB_{current}/SB_0$	0.79	0.77	0.82
SB_{latest}/SB_0	0.60	0.58	0.62
$SB_{current}/SB_{MSY}$	2.94	2.45	3.69
SB_{latest}/SB_{MSY}	2.21	1.84	2.80
$SB_{curr}/SB_{curr_{F=0}}$	0.63	0.63	0.65
$SB_{latest}/SB_{latest_{F=0}}$	0.54	0.54	0.56
Steepness (h)	0.80	0.65	0.95

Table SKJ2. Estimates of reference points from the 2011 (with uncertainty based on the range of models in Table SKJ1), 2010, and 2008 skipjack tuna stock assessments. The spatial domain of the 2008 assessment was limited to the equatorial region of the WCPO.

Management quantity	2011 assessment (uncertainty)	2010 assessment	2008 assessment
Most recent catch	1,556,643 mt	1,575,287 mt (catch based on spill sampling) ^a	1,546,436 mt (2007 ^b) 1,726,702 mt (2007 ^c) 1,410,389 (WCPO catch based on spill sampling)
MSY	1,503,600 mt (1274000–1818000)	1,375,600 mt	1,280,000 mt
$Y_{F_{current}}/MSY$	0.76 (0.65–0.86)	0.80	0.70
$B_{current}/B_{current, F=0}$	0.65 (0.65–0.67)	0.63	0.66
$F_{current}/F_{MSY}$	0.37 (0.22–0.53)	0.34	0.26
$B_{current}/B_{MSY}$	2.68 (2.32–3.17)	2.24	2.99
$SB_{current}/SB_{MSY}$	2.94 (2.45–3.69)	2.67	3.82

Discussion

210. SC7 thanked the science services provider for the skipjack assessment, which had similar conclusions to past assessments. SC7 noted that there have been changes to the model structure and underlying assumptions. It also noted that the revisions and additions to the input data used in the 2011 assessment have influenced the assessment. SC7 supported the principal conclusions that skipjack is moderately exploited and that the stock is neither subject to overfishing nor is it overfished, and that these conclusions appear relatively robust, at least within the statistical uncertainty of the current assessment.

211. SC7 also recognized that fishing pressure and recruitment variability, influenced by environmental conditions, will continue to be the primary influences on stock size and fishery performance. SC7 endorsed the idea that the reference case of the stock assessment should be the basis for the SC's advice on skipjack. The advice provided should also include stock status advice with the stock recruitment steepness parameter fixed at 0.65 and 0.95 to describe the uncertainty in the assessment. The SC would like to see work to improve the skipjack model continued as a priority so that CCMs can clearly understand changes in the status of this stock.

212. SC7 noted that at the pre-assessment workshop there was general agreement that the reference case for 2011 would use a steepness of 0.8. A comparison of this reference case with 2010 assessment results where the steepness of the base case was 0.75 suggests that the choice of steepness values of 0.8 or 0.75 has little influence on the skipjack assessment, and there is no strong reason to choose one over the other. SC7 invited comment from the science services provider on whether, for consistency between assessments, it was advisable that 0.75 be selected as the base case in 2011. SC7 was advised that Run5 of the structural sensitivity analyses includes the reference case dynamics with steepness changed to 0.75. However, this is the only model structure in the suite of model runs with a steepness of 0.75. All models in the structural sensitivity grid have a steepness of 0.65, 0.8 or 0.95.

213. SC7 noted concerns about the decline of skipjack catches in the northern coastal area around Japan (see SC7-SA-IP-12). Furthermore, although in 2010 skipjack catches by the middle-sized Japanese pole-and-line fishery recovered from 2009 (lowest), the second lowest catch was recorded in 2010. It is suggested that the statement from the SC6 report (reducing skipjack availability to high latitude due to high catches in the equatorial area) should be repeated in the SC7 report. This statement reads “There is concern, yet to be substantiated, that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitudes (e.g. Japan, Australia, and New Zealand) fisheries.”

Index of abundance

214. SC7 noted that the catch rate index that was used in the assessment was generated from fisheries that only represented 4% of the catch in recent years and that the spatial coverage of these fisheries has changed over time. SC7 noted that there was wide spatial coverage by pole-and-line fleets until the 1980s when the purse-seine fleet expanded. However there is little spatial overlap between the pole-and-line fisheries and purse-seine fisheries, with the pole-and-line fisheries largely restricted to the boundaries between Regions 1, 2 and 3. SC7 noted that this was potentially a concern for the structure of the assessment model as it is likely that there are different trends and variability in the response of the stock to harvest at the periphery as opposed to the core of skipjack distributions.

215. One of the major changes in the 2011 skipjack stock assessment was the estimated change in the biomass trend around 1984. The use of a revised standardized CPUE is a feature of the new assessment and is estimated from operational pole-and-line data, and takes vessel effects into account. There has not yet been sufficient opportunity to fully evaluate and understand the factors that influence CPUE, and this is ongoing work. However, it was noted that the change in biomass coincides with changes in the Japanese distant-water, pole-and-line fleet (see SC7-SA-IP-13). In response to low catches in this period the size of the pole-and-line fleet decreased and extended farther into equatorial areas.

Length-frequency data

216. SC7 noted that the use of information obtained from spill and grab sampling to adjust the size distribution used in the assessment could have resulted in obscuring of length-frequency modes. This was not a factor in the 2010 skipjack assessment as this assessment used unadjusted size composition data. SC7 noted that SC7-ST-IP-02 provides further explanation on size composition data.

217. In the 2011 yellowfin assessment it was noted that the growth curve estimated for Region 3 was different to previous years and it is suspected that this is due to the change in size composition data. However, this explanation is preliminary because no formal evaluation of the yellowfin model has been undertaken to explain this observation.

New fisheries data

218. Clarification was requested on whether the current definition for the Indonesia and Philippines fisheries used in the model included the new data recently provided under the WPEA OFM project. SC7 noted that SC7-SA-IP-03 explains how these new data have been used. It was noted that for Indonesia, catch data are provided as an annual catch estimate and disaggregation of these data is based on best knowledge and expert opinion. Future logbook data are expected to improve the disaggregation of these data. On the issue of fishery definition, SC7 requested that in the future, it would be preferable if the science services provider standardized the abbreviations of the various fisheries across the assessments for each species.

Model structure and parameterization

219. SC7 also noted that there was some conflict between the new CPUE data and PTTP data, particularly at the end of the time series where CPUE data estimate a steeper decline in biomass without PTTP data, and this issue needs to be resolved. In structural sensitivity analyses, alternate CPUEs were included, although there were no models that explicitly tested the inclusion or exclusion of PTTP data; however, such a model was included in the overall suite of model runs.

220. SC7 commented that the fishing mortality estimate for Region 1 in the stock assessment model had increased by two times in comparison to that estimated for Region 1 in the 2010 assessment. The changes made to the CPUE index are likely to have been responsible for this change.

221. It was noted that the north and south movement and recruitment distribution estimated by the model may be unrealistic given the known distribution of suitable spawning habitat (inferred from sea surface temperature and other factors); however, this is mitigated by the fact that recruitment in MULTIFAN-CL (MFCL) is driven by observations in the fisheries. In this case, fish at the age of recruitment are too small to be observed and may move into non-spawning areas in the period between hatching and having grown to a size vulnerable to the fishery. There is potential in the future to use alternative models such as the spatial ecosystem and population dynamics model (SEAPODYM), which models fish distribution in association with habitats at a high resolution, to estimate mixing rates that could then be used in MFCL to better assign the biomass of fish aged less than six months (two quarters of age).

3.4.2 Provision of scientific information

a. Stock status and trends

222. SC7 selected the reference case as the base model to represent the stock status and Committee's advice on skipjack tuna. A value of 0.8 was chosen as the mid-point of the range of steepness values considered in the 2011 assessment. Similar to other tuna species, the actual value of steepness for WCPO skipjack currently remains unknown.

223. Fishing mortality rates tended to be higher during the last decade than for the preceding period, and fishing mortality and biomass indicators relative to MSY started to move towards 1.0, although they remained substantially below the F_{MSY} level ($F_{current}/F_{MSY} = 0.37$). The stock is not in an overfished state because biomass is above B_{MSY} ($B_{current}/B_{MSY} = 2.68$).

b. Management advice and implications

224. Catches in 2010 were roughly 1.556 million mt, the second highest recorded, and below the record high catch of 1.608 million mt in 2009. Equilibrium yield at the current F is about 1.14 million mt. This is about 76% of the MSY level. The assessment continues to show that the stock is currently only moderately exploited ($F_{current}/F_{MSY} = 0.37$) and fishing mortality levels are sustainable. However, there is concern that high catches in the equatorial region could result in range contractions of the stock, thus reducing skipjack availability to higher latitude (e.g. Japan, Australia, New Zealand and Hawaii) fisheries.

225. If recent fishing patterns continue, catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored. The Commission should consider developing limits on fishing for skipjack to limit the declines in catch rates associated with further declines in biomass.

226. Fishing is having a significant impact on stock size, especially in the western equatorial region, 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 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.

227. Noting the uncertainty in purse-seine species composition, SC7 urged the Commission to continue improving estimates of purse-seine composition data. SC7 requested CCMs, port states, flag states and vessel operators to support efforts for paired spill and grab sampling together with effort to collect landings and cannery data.

3.5 South Pacific albacore

228. Two working papers that addressed the review of Project 39 (SC7-SA-WP-05), and the albacore tuna stock assessment (SC7-SA-WP-06) were presented.

3.5.1 Review of research and information

a. Review of Project 39

Summary of SC7-SA-WP-05 (Regional study of South Pacific albacore population biology: Year 3 – Biological sampling and analysis)

229. S. Nicol presented Project 39, a regional study of South Pacific albacore population biology, and described the third year of the project (SC7-SA-WP-05). The objectives for the third year were to complete biological sampling of albacore (otoliths and gonads) in the southwest Pacific region, continue laboratory analysis of the material collected, and estimate preliminary biological parameters (age, growth and reproduction).

230. The biological sampling component of the project is complete, with material being collected from 3,384 albacore caught across the southwest region from Australia to south of the Pitcairn Islands (i.e. from 130°E to 130°W). Very good industry cooperation was integral to the success of the sampling programme. All material sampled has been received and archived for current and future use.

231. Preliminary length-weight relationships have been calculated for albacore sampled in Australia and New Zealand based on 1,756 measurements. Validated (direct and indirect) otolith-based ageing protocols have been developed for albacore. Otoliths from 2,152 fish have subsequently been selected for annual age estimation based on sampling location, fork length, and sex. All otoliths have been prepared (sectioned) and approximately half have been read. Daily ageing of small fish is also being undertaken to further validate annual ageing protocols and to examine growth in the first year of life.

232. Histological sections of ovaries have been prepared for all females >70 cm fork length sampled (n=1,162). This size range encompasses immature and mature fish, which is important for examining reproductive characteristics such as size-at-maturity and age-at-maturity, spawning time and area, and spawning fraction. All sections have been read and the reproductive status determined. The priority for the next five months is to complete laboratory work and analyses. Biological parameters will be delivered to stock assessment and harvest strategy scientists by the end of 2011.

Discussion

233. SC7 commended project participants on the project and noted that it has generated significant new and important information on albacore population biology. Some CCMs expressed their gratitude to

the many people who have taken part in this project and looked forward to the results and outcomes of the study and their incorporation in the next stock assessment. One CCM expressed concern about whether the methods used to read otoliths have been peer-reviewed and generally accepted by the scientific community, and encouraged project investigators to seek publication of the methods and results in scientific journals.

b. Review of 2011 stock assessment

Summary of SC7-SA-WP-06 (Stock assessment of South Pacific albacore tuna)

234. S. Hoyle (SPC) presented “Stock assessment of albacore tuna in the South Pacific Ocean”. The excerpts from the Executive Summary of this paper are provided below as are several figures and tables regarding stock status that reflect the model run selected by SC for the determination of current stock status and the provision of management advice.

235. This assessment uses the same underlying structural assumptions as the 2009 assessment. Due to improved understanding of the data inputs, the model structure of the 2009 alternate case was applied in the 2011 reference case. The main conclusions of the assessment are:

- a) Estimated stock status is similar to 2009 estimates (Figs. ALB1–ALB3).
- b) Biological research indicates that male and female albacore have quite different growth curves, which are not included in the model. Growth curve errors can bias estimates of biomass and fishing mortality. Estimated management parameters should, therefore, be viewed with caution.
- c) There is considerable uncertainty about the early biomass trend, but this has a negligible effect on management parameters, or advice to managers regarding the status of the stock.
- d) Estimates of $F_{2007-2009}/F_{MSY}$ (0.26), SB_{2009}/SB_{MSY} (2.25) do not indicate overfishing above F_{MSY} , nor an overfished state below SB_{MSY} (Fig. ALB3).
- e) Results from the 2009 assessment suggest that much of the variation in management parameters is attributable to steepness, which we have no information about. This variation makes management advice based on MSY relatively uninformative. Alternative metrics such as the expected CPUE, relative to a target CPUE, may be less affected by uncertainty. They may also be more relevant to the management needs of the fishery.
- f) There is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries.
- g) Longline catch rates appear to be declining, and catches over the last 10 years have been at historically high levels. This CPUE trend may be significant for management.

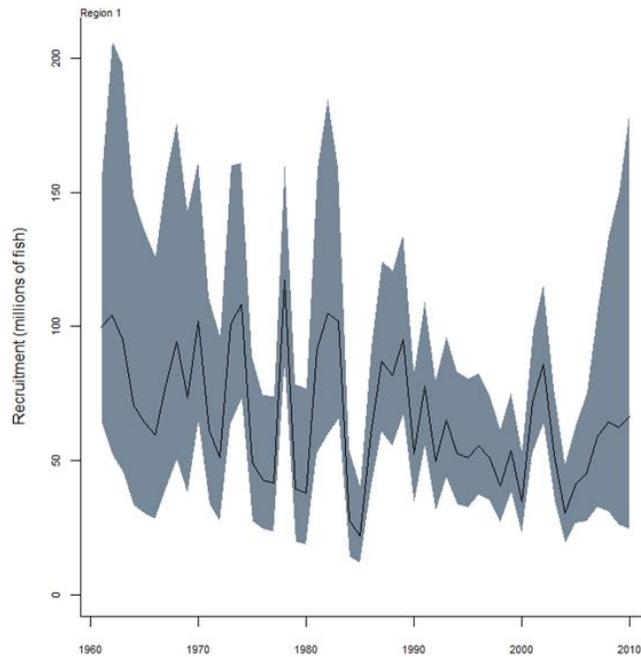


Figure ALB1: Annual recruitment (number of fish) estimates. Grey area represents parameter uncertainty estimated from the Hessian matrix.

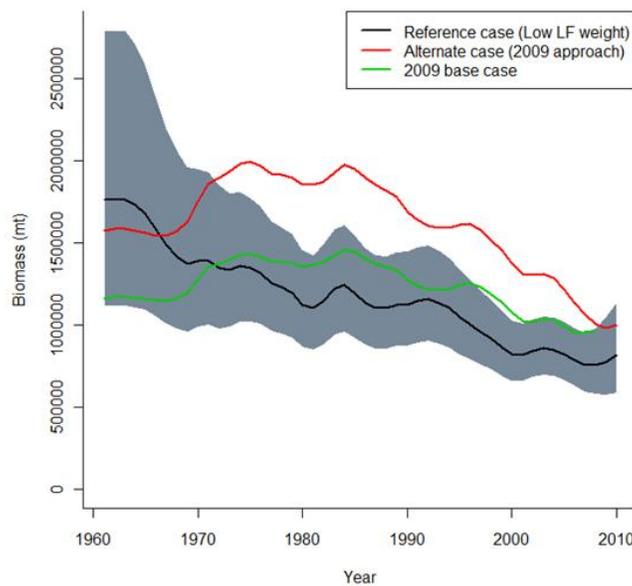


Figure ALB2: Annual estimates of total biomass (thousands of metric tonnes). Several scenarios are shown to illustrate the change between this year's reference case, the alternate case that used the same approach as in 2009, and the biomass trend estimated in the 2009 base case. The comparisons illustrate some effects of conflict between CPUE and length-frequency data. Grey area represents parameter uncertainty estimated from the Hessian matrix.

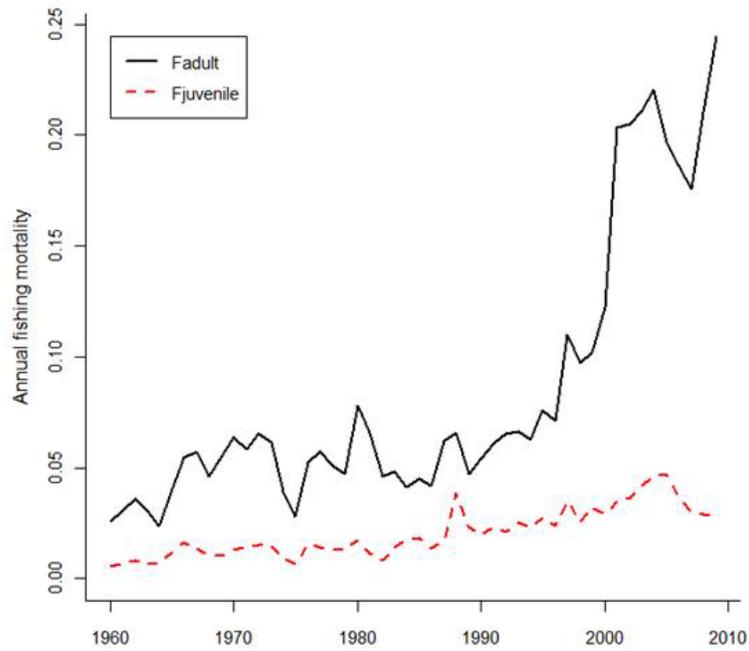


Figure ALB3: Annual estimates of fishing mortality for juvenile and adult South Pacific albacore.

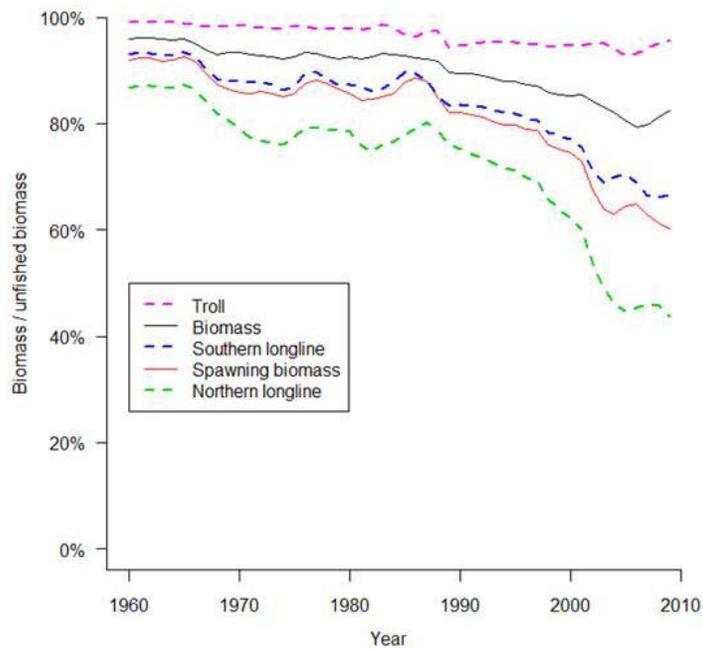


Figure ALB4: Decline in biomass due to the impact of fishing mortality, for exploitable biomass in the troll, southern longline, and northern longline fisheries, for total biomass and for spawning biomass.

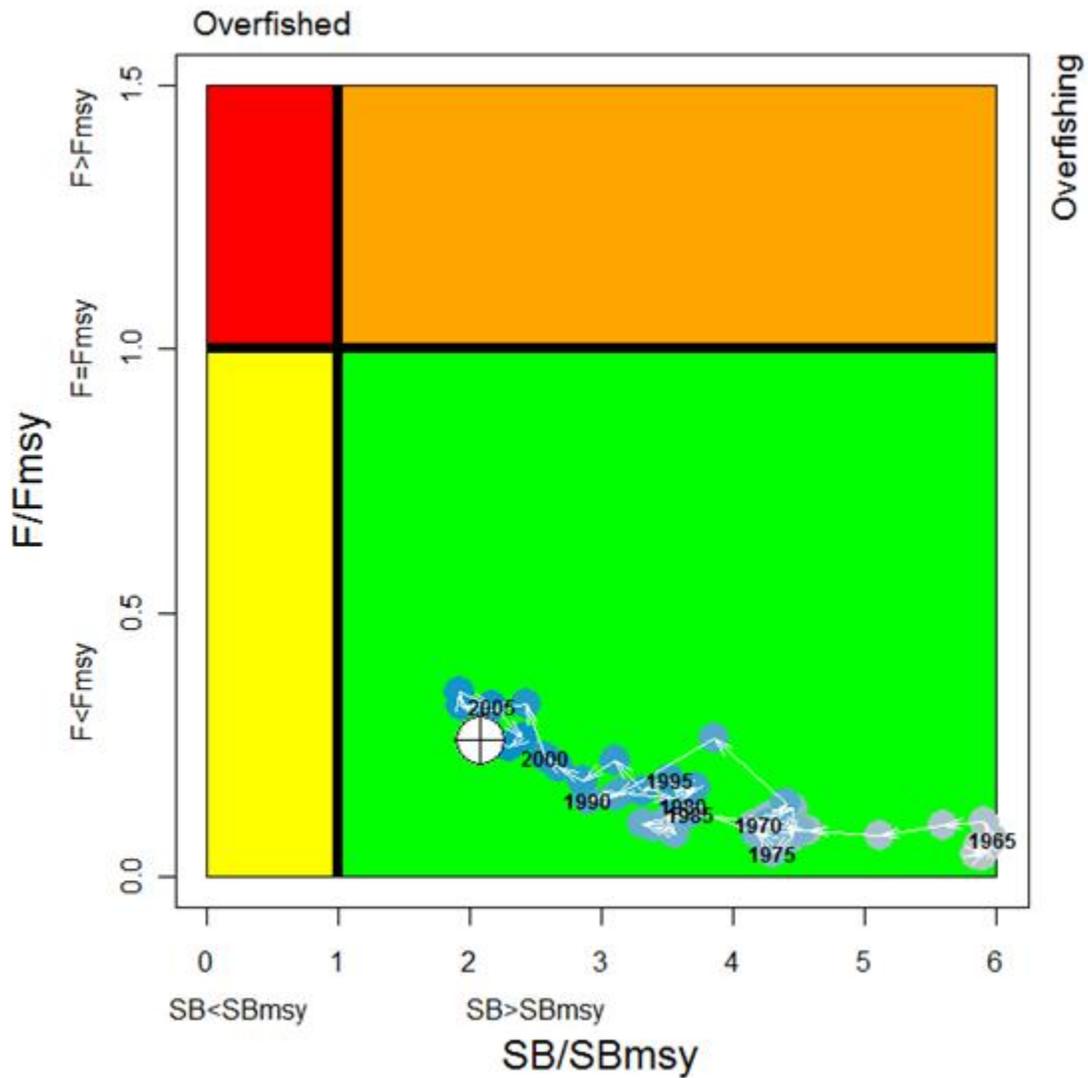


Figure ALB5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (starting in 1960). The color of the points is graduated from pale blue (1960) to blue (2009), and points are labeled at five-year intervals. The last year of the model (2010) is excluded because it is highly uncertain.

Table ALB1: Management parameters estimated from the 2011 reference case model, and estimates from the 2009 assessment, for comparison.

Management quantity	Reference case	Management quantity	2009 base case	2009 median
$C_{2007-2009}$	54,520	$C_{2005-2007}$	66,869	65,801
$YF_{2007-2009}$	57,130	$YF_{2005-2007}$	64,490	58,955
MSY	85,200	MSY	97,610	81,580
$YF_{2007-2009} / MSY$	0.67	$YF_{2005-2007} / MSY$	0.66	0.72
$C_{2007-2009} / MSY$	0.64	$C_{2005-2007} / MSY$	0.69	0.80
F_{MSY}	0.14	F_{MSY}	0.14	0.16
$F_{2007-2009} / F_{MSY}$	0.26	$F_{2005-2007} / F_{MSY}$	0.25	0.29
B_0	1,141,000	B_0	1,309,000	1,098,500
B_{MSY}	605,900	B_{MSY}	692,100	553,200
B_{MSY} / B_0	0.53	B_{MSY} / B_0	0.53	0.49
$B_{2007-2009}$	762,240	$B_{2005-2007}$	965,860	863,665
$BF_{2007-2009}$	903,500	$BF_{2005-2007}$	1,041,000	836,300
$B_{2007-2009}F_0$	950,947	$B_{2005-2007}F_0$	1,159,433	1,084,933
SB_0	400,700	SB_0	460,400	406,600
SB_{MSY}	104,200	SB_{MSY}	120,000	101,700
SB_{MSY} / SB_0	0.26	SB_{MSY} / SB_0	0.26	0.24
SB_{2009}	234,537	SB_{2007}	273,557	236,793
SBF_{2009}	251,500	SBF_{2007}	292,500	235,250
$SB_{2009}F_0$	372,043	$SB_{2007}F_0$	402,873	390,193
$B_{2007-2009} / B_0$	0.67	$B_{2005-2007} / B_0$	0.74	0.76
$BF_{2007-2009} / B_0$	0.79	$BF_{2005-2007} / B_0$	0.80	0.74
$B_{2007-2009} / B_{MSY}$	1.26	$B_{2005-2007} / B_{MSY}$	1.40	1.53
$BF_{2007-2009} / B_{MSY}$	1.49	$BF_{2005-2007} / B_{MSY}$	1.50	1.49
$B_{2007-2009} / B_{2007-}$	0.80	$B_{2005-2007} / B_{2005-}$	0.83	0.80
SB_{2009} / SB_0	0.59	SB_{2007} / SB_0	0.59	0.60
SBF_{2009} / SB_0	0.63	SBF_{2007} / SB_0	0.64	0.59
SB_{2009} / SB_{MSY}	2.25	SB_{2007} / SB_{MSY}	2.28	2.44
SBF_{2009} / SB_{MSY}	2.41	SBF_{2007} / SB_{MSY}	2.44	2.36
$SB_{2009} / SB_{2009}F_0$	0.63	$SB_{2007} / SB_{2007}F_0$	0.68	0.64

Discussion

236. SC7 thanked the science services provider for its stock assessment of South Pacific albacore tuna and noted that its conclusion was consistent with previous assessments. SC7 recognized that a key distinguishing feature of the South Pacific albacore tuna assessment was that most of the exploitation is on the adult stock and not juveniles. This partly helps to explain the resilience of the South Pacific albacore stock. The members agreed that the reference case for South Pacific albacore tuna stock status and trends is reasonable and the sensitivity tests undertaken were appropriate.

237. However, some CCMs noted that key conclusions are now somewhat more pessimistic than previous assessments (i.e. B/B_{MSY} is closer to 1). Some uncertainty remains regarding current levels of fishing mortality, and support was expressed by some CCMs for further research to improve the model, culminating in an updated assessment in 2012

238. SC7 asked SPC to explain why the trajectory estimated in the Kobe plot of South Pacific albacore tuna looks so different from other species, with $B_{current}$ approaching B_{MSY} while $F_{current}$ remains well below F_{MSY} . SC7 was advised that because fishing effort is not high enough to explain the decline in CPUE (i.e. fishing effort is low relative to F_{MSY}), the model may be compensating by estimating declining recruitment (and subsequently declining biomass). This might also result in an overestimation of the overall level of biomass, although there are other possible explanations for the observed trends and further analyses are needed.

239. One CCM suggested that the next assessment should perhaps provide more focus on the longline fisheries north of 25°S, which appear to be depleting biomass considerably, with potential implications for its management. Concern was expressed by members about the transfer of longline effort from the Indian Ocean, which is occurring despite the CMM that exists to regulate this. One member requested analyses by SPC to determine if a shift of effort to south of 20°S has occurred for longline fisheries.

Input data

240. SC7 expressed concern about the differences in catches shown in SC7-GN-WP-01 and those shown in the stock assessment paper. SPC clarified that the differences in data were related to the different availability of data at the time when the two papers were prepared.

241. Concern was also expressed regarding processes that can bias tuna data collection and the extent to which that can be understood or accounted for in future albacore assessments (e.g. port sampling of longline-caught fish, where small albacore are binned on aggregate but big fish are weighed individually, a process that may create bias. High grading for size at sea was another example). SPC agreed that better metadata are needed to understand how data collection processes have changed through time and SC7 was referred to the information paper on data gaps (SC7-ST-IP-01), which highlights the need for more information on how data are collected.

Catch per unit effort

242. SC7 discussed some recent changes in the fishery, such as a recent decline in CPUE for China's longline fishery. It was noted that the large regional scales of the current assessment model (where fisheries data are aggregated across large areas and sometimes fisheries) limit its ability to identify reasons for such declines.

243. SC7 briefly discussed the standardization process for longline CPUEs and noted that while significant analyses have been devoted to this in the past (e.g. a cluster analysis of operational-level data was used to separate targeted versus non-targeted effort), there is still potential to improve this standardization with additional fine-scale operational data.

Model structure and parameterization

244. Some CCMs noted that there may be merit in sharing biological and selectivity information between North Pacific and South Pacific albacore assessments. It was noted that natural mortality and biomass were influenced by steepness, which is poorly informed by assessment data. SC7 emphasized the importance of gaining a better understanding of the impacts of variability in climate and oceanography on stock dynamics, and suggested that these effects need consideration in future assessments.

245. There was discussion on the potential to structure future assessment models by explicitly modeling the dynamics of each sex. The limited availability of historical sex ratio data for future assessment models was raised and it was noted that the lack of sex-specific length-frequency data should not be a problem. If future assessment models explicitly account for sex, then observer data on sexing will be an important data source for the model.

Status and trends

246. The 2011 assessment results are similar to those of the 2009 assessment (Table ALB1).

247. Time trends in estimated recruitment, biomass, fishing mortality, and depletion are shown in Figures ALB1–4, and Table ALB1 compares reference points between 2011 and 2009 assessments.

248. The key conclusion of the reference case is that overfishing is not occurring and the stock is not in an overfished state (Fig. ALB5). Reference point levels estimated in the 2011 assessment were similar to those estimated in the 2009 assessment, and depletion levels ($SB_{2009}/SB_{2009,F=0}$) of albacore were moderate at ~37%. However, SC7 noted that depletion levels of albacore available to longline fisheries north of 25°S was above 50%.

Management advice and implications

249. The South Pacific albacore stock is currently not overfished nor is overfishing occurring, and current biomass levels are sufficient to support current catch levels. Any increases in catch or effort are likely to result in catch rate declines, especially for longline catches of adult albacore, with associated impacts on vessel profitability. SC7 further noted that vessel activity must be managed, as per the requirements of CMM 2010-05.

250. SC7 noted that the impact of oceanographic and climatic variability is a key area of uncertainty, and supported continued integration in future stock assessments. SC7 recognized the economic difficulties faced by the domestic albacore fisheries of Pacific Island countries and territories.

3.6 South Pacific swordfish

3.6.1 Review of research and information

251. There was no presentation of a formal working paper under this agenda item, although SC7 noted the relevance of paper SC7-ST-IP-04 (“South Pacific swordfish data available for stock assessments”)

Discussion

252. SC7 highlighted the need for a new South Pacific swordfish stock assessment, but recognized that this would not be possible without operational data for the Spanish longline fleet, which operates in the South Pacific, an issue that was highlighted in SC7-ST-IP-04. Some CCMs recommended that the paper SC7-ST-IP-01 (“Estimates of annual catches in the WCPFC statistical area”) be forwarded to the seventh meeting of the Technical and Compliance Committee (TCC7), and that the data be provided by WCPFC8.

253. SC7 was advised that the delay in the provision of Spanish data was due to the need for an explanatory document to be drafted to accompany the data, which will soon be forthcoming. SPC described discussions with the EU that indicated a commitment had been given to provide operational-level catch and effort data (including data prior to 2010) and 1 cm binned size data.

254. Some CCMs recommended that initially the SC should direct SPC to work with the EU and provide an assessment of the dataset, and that the SC include an analysis of fishery indicators for this stock in the work plan for next year.

255. The Cook Islands briefly described satellite tagging research being conducted on swordfish in its waters, and recommended that information from this and other Pacific swordfish tagging programmes be included in the fishery indicator paper for the SC in 2012.

256. It was noted that Australia currently holds a substantial amount of electronic tag data for swordfish, and the SC asked if these were available to help distinguish southwest Pacific swordfish from south-central Pacific swordfish. Australia referred to SC7-ST-IP-04, and noted that a report on these data was available on the Australian Fisheries Management Authority website (<http://www.afma.gov.au/wp-content/uploads/2010/06/RR2006-809-Investigation-of-local-movement-and-regional-migration-behaviour-of-broadbill-swordfish-targeted-by-the-Eastern-Tuna-and-Billfish-Fishery.pdf>).

3.6.2 Provision of scientific information

a. Status and trends

257. SC7 noted that no stock assessment was conducted for South Pacific swordfish in 2011; therefore, the stock status description and management recommendations from SC5 are still current.

258. SC7 noted that current WCPFC data holdings are insufficient to undertake an assessment in 2012, as indicated in SC7-ST-IP-04. The EU advised that the provision of its operational longline data will be provided to the WCPFC shortly. SC7 recommended that SPC work with the EU with regards to their data, and provide an assessment as to whether the dataset will be useful in expanding the spatial scope of previous assessments to include the south-central Pacific, or if possible, the entire South Pacific Ocean. SC7 further recommended that an analysis of fishery indicators of this stock be prepared for presentation at SC8.

b. Management advice and implications

259. The advice from SC5 should be maintained, pending a new assessment or other new information. SC7 recommended that SC7-ST-IP-04 be forwarded to the TCC for consideration.

3.7 Southwest Pacific striped marlin

3.7.1 Review of research and information

260. S. Brouwer (New Zealand) provided the progress of Project 64 (Collation of South Pacific striped marlin data) as follows:

This work comes out of SC6 where it was decided to begin work for a striped marlin assessment. It was noted that some time would be required to collate the data that sit outside of the WCPFC data holdings, and that the data would be informative for this assessment. About USD 30,000 was allocated for this work. New Zealand and Australia are collaborating to gather these data. We will be presenting this work to the pre-assessment workshop and SC7 next year. This project collates and analyses data from commercial data for striped marlin caught in New Zealand waters and commercial and recreational data from both New Zealand and Australia.

In New Zealand, two commercial datasets are available for investigation: commercial tuna longline logbooks and observer logbooks. The total number of striped marlin reported is small: 3,597 striped marlin have been reported by commercial tuna longliners since 2000, and just 421 striped marlin have been observed since 1990. The overwhelming majority of sets are unsuccessful.

Commercial logbooks are compromised by the failure of many vessels to report their catch of striped marlin, which they are required to release, but the standardized series of positive catches shows some promise as an index of relative abundance.

Two signals of relative abundance are potentially available from each dataset; the probability of capture (presence-absence) and the catch rate in positive sets. These can be combined, but in this study they are considered separately because the binomial part is either unreliable (as in the case of commercial logbook data) and/or it dominates the combined index because of the very high proportion of unsuccessful sets (both datasets). The binomial and combined series are presented for completeness without detailed diagnostics.

Positive catches usually comprise a single fish and rarely more than two fish per set. There is, therefore, little contrast in catch rates in positive sets, but the standardized series suggests an overall decline in abundance. The fit of positive catches to the lognormal assumption is poor and is improved slightly by assuming an inverse Gaussian error distribution. The effect of the alternative error distribution on annual indices is to steepen the decline slightly in recent years. The series is based on observed catches, and has large error bars around each point due to the small number of records.

Nominal CPUE reflects the encounter rate, which is very low and highly variable from year to year. Constraining the commercial logbook dataset to effective effort (with respect to striped marlin) did not markedly alter this pattern; and although it is possible that it reflects real changes in the availability of the stock to New Zealand waters, the observed encounter rate provided no corroboration of the pattern seen in commercial logbook series.

These CPUE analyses are done on data that were groomed and submitted to WCPFC. With regard to some potential explanatory variables, these datasets are not complete, and there is some potential to improve the analyses in the future with dedicated data extracts. The shortened time series of commercial data used reflects the period for which we have confidence that striped marlin were being reported; however, there is some potential to extend that series back a little further in time for the positive catches only.

The New Zealand Sport Fishing Council (formerly the New Zealand Big Game Fishing Council) compiles annual sport fish tallies for the main species from 60 game fishing clubs around New Zealand. These records contain a reasonably complete record of striped marlin catches and were used to provide an estimate of the national landed recreational catch. The tagging database was used to provide the number of striped marlin by species, recorded as tagged and released. There has been a significant increase in the total recreational catch of striped marlin since the 1987 billfish moratorium and subsequent regulations were introduced.

Individual weights of recreationally caught marlin are recorded by game fish clubs, with some records going back to the start of the fishery in the 1920s. Prior to 1988, a high proportion of the recreational catch was landed and accurately weighed. Since the early 1990s, 60% of all striped marlin caught by recreational anglers were tagged and released. Fish weight is estimated for fish alongside the boat and the accuracy of these estimates cannot be assured. The average annual striped marlin weights for four of the oldest deep sea angling clubs has declined since the late 1950s with higher interannual variability.

Northland charter boat CPUE data have been collected in a relatively coarse form (average catch per vessel day for the season) since 1977. A subset of the detailed daily logbook data has been used to extend this data series since 2007. There are few informative variables available to use in standardizing charter CPUE. Vessel technology, equipment, and fishing techniques have changed significantly over this time series. Current CPUE is about equivalent to the best years in the late 1970s and early 1980s

Discussion

261. The Convener asked New Zealand to summarize the prospects for a new South Pacific striped marlin assessment. It was noted that at SC6, there were unutilized data sources available from New Zealand, notably from New Zealand longline vessels that were required to discard striped marlin, and from New Zealand and Australian recreational fishing vessels. Work was ongoing to explore the New Zealand observer data on striped marlin discards. There were problems with the data quality in that positive records of striped marlin catches were frequently for only a single fish.

262. Recreational data in New Zealand were of higher quality because recreational fishermen had been keeping records over a relatively long period, extending back in some cases to the 1920s. Fishermen recorded estimated weights on tag and release, and this was being validated by analyzing recreational striped marlin tag and recaptures of less than one month. New Zealand was also looking at a charter vessel CPUE time series that extends back to 1977. These data will be made available for the SPC pre-assessment workshop in 2012 and for incorporation into a 2012 stock assessment. SC7 noted that a 2009 study on striped marlin biology will provide improved life history parameters for the 2012 stock assessment, and that the new assessment would benefit from the inclusion of Chinese Taipei and Japanese longline data.

3.7.2 Provision of scientific information

a. Status and trends

263. SC7 noted that no stock assessment was conducted for southwest Pacific striped marlin in 2011; therefore, the stock status description and management recommendations from SC2 are still current.

264. SC7 further noted the progress of Project 64, the compilation of striped marlin data by New Zealand and Australia that will be completed in March 2012. Results of this work will be presented to the

pre-assessment workshop for incorporation into the stock assessment in 2012. It was noted that the last stock assessment was carried out in 2006, and an updated assessment is required. It was proposed that SPC be tasked with carrying out a revised stock assessment for presentation at SC8.

b. Management advice and implications

265. The stock status description and management advice from SC2 should be maintained, pending a new assessment or other new information.

3.8 North Pacific striped marlin

3.8.1 Review of research and information

266. The Stock Assessment convener presented information on North Pacific striped marlin on behalf of the ISC chair, with information arising from ISC11. There was no stock assessment completed for North Pacific striped marlin in 2011.

Discussion

267. Some CCMs expressed their concern over both the status of the North Pacific striped marlin stock and their disappointment that the planned ISC stock assessment for North Pacific striped marlin had not been completed to date, which was largely due to delays in data submission by ISC members. CCMs further called into question the ability of the ISC process to deliver on this issue. They subsequently recommended that SPC-OFP, as the science services provider to the Commission, be tasked with undertaking a new stock assessment in 2012 as part of the SC work programme. Concern was also expressed regarding the lack of an SC working paper to support the presentation on striped marlin. In response, the presenter indicated that papers describing this research were available on the ISC website.

268. SC7 noted that North Pacific striped marlin is not a “northern stock” according to the Convention and rules of procedure, and therefore should be considered by the SC and not by the ISC. It was clarified that there would be no formal presentation on North Pacific striped marlin.

269. SC7 also requested advice from CCMs or SPC about the appropriateness of catch limits in CMM 2010-01.

3.8.2 Provision of scientific information

a. Status and trends

270. SC7 noted that no stock assessment was conducted for North Pacific striped marlin in 2011; therefore, the stock status description and management recommendations from SC6 are still current.

b. Management advice and implications

271. SC7 recommended an immediate reduction in fishing mortality for this stock, and noted that CMM 2010-01 was agreed on by WCPFC7 to achieve this goal, but that the catch limits in that CMM need to be reviewed to ensure that they are sufficient.

272. SC7 recommended that SPC should work with ISC on data-related work required for the next assessment. If ISC fails to provide stock assessment results by SC8, future stock assessments for this stock should be undertaken by the science services provider as part of the SC work programme.

3.9 Northern stocks

3.9.1 North Pacific albacore (CMM 2005-03)

273. S. Teo (USA) presented the recently completed North Pacific albacore stock assessment, which was conducted by the ISC Albacore Working Group. The assessment was completed in June 2011 using fishery data through 2009. The assessment was conducted using a seasonal, length-based, age-structured, forward simulation population model developed within the Stock Synthesis modeling platform (Version 3.11b, referred to hereafter as SS3) and was based on the assumption that there is a single well-mixed stock of albacore in the North Pacific Ocean (base-case model). The model used quarterly catch-at-length data; 16 age-aggregated fisheries defined by gear, location, season, and catch units (weight or number); a new growth curve estimated within the model; and use of conditional age-at-length (otoliths) data not previously available.

274. Analyses were carried out to assess the sensitivity of the results to assumptions, including data weighting (both between data types and relative weightings of different sources within a data type), biology (stock-recruitment relationship, natural mortality, growth), and fishery selectivity patterns. Stochastic future projections of the stock were conducted to estimate the probability that future spawning stock biomass (SSB) will fall below the average of the 10 historically lowest estimated SSBs (SSB-ATHL) in at least 1 year of a 25-year (2010–2035) projection period. The base-case scenario for projections assumed average recruitment and constant F (at the current F level, $F_{2006-2008}$), but sensitivity of results to alternative harvest scenarios (constant catch and constant $F_{2002-2004}$), two recruitment scenarios (high and low levels), and alternative structural assumptions (down-weighting of the length composition data, stock recruitment relationship, growth) was investigated. Retrospective analyses were conducted to assess the level of bias and uncertainty in terminal year estimates of biomass, recruitment, and fishing mortality. A reference run of the virtual population analysis (VPA) model configured as in the 2006 assessment, but with updated catch-at-age and age-aggregated CPUE indices, was conducted to compare important estimated quantities for model-related changes.

275. The base-case model estimated that SSB likely fluctuated between 300,000 mt and 500,000 mt between 1966 and 2009, and that recruitment averaged 48 million fish annually during this period. The pattern of F -at-age showed fishing mortality increasing to its highest level on three-year-old fish and then declining to a much lower and stable level in mature fish.

276. Current F (geometric mean of 2006 to 2008, $F_{2006-2008}$) is lower than $F_{2002-2004}$ (current F in the 2006 assessment). Future SSB is expected to fluctuate around the historical median SSB (~400,000 mt) assuming F remains constant at $F_{2006-2008}$ and average historical recruitment levels persist. $F_{2006-2008}$ is approximately 30% below $F_{SSB-ATHL}$ 50%, and there is about a 1% risk that future SSB will fall below the SSB-ATHL threshold in at least one year in the projection period, assuming average historical recruitment and constant $F_{2006-2008}$ (i.e. current F is well below the 50% probability level). However, if recruitment is about 25% lower than the historical average and F remains constant at $F_{2006-2008}$, then the risk of future SSB falling below the threshold by the end of the projection period increases to as high as 54%.

277. Sensitivity and retrospective analyses evaluated the impact of alternative assumptions on the assessment results. These analyses revealed scaling differences in estimated biomass (total and SSB) and, to a lesser extent, recruitment, but few differences in overall trends. Relative F -at-age patterns were not affected by different assumptions, except when growth curve parameters from the 2006 assessment were used, and $F_{2006-2008}$ was consistently lower than $F_{2002-2004}$. Although there was considerable uncertainty in

absolute estimates of biomass and fishing mortality, the estimated trends in both quantities were robust and advice based on F_{SSB} was not affected by this uncertainty. Terminal-year estimates of biomass and recruitment show no bias, but there was a high level of uncertainty in the most recent recruitment estimates. Given these findings, the working group believes that the current parameterization of the base-case model is appropriate.

278. Both the SS3 base-case model and the VPA reference run estimated similar historical trends in SSB and recruitment, but with different scaling for biomass. The scaling difference was largely attributable to the different growth curves used in SS3 base-case model and the VPA reference run. A sensitivity run of the base-case model in which growth parameters were fixed to those used in the VPA, reduced the scaling of biomass to the level of the VPA reference run. Sensitivity analyses of future projections showed that stock status and conservation advice is relatively insensitive to these scaling differences. The working group concluded that the growth curve used in the 2006 assessment was not representative of growth in North Pacific albacore. The working group also concluded that the SS3 model will replace the VPA as the principal model in future North Pacific albacore assessments.

Discussion

279. SC7 thanked the ISC for this stock assessment and for providing such a comprehensive working paper and presentation. It was noted that this is the first time that this level of detail has been made available to the SC and this is a positive step. SC7 sought clarification on the spatial characteristics of albacore catches, especially in relation to fisheries F6 and F8 in the assessment, and how data standardization had been accommodated. SC7 was advised that information on the spatial distribution of the fishery had not been included in the stock assessment but that the information is available in ISC11 information papers. SC7 was advised that CPUE indices were standardized using operational-level data provided by ISC members, and that the model is very sensitive to CPUE indices, particularly those for fishery S7.

280. SPC noted that longline targeting in the area north of Region 3 had shifted toward albacore from about 1994, as reported in SC6-SA-WP-02. This shift in targeting may have increased the CPUE in the S7 index at this time, and exaggerated the increase in model-derived abundance indices. SPC indicated that including hooks per basket information in the standardization would be unlikely to fully remove targeting switch effects. SC7 was advised that these issues would be taken back to the ISC working group for consideration for further analyses.

281. SC7 posed a series of questions in relation to: i) the temporal extent of the model run that begins in 1966; ii) whether Chinese longline data had been included in the analysis; iii) how the incorporation of otolith data from Wells et al. (2011) may influence model results; and iv) questioned whether tagging data from the 1970s were included in the assessment.

282. In response, the SC was advised that: i) data on length-frequency and other parameters were less reliable prior to 1966 and so were excluded from this analysis; ii) Chinese longline catch data had been included in the analysis; iii) the sensitivity of including Wells et al. (2011) growth data had not been conducted; and iv) the 1970s tagging data are not currently included in the analysis but the ISC is currently examining how tagging data may be incorporated in future assessments.

283. SPC noted that the assessment indicates a high variability in catch and biomass, which might suggest that biomass is being affected by catch, but the assessment suggests that abundance is driven by recruitment. SPC suggested that the biomass is too high for the catch to drive the modeled biomass down, and may be overestimated. SPC further noted that if the S7 CPUE series was removed, a much lower

biomass would result, meaning that the high biomass estimate is being driven by S7, an index that may be affected by target change. The presenter added that current data show no clear trends but will be investigated further.

284. SPC noted the ISC had catch data dating back to 1952 that could be easily incorporated into the assessment. The presenter indicated that future assessments would attempt to make better use of historical data.

285. Some CCMs indicated that they did not consider maintaining SSB at the average of the 10 historically lowest estimated levels to be a suitable target reference point or management objective as referred to in the paper. This could be regarded as a limit reference point. They recommended that the ISC evaluate the interim reference point for this species against other, more common, reference points so that there is an understanding of its implications.

286. Some CCMs also observed that this latest assessment is inconsistent with previous advice from the Albacore Working Group, with the current assessment much more optimistic than the past two assessments. Its reliance on the level of recruitment remaining at historical levels to maintain present levels of F suggests that a more precautionary approach needs to be taken with regard to present management measures. Those CCMs recommended that the current measure be reviewed to ensure that it is capable of restraining fishing mortality, noting that a lack of data has made this difficult in the past. SC7 welcomed ISC's advice that this assessment would be independently reviewed.

a. Status and trends

287. SC7 noted that the ISC Albacore Working Group provided the following conclusions on the stock status of North Pacific albacore:

“Although there is uncertainty in the absolute estimates of biomass (total and SSB) and fishing mortality, the stock status and conservation advice based on the $F_{SSB-ATHL}$ reference point are relatively insensitive to these uncertainties as trends in SSB and recruitment are robust to the different plausible assumptions tested by the WG. Estimates of $F_{2006-2008}$ (current F) expressed as a ratio relative to several potential F-based reference points (F_{MAX} , $F_{0.1}$, F_{MED} , $F_{20-50\%}$) are less than 1.0 (Table 7-1, Report of ISC11) and SSB is currently around the long-term median of the stock and is expected to fluctuate around the historical median SSB in the future assuming constant $F_{2006-2008}$ and average historical recruitment. The ratio $F_{2006-2008} / F_{SSB-ATHL}$ is 0.71, which means current F is well below the fishing mortality that would lead SSB to fall below the SSB-ATHL threshold.”

Table NPALB1: Potential reference points and estimated F-ratio using $F_{current}$ ($F_{2006-2008}$), associated spawning biomass and equilibrium yield. $F_{SSB-ATHL}$ is not equilibrium concept so SSB and yield are given as median levels. (ref***)

Reference point	$F_{2006-2008}/F_{RP}$	SSB (mt)	Equilibrium yield (mt)
$F_{SSB-ATHL}$	0.71	346,382	101,426
F_{MAX}	0.14	11,186	185,913
$F_{0.1}$	0.29	107,130	170,334
F_{MED}	0.99	452,897	94,080
$F_{20\%}$	0.38	171,427	156,922
$F_{30\%}$	0.52	257,140	138,248
$F_{40\%}$	0.68	342,854	119,094
$F_{50\%}$	0.91	428,567	99,643

288. The working group concluded that overfishing is not occurring and that the stock is not likely to be in an overfished condition (e.g. $F_{20-50\%} < 1.0$), although biomass-based reference points have not been established for this stock.

289. SC7 considered the $F_{SSB-ATHL}$ reference point to be a limit reference point.

b. Management advice and implications

290. SC7 noted the following conservation advice from ISC.

The ISC noted that $F_{2006-2008}$ is significantly below $F_{2002-2004}$ and provided the following recommendations on conservation advice:

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

3.9.2 Pacific bluefin tuna (CMM 2010-04)

291. J. Broziak very briefly presented some information on Pacific bluefin tuna from ISC11 on behalf of the ISC chair. There was no discussion relating to this agenda item.

a. Status and trends

292. SC7 noted that no stock assessment was conducted for Pacific bluefin tuna in 2011; therefore, the stock status description and management recommendations from SC6 are still current.

b. Management advice and implications

293. SC7 recalled previous SC advice that it was important to reduce fishing mortality on Pacific bluefin tuna to 2002–2004 levels or below, particularly on juveniles in the 0–3 age classes, and requested that the Northern Committee continue to monitor fishing mortality on age 0–3 fish.

3.9.3 North Pacific swordfish

294. J. Broziak very briefly presented some information on North Pacific swordfish from ISC11 on behalf of the ISC chair. There was no discussion relating to this agenda item.

a. Status and trends

295. SC7 noted that no stock assessment was conducted for North Pacific swordfish in 2011; therefore, the stock status description and management recommendations from SC6 are still current. SC7 noted that the last ISC assessment concluded that this stock is not overfished and overfishing is not occurring, and that the current catch levels are sustainable. Continued monitoring of exploitation rates in the area north of 20°N is required to ensure that the stock remains well above B_{MSY} . SC7 noted that the Northern Committee has scheduled an assessment for this stock for 2013.

b. Management advice and implications

296. SC7 noted that at SC6, ISC concluded that both swordfish stocks in the North Pacific are healthy and above the level required to sustain recent catches. No management advice was provided. Therefore, the advice from SC6 should be maintained, pending a new assessment or other new information.

297. SC7 recommended that the Commission task the Northern Committee with providing the 2013 assessment to SC9 at its completion, for review.

AGENDA ITEM 4 – MANAGEMENT ISSUES THEME

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

299. G. Pilling (SPC), I. Freeman (FFA), S. Auld (Australia) and M. Kamatie (FFA) were selected as rapporteurs.

300. The convener informed SC7 that five working papers would be presented during this session and that a further three information papers had been prepared. He also noted that a presentation on SC7-MI-IP-01 (“TUMAS: A tool to allow analysis of management options using WCPFC stock assessments”) had been made by S. Hoyle (SPC) during a session held on Wednesday evening.

4.1 Terms of reference

301. The convener informed SC7 that because this theme had only met for the first time at SC6, there were currently no terms of reference (TOR) for this theme, and based on a recommendation from SC6, he had drafted some TOR for consideration. The convenor then presented these draft TOR (contained in SC7-MI-IP-02) to SC7 for discussion. After some discussion, the TOR, as drafted by the convenor and with the above change, were then adopted. The final adopted TOR are found in Attachment F.

Discussion

302. There was a suggestion that the last TOR be changed from, “Make recommendations to the Commission...” to “Provide advice to the Commission...” After some discussion and clarification on the difference between the words “advice” and “recommendations”, however, and when the meeting was informed that the SC Chair only reports recommendations to the Commission, it was agreed to change this TOR to “Provide advice and make recommendations to the Commission...”.

Recommendations

303. SC7 recommended that the Commission adopt the TOR for the Management Issues theme as outlined in Attachment F

4.2 Limit reference points for the WCPFC

304. The convener opened this agenda item by reminding the meeting of the recommendations made at SC6, that Project 57 on reference points be completed intersessionally, and that the results be reported to SC7. After reviewing the results, SC7 was then to make a recommendation to the Commission on candidate reference points (both type and value) for each of the key target species in the WCPFC.

305. The convener listed the intercessional work programme identified as Project 57 on the Scientific Research Plan.

- a) Identify candidate indicators (e.g. $B_{current}/B_o$, $SB_{current}/SB_{MSY}$) and related limit reference points (LRPs) (e.g. $B_{current}/B_o=X$, $SB_{current}/SB_{MSY}=Y$), the specific information needs they meet, the data and information required to estimate them, the associated uncertainty of these estimates, and the relative strengths and weaknesses of using each type within a management framework.
- b) Using past assessments, evaluate the probabilities that related performance indicators exceed the values associated with candidate RPs.
- c) Evaluate the consequences of adopting particular LRPs based on stochastic projections using the stock assessment models.
- d) Undertake a literature review or meta-analyses to provide insights into levels of depletion that may serve as appropriate limit reference points and other uncertain assessment parameters (e.g. steepness).

306. He further explained that of the four tasks included in Project 57, tasks 2 and 3 had been undertaken by SPC-OFP while tasks 1 and 4 had been put out to tender with the Commonwealth Scientific and Industrial Research Organisation (Australia) having been selected to undertake these tasks. The discussion for the following papers — SC7-MI-WP-03 and SC7-MI-WP-04 — are combined and summarized following the two papers’ abstracts.

Summary of SC7-MI-WP-03 (“Identification of candidate limit reference points for the key target species in the WCPFC”)

307. R. Campbell presented a summary of SC7-MI-WP-03 (“Identification of candidate limit reference points for the key target species in the WCPFC”) working paper on the behalf of the authors who were unable to attend.

308. The paper provides the results of the commissioned project to provide the WCPFC and SC with a set of candidate limit reference points for the key target species in the WCPFC, and to review steepness and depletion levels used across tuna RFMOs.

309. The project defined limit reference points as the level of fishing mortality (F) or level of SSB or total biomass to be avoided. It was noted that additional limit reference points may be needed when management objectives are defined for bycatch species, ecosystem considerations, other conservation objectives, economic and social objectives.

310. Three categories of limit reference points, with varying data requirements and strengths and weaknesses, were examined: MSY, spawning potential-per-recruit (SPR), and depletion-based limit reference points.

311. Some reference points are sensitive to the value for “steepness”, which is a key parameter in fisheries stock assessments, and which measures productivity of the stock at low stock size. A review of the stock assessments of tunas and tuna-like species across tuna RFMOs highlights the difficulty in estimating or assuming a value for steepness for the majority of tuna stocks. There is commonly insufficient data on recruitment at low stock size and recovery from depletion to enable steepness to be reliably estimated in tuna stock assessments. Providing stock status and management advice that is robust to the uncertainty in steepness is essential for effective management, and is often understated.

312. The authors recommended a three-level hierarchical approach to selecting and setting limit reference points for F and SSB based on decreasing levels of available information. The first level uses F_{MSY} and SSB_{MSY} but only in the case where a reliable and precise estimate of steepness is available. The second level uses F_{SPR} and 20% of SSB_0 for cases in which uncertainty in steepness is high, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated. The third level does not include an F-based limit reference point if the key biological and fishery variables are not well estimated, but simply uses a SSB limit of 20% of SSB_0 .

313. A simulation model of tuna-like species was developed to evaluate the consistency and robustness of limit reference points for specific target species of tuna in the WCPO. It was parameterized to represent yellowfin, bigeye and skipjack tuna type populations. From this work, default values for candidate limit reference points were recommended. Specific values for reference points for each species should be evaluated with decision rules (that define action to be taken) to ensure performance to protect the stock.

314. For yellowfin and bigeye, the second level of the hierarchy of reference points was recommended. For skipjack, the third level of the hierarchy was recommended because of the sensitivity of the estimates of F_{SPR} to the maturity-at-age relationship required for level 2. For albacore and billfish species, the third level of the hierarchy was recommended because of uncertainties in some of the key life history and fishery variables required for level 1 or level 2.

Summary of SC7-MI-WP-04 (“Evaluation of stock status of bigeye, skipjack and yellowfin tunas against potential limit reference points”)

315. S. Harley (SPC) presented SC7-MI-WP-04 (“Evaluation of stock status of bigeye, skipjack, and yellowfin tunas against potential limit reference points”)

316. This paper describes analyses of the limit reference points proposed in Preece et al. (2011; SC7-MI-WP-03). The analyses address the probabilities that related performance indicators exceed the values associated with candidate reference points; and the evaluation of the consequences of adopting particular LRPs based on stochastic projections using stock assessment models. Two approaches were considered for evaluating uncertainty in stock status against the reference points: structural uncertainty based on the grid used in each assessment; and stochastic projections (for bigeye and yellowfin tunas only due to time constraints).

317. With respect to the reference points proposed by Preece et al. (2011) we found that:

- a) Bigeye tuna: the fishing mortality limit reference point ($F_{SPR40\%}$) has been exceeded with high probability for the past 20 years and will continue to be exceeded with high probability into the future under current levels of fishing. The spawning biomass limit reference point ($20\%SB_0$) will only be exceeded with very low probability in the future unless recruitment declines to the mean level predicted by the SRR [spawning recruitment relationship]; then that limit reference point will be exceeded with relatively high probability (0.48 in 2021). It is important to note that under the assumption of recent average recruitment, the estimate of SB_0 based on historical recruitment will underestimate the average unfished biomass in the projection period;
- b) Skipjack tuna: historical and projected future biomass far exceed the spawning biomass limit reference point;
- c) Yellowfin tuna: the fishing mortality limit reference point has been exceeded with high probability for the past 10 years and the probability that it will be exceeded in the future was very sensitive to future recruitment assumptions. While yellowfin is much closer to the spawning biomass limit reference point than skipjack tuna, none of the historical estimates or future projections of spawning biomass declined below this level.
- d) These results suggest that adoption of limit reference points is important for bigeye and yellowfin tuna as these stocks are at levels (biomass and/or fishing mortality) where limit reference points are likely to impact on future fishing management strategies. For skipjack tuna, we are likely to be at a much higher level, so instead the focus must be on determining management objectives and setting target reference points to maximize fishery performance.
- e) Finally, it is suggested that if biomass-based limit reference points be adopted, that consideration be given to adopting variants that are robust to non-equilibrium conditions.

Discussion

318. In response to a question regarding how accurate an estimate of the age-at-maturity needed to be for skipjack, if one were to use an SPR reference point for this species, it was explained that while this still needed to be determined, the choice of reference points for this or any other species can be adjusted as better information is gained on key parameters, allowing one to move up the hierarchy of reference points. SPC informed the meeting that characterization of the spawning biomass of bigeye and yellowfin is still improving, but could indeed change as more information on reproductive biology is gained through projects currently underway.

319. A further question was asked as to whether the SPR values used in the paper were based on female life history parameters or composite sex life history parameters as this could make a difference in the results. The convenor undertook to investigate this.

320. Some CCMs asked that the SC recommend to the Commission that the limit reference points recommended be adopted, but on a provisional basis, but noting there are further issues that need to be considered before these or any other limit reference points could be formally adopted by the Commission. These include:

- a) SPR is a suitable indicator but further consideration is required of whether $40\%SPR_0$ is an appropriate limit reference point.
- b) Further work is required to make decisions about the acceptable levels of risk associated with the use of $20\%SB_0$ and the harvest control rules that the Commission needs to adopt to make sure that it avoids the limit.

- c) Potential conflict between having one reference point ($40\%SPR_0$) that is similar to MSY and another ($20\%SB_0$) that is similar to half of MSY.
- d) Need for a comparison of the newly proposed reference points to estimates of the (MSY-based) reference points according to the previous stock assessments of each species, for all stocks considered under the Commissions mandate.
- e) Any reference point should be implemented in a way that is compatible with the provisions about the Convention on principles for the management of stocks and also on ensuring the optimum utilisation of those stocks. This last concept is crucial given the multispecies nature of the fisheries we are dealing with. These trade-offs need to be considered actively when the Commission sets reference points and designs harvest rules around them, as losses in target species catch may result from actions required to avoid a limit reference point for a bycatch species. In particular, the harvest strategy for all stocks needs to account for this in a way that allows for the optimum utilisation of stocks, which may result in a situation where there are different reference points and associated risk levels for different stocks, rather than the current approach of consistent reference points for all stocks.
- f) Further consideration of whether the SB reference point should be $20\%SB_0$ or $20\%SB_{F=0}$.

321. A question was raised, asking if the $20\%SB_0$ and $40\%SPR_0$ reference points could be seen as defaults, but if the percentage values needed to vary between species, then how could the best values for each species best be identified? The convenor explained that the technique outlined in SC7-MI-WP-03 might be used to examine the relationship between the ratio $F_{X\%SPR}/F_{MSY}$ over a range of plausible values of steepness and attempt to find the value of “x” where this ratio most closely approximated the value of 1 over this range. However, it was agreed that projections which use a stock-recruitment relation are still based on an assumed value of steepness unless one adopts, for example, average recent recruitment.

322. Some CCMs indicated that setting the level of the limit reference point is the first step. The next step will be to determine the allowable risk of breaching the reference point when designing harvest control rules.

323. A further comment was that the first two tiers of the approach outlined in SC7-MI-WP-03 were a positive move and that the use of SPR is common among other fisheries management agencies, and provides a meaningful proxy for MSY. For these reasons the use of SPR was advocated. The use of a percentage SPR is very useful and has been evaluated in numerous simulations, but it needs to match with the stock assessment outcomes and should be derived from the biology of female fishes. However, the need for the third tier was questioned because of the uncertainty in the estimation of SB_0 when life history parameters are not known.

324. A further comment was made that it would be necessary to consider regime shifts and oceanography in the analysis of reference points because there was a need to ensure the maintenance of stocks in times when productivity was below average. While it was acknowledged that such analyses are difficult, it was suggested that one could compare recruitment anomalies with changes in the Southern Oscillation Index (SOI).

325. The need to define what is meant by a limit reference point was also raised, and support was expressed for the definition used in SC7-MI-WP-03 or that used in the UN Fish Stocks Agreement.

326. The convenor provided the following summary of the discussion. The utility of the hierarchical approach appeared to have general support, although a concern had been expressed on the need to go down to level 3. There was also support for the use of SPR as a limit reference point, though the need for further analyses to identify the most appropriate percentage values also was supported. The comment on

the need to consider regime shifts was also noted, and whether current depletion under an $F=0$ scenario is better than the use of SB_0 .

327. SC7 was informed of the work undertaken by the late Dr Myers on reproductive potential, and there was a question about whether the estimates provided on the steepness for tuna and billfish by this work could provide some prior understanding. It was also noted that a Myers legacy database was being developed and some re-analysis is planned. An alternative approach by Mangel and Brodziak was described, called the “direct approach”, which is based on life history parameters, to estimate a prior distribution for steepness. SPC commented that some work that supplants Dr Myers’ work had already been undertaken (SC7-SA-IP-08) and that further work was planned.

328. Some CCMs noted that it would still be necessary to consider other reference points for the key target stocks, including empirical reference points as well as those derived from stock assessment models. These CCMs expressed interest in standardized CPUE-based reference points as part of the management package for those fisheries where high levels of profitability are sought such as skipjack and albacore.

329. Some CCMs indicated that setting target reference points for skipjack is a key for determining purse-seine effort limits. A request was made for SPC to provide a paper for WCPFC8 on candidate target reference points, based on the use of empirical CPUE as well as stock assessment models.

330. Following a question about whether the approach proposed in paper SC7-MI-WP-03 would be recommended to the Commission, the convener noted that while there had been support expressed for this proposal there had also been some concerns expressed about the value associated with the SPR reference point.

331. A proposal was made to include in the recommendations the comment in SC7-MI-WP-03 that additional reference points will be needed as management objectives are identified and defined for other management related issues such as the impact of fishing on bycatch species and the ecosystem, as well as economic and social objectives.

332. In response to a question about the choice between using reference points based on B_0 versus current depletion under an $F=0$ assumption, it was noted that under equilibrium recruitment the two approaches should give similar results but where there is a strong pattern in recruitment trends, estimating biomass in the absence of fishing is more robust. Furthermore, the use of that type of metric as a reference point would also take into account potential regime shifts and other more general changes and the large degree of non-stationarity seen in stock assessments suggests the latter approach better.

333. A view was expressed and supported to provisionally adopt the reference points outlined in SC7-MI-WP-03 but that further work was required to clarify the appropriate value of X in the $X\%SPR_0$ reference point.

Recommendations

334. SC7 provided the following recommendations:

- a) SC7 recommended that the Commission note the working papers on the identification and evaluation of candidate limit reference points (LRPs) presented to SC7.
- b) SC7 recommended that the Commission adopt a working definition for LRPs based on the following principles:
 - they define a state of the fishery that is considered to be undesirable and which management action should avoid;
 - the probability of breaching an LRP should be very low;

- management actions should be taken before the fishery falls below or is at risk of falling below an LRP.
- c) SC7 recommended that the Commission adopt the hierarchical approach (as outlined in SC7-MI-WP-03) to identify key LRPs for key target species in the WCPFC as follows:

Level	Condition	LRPs
Level 1	A reliable estimate of steepness is available	F_{MSY} and B_{MSY}
Level 2	Steepness is not known well, if at all, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated.	$F_{X\%SPR_o}$ and either $X\%SB_o$ or $X\%SB_{current,F=0}$
Level 3	The key biological and fishery variables are not well estimated or understood.	$X\%SB_o$ or $X\%SB_{current,F=0}$

- d) SC7 recommended that due to a high degree of uncertainty in the steepness parameter for yellowfin tuna and bigeye tuna, the Commission adopt a fishing mortality-based LRP based on a spawner-per-recruit level of $F_{X\%SPR_o}$ and a biomass-based LRP based on a depletion level of either $X\%SB_o$ or $X\%SB_{current,F=0}$ for these species in the WCPFC.
- e) SC7 recommended that due to a high degree of uncertainty in the steepness parameter and uncertainties in some life history and fishery parameters for other key target species in the WCPFC, that the Commission adopt either an $X\%SB_o$ or an $X\%SB_{current,F=0}$ reference level as a biomass-based LRP for these species.
- f) SC7 recommended that SPC-OFP, using the most recent stock assessment models for South Pacific albacore, bigeye, skipjack, and yellowfin tunas undertake further analyses to evaluate the consequences of:
 - i) different levels of SPR, $X\%SPR_o$ (where X is in the range 20–50% in 10% increments) to be associated with the adopted fishing mortality-based LRP;
 - ii) using either a $X\%SB_o$ or a $X\%SB_{current,F=0}$ biomass-based LRP (range of X of 10–40%); and
 - iii) adopting an SPR-based LRP for key target species other than yellowfin and bigeye tunas.
- g) Noting the progress made by ISC in developing reference points, SC7 recommended to the Commission that the Northern Committee consider similar analyses for the three stocks that they assess, including for North Pacific albacore a comparison of these to the $F_{SSB-ATHL}$ reference point identified by the Northern Committee.
- h) SC7 recommended that the results of these further analyses be presented to, and reviewed by, the Management Objectives Workshop to be held in early 2012 and workshop conclusions be reported to SC8 for comment before consideration by the Commission.
- i) SC7 noted that once adopted, these reference points will need to be implemented along with harvest control rules. SC7 recommended that development of these harvest control rules should be included in the SC work plan and budget. Such harvest control rules must give adequate recognition to the fact that these are multi-species fisheries as well as the provisions of the Convention.
- j) SC7 recommended that the Commission hold open the consideration of other reference points (both target and limit) to reflect management objectives as they are identified and defined for other management related issues such as the impact of fishing on bycatch species and the ecosystem, as well as economic and social objectives. These could include empirical as well as model-based reference points.
- k) SC7 requested that SPC-OFP prepare a paper for the Management Objectives Workshop to identify and evaluate candidate target reference points for skipjack, including empirical

reference points such as those based on CPUE as well as possible target reference points derived from stock assessment models.

4.3 Review of CMM 2008-01

335. The convenor opened this agenda item by noting that the review of CMM-2008-01 had originally been listed as Agenda item 3.3b under the Stock Assessment theme, but had been moved to the Management Issues theme.

336. John Hampton (SPC-OFP) made a combined presentation of SC7-MI-WP-01 and an updated version of WCPFC7-2010/15, which had been provided to WCPFC7 (<http://www.wcpfc.int/doc/wcpfc7-2010-15/review-implementation-and-effectiveness-cmm-2008>). The following contains the abstract from SC7-MI-WP-01 and a combined summary of the discussion for both papers.

Summary of SC7-MI-WP-01 (“Analysis of purse-seine set type behavior in 2009 and 2010”)

337. This paper describes the purse-seine fishery in 2009 and 2010, with particular reference to FAD closures that occurred in both years. Raised logsheet and observer data were used in the analysis. The main findings of the paper are:

- a) The incidence of reported activity related to the use of drifting FADs was considerably lower in 2010 (5.1%) compared with 2009 (13.5%).
- b) The use of fish aggregation lights was observed on some vessels with similar incidences occurring in 2009 (2.2%) and 2010 (2.9%).
- c) Total catch was below average during the 2009 closure and in September of the 2010 closure, although effort remained at around normal levels throughout both closures.
- d) Catches of bigeye tuna were strongly reduced during both closure periods compared with other months of those years;
- e) The impacts of the closures on skipjack and yellowfin catches are more moderate.
- f) The proportions of associated sets conducted during the 2010 closure were close to zero, and compliance with the measure appears to have improved somewhat.
- g) In 2010, the proportions of catch and effort associated with FAD usage outside the closure period, particularly the months immediately before and after the closure, had lower FAD usage than is typically the case. This may be associated with the retrieval and re-deployment of FADs, although this needs to be verified by other data.
- h) While catches were reduced during the closures, the average size of the catch was higher for all species, particularly yellowfin, during the closures because of the larger average size of fish caught in unassociated sets. These larger average sizes may offset, to some extent, the loss of catch that occurs as a result of the closures.

Discussion

338. It was noted that the data presented were for the area between 20°N and 20°S only, so did not include purse-seine catches outside this area, nor did the data include catches from the Indonesia and Philippines fleets. In turn, levels of purse-seine effort in 2010 were significantly higher than in previous years.

339. It was noted that overall, the results of the stock assessment presented a similar picture of stock status of previous years. It was again noted that purse-seine effort remains high, contributed to by exemptions agreed to in the CMM. Uncertainty remains over the longline catch decrease, particularly given that longline vessels were relocating to the Pacific from the Indian Ocean, while it was noted that a

reduction in longline catch of 30% does not necessarily result in a significant reduction of F, if catch were declining due to declines in stock size.

340. It was also noted that a better understanding of how fishing mortality on bigeye tuna has changed in recent years in response to CMM 2008-01 actions must await reliable estimates for 2010 juvenile and adult fishing mortality from the stock assessments. Fishing mortality estimates in the terminal year are not reliable and so will need a further year or two to get a better estimate.

341. With reference to the slide on the size composition of skipjack tuna in 2009 and 2010, it was queried why no size data were presented for the closed period in 2010, whereas data were presented for other species. The SC was advised that this was due to the reduction in FAD sets and the resulting low catches of skipjack on FAD sets (making the size data not apparent on the figure), while the catches of other species in other areas could be from archipelagic waters, where there may be a higher composition of yellowfin and bigeye in those regions.

342. It was noted that the exclusion of catches from those longline fleets exempted under CMM 2008-01 from the plot of overall longline bigeye tuna catches by year might result in a very different pattern in recent years.

343. Some CCMs noted that while evaluation of the impact of the CMM as a whole is in its early days, the trends demonstrated in the preliminary analysis were pleasing. Most notably that: i) incidence of reported activity related to the use of drifting FADs was considerably lower in 2010 compared with 2009; ii) total catch was below average during the 2009 closure and in September of the 2010 closure; iii) catches of bigeye tuna were strongly reduced during both closure periods compared with other months of those years; and iv) 2010 proportions of catch and effort associated with FAD usage outside the closure period had lower FAD usage than is typically the case.

344. Some CCMs also noted that the average size of the catch was higher for all species, particularly yellowfin, during the closures because of the larger average size of fish caught in unassociated sets. These larger average sizes may offset, to some extent, any loss of catch that occurs as a result of the closures

Summary SC7-MI-WP-02 (“Projections based on 2011 stock assessments”)

345. S. Harley (SPC-OPF) made a presentation of SC7-MI-WP-02.

346. This paper provides a brief overview of the generic forward projections that were undertaken using the reference case models for 2011 assessments for bigeye, skipjack and yellowfin tunas. Similar methods were used as in previous years and the results are provided in the form of an Excel spreadsheet with a separate worksheet for each species. Projections were run using two recruitment assumptions — spawner recruitment relationship-based estimates, and the 10-year recent average. The former may be more appropriate for yellowfin and skipjack tunas.

347. There are many important data issues that, while likely having minimal impact on the stock status conclusions of the assessments, will have a critical bearing on the interpretation of projection results summarized here. These issues arise partly because this is the first year that projections have been undertaken with the current assessment so early in the year (i.e. for the SC).

348. Depending on the outcomes of SC7 with respect to choosing those assessment model run(s) to be used for the provision of management advice, these projection results may be updated after the SC and, if necessary, a different (e.g. finer) grid could be used.

Discussion

349. It was noted that the data used in the projections was incomplete, which may bias the projected outcomes, and there was a need to perform an updated set of projections, incorporating the most recent data received by the Commission. Discussion of the projection paper focused on the methodological approach to perform the projections, and the scenarios that might be examined.

350. It was also noted that the deterministic projection approach reduced the ability to evaluate the probability that reference points might be exceeded. Stochastic projections, particularly with the inclusion of a stock recruitment relationship and sampling from recent recruitment per spawner residuals, was suggested as an option for the future.

351. Given the uncertainty in the 2010 longline catch, the suggestion was made that it may be useful to consider 2009 as a starting point for projections, given that catches are better represented in that year. It was noted that this would require plausible assumptions regarding the performance of the initial 10% reduction from that level from 2009 to 2010. Related to this, the terminal year fishing mortality has been identified as uncertain based on retrospective analyses, which interacts with the catchabilities estimated for 2010, used in the forward projection. It was noted that gaps in the catch data in the last year may correlate with underestimates of fishing mortality, which also has implications for projections. It was noted that the timescale for improving catch information is uncertain, given the pattern of fishing and frequency of return to port for provision of logbooks, although the potential for vessels to radio information in was noted. Annual catch estimates may be updated more rapidly.

352. Some CCMs had independently undertaken analysis of several of key runs in the Excel file, and based on the results of those, they suggested that: i) further moderate reductions in fishing mortality are necessary in order to be more confident of removing bigeye overfishing; ii) further reductions in purse-seine effort are projected to produce relatively smaller gains in stock status than previously because of the low level of FAD use in 2010 as the base year for the projections, which remains to be confirmed as a sustained response to the FAD closure; and iii) a package of further moderate reductions in fishing mortality from both longlining and purse seining are likely to be necessary.

353. Some CCMs believed that there are indications from the 2010 data and projections that the current package of measures in CMM 2008-01 could be largely achieving the objectives of the CMM, and that current effort levels would maintain the skipjack stock well within MSY-based reference points. However, the Commission's science services provider informed the meeting that it is likely to take information from two or three years to assess the effectiveness of the current measures, and as such, the SC should therefore be rather cautious in providing advice based largely on only partial information from 2010.

354. The scenarios to be run within the projections were discussed. The option to include scalars implemented in a stepped basis was discussed and the option for an increment of 0.1 was noted. It was also noted that the number of scenarios to be run should be constrained to a reasonable level, given the time required to perform the work, and some prioritization of the runs was needed. Scoping of the robustness of the projection results to lower priority runs, such as the phasing-in of management measures was suggested during less pressurized time periods.

355. Based on this discussion, and the opinions expressed, the convenor requested that SPC draft a set of options for running the updated projections, and that these would be considered further when adopting recommendations.

356. PNA members advised SC7 that they are introducing an extra one-month closure to the three-month FAD closure for foreign vessels, which is already in place in 2011, and this should have a further

positive impact in reducing the catch of bigeye tuna, and further suggested that the planned projections should include analysis of this option. There was a request for the projections to include options for the reduction of overall purse-seine effort.

Summary of SC7-MI-WP-05 (“Prospects for effective conservation of bigeye tuna stocks in the WCPO”)

357. Patrick Lehodey (CLS, France) made a presentation of Working Paper SC7-MI-WP-02. The main issues highlighted by the paper were as follows.

358. WCPFC agreed to close certain high-seas areas in the WCPO to purse-seine tuna fishing starting in 2010. These measures have potential economic benefits to the countries surrounding the closed areas and may also have potential stock conservation benefits for tunas. We used a spatially explicit ecosystem model of tuna population dynamics, SEAPODYM, to simulate the effects of closures on stock biomass and catch of bigeye tuna (*Thunnus obesus*) from 1980 through 2003. The fate of the fishing effort displaced by these closures was not considered in WCPFC conservation measures.

359. Two different effort displacement scenarios were examined: complete loss of the displaced fishing effort, and redistribution of effort proportional to the historical (average) distribution of CPUE. When fishing effort is redeployed, benefits to the stock are not detectable. The beneficial effect on stock biomass is greatest when the displaced fishing effort was completely lost. However, even in this latter case, the effects of the closures on stock size are quite small (less than 4% averaged over the simulation period). In view of limited stock conservation benefits of the closures, other potential bigeye conservation measures were considered. If spatial closures are extended to longline fisheries, the biomass increase becomes greater (approximately 7%). Prohibition of the use of FADs by the purse-seine fleet produces a similar biomass increase. We conclude that:

- a) Closing areas to purse-seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation.
- b) Conservation measures that combine closing areas to purse-seine fishing with proportional reduction of fishing effort may yield a small bigeye conservation benefit.
- c) Restricting longline fishing in known bigeye spawning areas in combination with purse-seine area closures and effort reduction offers the best option for achieving effective bigeye conservation.
- d) Limitation of FAD use would have a strong positive impact on bigeye stock conservation.
- e) Benefits from any bigeye conservation measure will only be detectable after 10 years and be fully realized after two decades (i.e. in the 2030s assuming timely implementation). Recovery will be modulated by both natural and anthropogenic climate-related ecosystem variability. Environmental changes induced by anthropogenic release of greenhouse gases should be clearly visible by the end of the 2030s (Lehodey et al 2010b). The status of the bigeye stock at that time will depend on today’s CMMs.
- f) The bigeye population encompasses both the WCPFC and IATTC convention areas. Though spatial measures have a strong local effect, they also have a spillover effect at the whole range of the species. Thus, the management of this stock would benefit from collaborative and coordinated actions of both international commissions.

Discussion

360. WCPFC agreed to close certain high-seas. Clarification was sought on the phrase “PNA high seas areas”, referred to in the presentation and an explanation was provided that these areas represented those high seas areas already closed by the PNA.

361. Discussions noted that the scenario examining the movement of longline effort out of the closed high seas areas assumed the effort was removed from the fishery. It was noted that in reality this effort might be displaced, and hence would have an impact on other tuna species, such as South Pacific albacore. It was noted that these fisheries are important to island states, and if catch rates in the albacore fisheries drop, they might become uneconomical. Consideration of multispecies issues is, therefore, important. It was noted that the work focused on bigeye tuna by design, but further work should include multispecies and multifishery issues.

362. Some CCMs encouraged more work of this kind from relatively independent sources, thereby bringing new scientific perspectives to management issues. The SC hoped that this work can be further reported on next year.

Recommendations

363. SC7 recommended that TCC and the Commission note the following conclusions based on analyses presented in SC7-MI-WP-01 and SC7-MI-WP-05, and an updated version of WCPFC-2010/15 when reviewing the implementation of CMM-2008-01:

- a) that the number of days reported with any activity related to a drifting FAD was 13.5% in 2009 and 5.1% in 2010 during the FAD closure periods. Trends in FAD usage and associated catch information indicate that the FAD closure has been effective in reducing FAD use by the purse-seine fishery;
- b) the limits placed on purse-seine operations have not adequately constrained total purse-seine effort, with total effort in 2009 and 2010 estimated to be 25% and 32%, (respectively) higher than 2001–2004 levels and the total purse-seine catch of bigeye during 2010, the eleventh highest on record;
- c) purse-seine catches of bigeye tuna (between 20°N and 20°S) declined in 2010 by 21.0% from 2009 and increased by 1.3% from the 2001–2004 average;
- d) closing areas to purse-seine fishing without consideration of the fate of displaced fishing effort will not be effective for bigeye conservation; and
- e) the provisional longline catch in 2010 was 30% lower than 2001–2004 levels. However, this estimate is based on incomplete data, and is despite an increase in fleet size. Furthermore, reductions in catch may not necessarily correspond to reductions in fishing mortality.

364. SC7 recommends that SPC-OFP update the projection results presented in SC7-MI-WP-02 and the results be presented to TCC7 and WCPFC8. These projections are to be based on the procedures outlined in the table and subsidiary notes below.

Factor	Options	Dimensions
Model runs	Base case model	1
Species	bigeye, skipjack, yellowfin	3
Recruitment	Recent average and SRR	2
Longline catch	1.2, 1.1, 1.0, 0.9, 0.8 times 2010 catches	5
Purse-seine total effort (excluding Indonesia/Philippines, excluding archipelagic waters)	2009 (low); 2010 (high)	2
FAD/unassociated set effort split (outside FAD closure)	2009 (high FAD use); 2010 (low FAD use)	2
Purse-seine FAD effort (including Indonesia/Philippines excluding archipelagic waters)	1.2, 1.1, 1.0, 0.9, 0.8, times total effort (with redistribution)	5
Indonesia/Philippines archipelagic waters fisheries	2010 catch and effort	2
Other fisheries (e.g. pole-and-line and Japanese coastal purse-seine)	1.2, 1.1, 1.0, 0.9, 0.8 times 2010 effort	5
Closures of purse-seine fishery	Two-month closure, three-month closure	2
CMM 2008-01 exemptions	With exemptions, without exemptions	2
	TOTAL RUNS	24,000

365. SC7 requested the following specific outputs in addition to those typically provided:

- a) projected stock status in relation to $20\%SB_o$ and $20\%SB_{2021,F=0}$;
- b) projected fishing mortality in relation to $F_{30\%SPRo}$ and $F_{40\%SPRo}$.

366. In addition, for a small subset of model runs, it is recommended that stochastic projections be undertaken and the probability of exceeding the above reference points be calculated.

4.4 Management Objectives Workshop

367. The convener informed the meeting that WCPFC had directed the Secretariat to prepare TOR for the Workshop on Management Objectives, which is proposed to be held in early 2012, and that SC7 had been invited to provide elements to be noted in the TOR. He further informed that meeting that following a request from the Secretariat, he had drafted some TOR for consideration by SC7 and these were outlined in SC7-MI-IP-03. These draft TOR had been updated based on comments provided by attendees at the Informal Small Group, which had met during the Thursday lunch break to discuss these TOR.

368. The convenor talked about this information paper, explaining that the original SC recommendation to the Commission to hold a Workshop on Management Objectives had been made at the Special Workshop on Reference Points, which had been held in conjunction with SC5 in 2009.

Discussion

369. Some CCMs noted that while scientific input would be required for the Workshop on Management Objectives, it would also require in-depth and difficult policy and political discussions. There will, therefore, be a need for further development of the TOR after SC7. These CCMs referred to key issues from WCPFC7 for consideration:

- a) that management objectives are firmly based on and reflect the full range of considerations related to stock management provided for in the Convention, including various principles in Articles 5 and 30; and
- b) that full consideration be given to multispecies issues.

370. In response to this statement, the convener noted that there will likely be a need to establish a coordinating committee to provide guidance on organizing the workshop. He also noted that, as identified by SC6, there would be a need for preparing working papers that would be presented at the workshop.

371. Noting that there were no further comments on the draft TOR, the convener informed the meeting that these TOR would be forwarded to the Secretariat, and could serve as a basis on which the Secretariat would then draft a final set of TOR for consideration at WCPFC8.

372. At the end of this agenda item, the convener informed the meeting that he would prepare a set of draft recommendations for each agenda item discussed by this theme, and that these recommendations would then be presented to and discussed by the SC at a later time.

Recommendations

373. SC7 recommended that the WCPFC Secretariat, when drafting TOR for the Commission for the Management Objectives Workshop, take into consideration the TOR cleared by SC7 (see Attachment G).

374. SC7 recommended that the Commission take into consideration the previous recommendations made at SC6 relating to the Management Objectives Workshop, in particular i) that an independent international expert(s) be invited to the workshop to provide expert guidance on the use of reference points and other issues of relevance to identifying fisheries management objectives; and ii) that in order to assist with the success of the workshop, some preparatory scientific work (e.g. as identified in paragraph 335, f and k, under Agenda Item 4.2) would need to be undertaken.

375. The convener thanked all presenters, the authors of all working and information papers, and the SC for its input to this theme session.

AGENDA ITEM 5 – ECOSYSTEM AND BYCATCH MITIGATION THEME

5.1 Ecosystem effects of fishing

a. Progress of SEAPODYM applications

376. P. Lehodey presented SEAPODYM applications in the WCPO – progress report (SC7-EB-WP-06). The development of SEAPODYM to Pacific tuna and billfish species has been included in the SC's programme of work as an affiliated, independently funded project. Progress in the model development and its application to Pacific skipjack tuna were presented. Key new developments included the implementation of robust normal likelihood for the parameter optimization approach and code upgrade allowing optimization experiments at any temporal and spatial resolution. Research studies funded by the SPC-OFP and the National Research Institute of Far Seas Fisheries (Fisheries Research Agency of Japan)

allowed development of a new skipjack model configuration using realistic high resolution environmental forcing, increased resolution of fishing data, and robust normal likelihood approaches. This led to improvements in the optimization of parameters for skipjack tuna with a better fit to fishing data and lower total biomass estimates. It remains important to investigate whether such a tendency continues while running optimization experiments with increased resolution and corresponding resolution of fishing datasets.

377. Skipjack adult biomass was predicted to be in its lower range in 2008 and 2009, but higher recruitment occurred in 2010 following the 2009–2010 El-Niño event. The powerful La Niña event developing in 2010–2011 resulted in lower skipjack recruitment in the first quarter of 2011. Based on this relationship between skipjack recruitment and ENSO, it is possible to forecast the future trend of the stock. Because ENSO-neutral conditions have developed in the second quarter of 2011 and are expected to continue until the end of the year, skipjack biomass would reach a low trough at the end of 2011. Unless an El Niño event develops in 2012, the skipjack biomass forecast for 2012–2013 should remain in the low range of its long-term productivity.

378. After scaling the new parameterization to a pre-operational model at a resolution of $0.25^\circ \times$ week, analyses can be conducted to investigate fine-scale changes in skipjack population dynamics and fisheries. Examples are provided at regional levels with Japanese domestic fleets, and at the EEZ scale in PNG. It also becomes possible to envisage near real-time monitoring of the stock. The interest of such products for the monitoring of fisheries needs to be discussed and evaluated.

379. The model was also used to investigate the impact of climate change under the UN International Panel on Climate Change A2 scenario for the next century. After correction of a temperature bias in the climate model outputs, a new projection of skipjack dynamics was achieved with parameter estimates close to the values obtained using more realistic re-analyses of the historical fishing period. Results showed a more clear extension of habitat towards higher latitudes and stabilization of skipjack total biomass in the WCPO until 2060 (without considering fishing). The result was insensitive to a “no change” scenario for oxygen concentration.

Discussion

380. Discussion focused on inputs for primary productivity, appropriate spatial scales for modeling, and the ability of SEAPODYM to test for range contraction in stocks. SEAPODYM uses satellite data as inputs for primary productivity, and the presenter stated that research has shown this to well represent seasonality in primary productivity although he noted that work is ongoing to evaluate the model and its inputs. To optimize the spatial scale used in the model, agreement was needed in the resolution of the fishing data and the realism of the environment. One method might be to increase the resolution until decreases in biomass stabilize, and the presenter suggested that this could be tested by using 0.5 degree data.

381. The presenter believed that SEAPODYM could be used to examine range contraction in a fishery by modulating the biomass of predators and by examining whether the biomass of adults contracts into a favorable zone due to fewer predators. Skipjack recruitment in the North Pacific could be set to zero and impacts on fisheries in the tropics could be examined. One of the co-authors highlighted the result of SEAPODYM simulation to examine range contraction, which suggests that when fishing mortality is removed from the equatorial region there is an impact on biomass of skipjack in the subtropical area, where there is a possible reproductive area for fish migrating to temperate waters. The presenter also postulated that range contraction might have occurred as a result of the recent contraction of the Kuroshio Current creating less favorable conditions in the north with a resulting movement of skipjack into its core habitat.

382. Moreover, there was recognition that skipjack may be a keystone species in the WCPO and some CCMs recommended further ecological studies be undertaken on this topic and that results be presented to the SC.

383. Some CCMs voiced support for the SEAPODYM research programme, noting the importance of SEAPODYM applications to better understand oceanographic effects on fishing and oceanography in national waters of their countries. There was also support for collaboration with research institutions to pursue this research and to conduct in-country productivity susceptibility analyses (PSAs) and ecological risk assessments (ERAs).

5.2 Sharks

a. Process for the nomination of key shark species.

384. Shelley Clarke presented a proposal (SC7-EB-WP-05) for a process that designates WCPFC key shark species for data provision and assessment. This work was conducted in response to SC6's request for SPC to develop a process for the nomination of key shark species and to identify a subset of these for assessment. The process provides a framework for evaluating proposals for new key shark species by describing the range of issues to be considered including: i) potential impact by fisheries; ii) designations by other conservation and management systems; iii) the degree of ecological concern; and iv) adequacy of available data and the potential to collect more. A proposed process flowchart and worksheet are provided to assist in evaluating whether the species should be designated as a WCPFC key shark species for data provision or assessment, or both.

Discussion

385. SC7 thanked SPC for its work in developing the proposal. Because shark species were added in previous years to key shark species listed in an *ad hoc* manner, several CCMs expressed enthusiasm for a process by which species could be considered for inclusion as a key shark species based on several factors, including the availability of data and the importance of species catches to the fishery. There was consensus that the step considering designation for conservation and management under other systems be removed from the process because there are varying levels of scientific rigor involved in designations conducted by other organizations, and the SC has the expertise to determine whether the science supports any additions to the key shark species list.

386. SC7 was reminded that the proposed process for designating key shark species is largely concerned with data collection and assessment, and that the Commission may adopt CMMs for any or all shark species on the basis of whatever information is available to it. SC7 agreed to recommend the proposed process to the Commission as amended in the preceding paragraph.

b. Stock status of key shark species included in the WCPFC Shark Research Plan

Summary of SC7-EB-WP-03 (“Analyses of catch data for oceanic whitetip and silky sharks reported by fishery observers in the Hawaii-based longline fishery in 1995–2010”)

387. K. Bigelow (USA) presented analyses of catch data for oceanic whitetip and silky sharks that were reported by fishery observers in the Hawaii-based longline fishery in 1995–2010. This report presented descriptive statistical summaries and GLM analyses of catch data for oceanic whitetip shark *Carcharhinus longimanus* and silky shark *C. falciformis* in the Hawaii-based pelagic longline fishery. The paper is a collaborative effort that was begun at SPC and completed at the US National Oceanic and Atmospheric Administration's Fisheries Pacific Islands Fisheries Science Center (PIFSC) in Hawaii. Data were collected by fishery observers aboard commercial vessels in 1995–2010. Oceanic whitetip shark

mean annual nominal CPUE decreased significantly from 0.428/1,000 hooks in 1995 to 0.036/1,000 hooks in 2010. This reflected a significant decrease in nominal CPUE on longline sets with positive catch from 1.690/1,000 hooks to 0.773/1,000 hooks, and a significant increase in longline sets with zero catches from 74.7% in 1995 to 95.3% in 2010. Oceanic whitetip shark CPUE was standardized by delta-lognormal and zero-inflated Poisson GLM methods. The latter method was employed because 90.1% of longline sets caught zero oceanic whitetip sharks.

388. Four factors — 16 haul years, calendar quarters, deep- and shallow-set fishery sectors, and 8 fishing regions — were significant explanatory variables in these analyses. Sea surface temperature was a significant continuous explanatory variable in a binomial GLM of the presence or absence of oceanic whitetip shark catches. The haul year effect coefficients from these models were used to compute indices of relative abundance. These time series were highly correlated, and each was also highly correlated with the time series of nominal CPUE. Silky shark catch data differed from oceanic whitetip shark data in four major respects. The first was that nearly all silky sharks are caught on deep sets. The second was that most (62.5%) of the silky shark catch was taken from 0°N–10°N, although only 3.4% of the observed fishing occurred in those latitudes. The third difference was that sample sizes were very small before 2000.

389. Finally, although 46.3% of the longline sets from 0°N–10°N caught zero silky sharks, 54.5% of the silky shark catch in these waters was taken on 11.5% of longline sets, which caught ≥ 5 silky sharks. These differences led to the use of data from 0°N–10°N in the deep sector from 2000–2010 in the GLM analyses, which were fitted by delta-lognormal and quasi-Poisson (i.e. overdispersed) methods. These GLM analyses had low explanatory power. Silky shark CPUE has ranged from 0.034/1,000 hooks to 1.840/1,000 hooks, but with no significant trend. Therefore, it is concluded that the relative abundance of silky sharks in tropical waters exploited by this fishery, particularly near the Line Islands (Kiribati), has remained fairly stable since 2000. This was not the case with oceanic whitetip shark, which has apparently undergone a highly significant decline in relative abundance in this fishery since 1995.

Discussion

390. Some CCMs asked whether any seasonal patterns in catch were seen for the two species in the Hawaii observer dataset, and whether there was any effect on catch by set depth. The presenter replied that no seasonal pattern for CPUE was seen for either species, and noted that oceanic whitetip sharks are epipelagic and that similar catches were observed in both shallow and deep sets. For silky sharks, however, catches have only been observed in deep sets in more tropical waters. Because the Hawaii shallow set fishery does not operate in that area, no conclusions can be made as to whether catches for silky sharks might vary by set type.

Summary of SC7-EB-WP-02 (“Analysis of North Pacific shark data from Japanese commercial longline and research/training vessel records”)

391. S. Clarke presented an analysis of North Pacific shark data from Japanese commercial longline and research training vessel records. These analyses included North Pacific longline operational data from research and training vessel surveys (1992–2008) and commercial longline logbook records (1993–2008) provided by Japan for onsite analysis in Shimizu during January–March 2011. Both datasets required filtering to remove records believed to under-report actual shark catches. The analysis was based on 7,974 sets representing 10 vessels in the research and training vessel surveys and 88,129 sets representing 112 vessels in the commercial longline fleet. Application of different filtering methods could result in larger sample sizes, but this benefit would need to be weighed against the probability of increasing the presence of under-reported catches in the filtered database. When considering the selection and application of data filters it is important to remember that if vessels began releasing or discarding (and not reporting) sharks in recent years, filtering may not fully correct for this effect, and declining catch rate trends would, thus,

potentially be exaggerated. On the other hand, if reporting practices do not change but shark stock abundance actually diminishes over time, declining catch rates would be expected. The challenge is to apply a filter that removes those catch records that are under-reported, but retains those that are low but accurate.

392. Filtered data were examined in terms of five potential indicators of fishing pressure: distribution, catch composition, catch rate, targeting and size. Blue sharks, which dominate the shark catch in the North Pacific, showed declining catch rates in research and training vessel surveys but a strong trend of increasing catch rates in commercial records until 2005, declining thereafter. Evidence of blue shark targeting was found in the increasing concentration of effort in areas of high catch rates. Mako sharks comprise a small proportion of the catch (<10%) but “effective” targeting may be increasing as a result of targeting co-occurring blue sharks. Mako catch rates showed an increasing trend in both datasets until 2006 for the main commercial fishing grounds in the western North Pacific. Decreasing catch rate trends were shown for mako sharks in both the central North Pacific and western North Pacific since 2006. Oceanic whitetip and silky shark catch rates showed declines in the research and training vessel data and were rarely recorded after 2005. There was also some evidence for a trend of decreasing size of both males and females of these species in recent years. Thresher sharks were analyzed as a group, and results are expected to mainly reflect the status of bigeye thresher. An increasing trend was found in the research and training vessel data and an inconclusive pattern in the commercial data.

Discussion

393. There was discussion on the concentration index, filtering, differing trends in blue shark CPUE in the commercial versus research/training data, factors considered in the standardization process, and whether changes observed were due to differences in the presence or absence of sharks, or to the number of sharks caught when catches are made. It was noted that Japanese training vessel trips are conducted for the purposes of training students to become fishermen. For safety reasons, there is general uniformity in their set and operational styles onboard training vessels. Additionally, most training vessels operate in different seasons or areas from commercial vessels in order to avoid interfering with commercial operations.

Summary of SC7-EB-WP-01 (“An indicator-based analysis of key shark species based on data held by SPC-OFP”)

394. S. Clarke then presented an indicator-based analysis of key shark species based on data held by SPC-OFP. Both longline and purse-seine logsheet datasets suffer from missing shark catch records and a lack of species-specific recording; therefore, the indicator analysis was based on observer data only. Shark data from observer datasets are, however, also constrained by a lack of representativeness, particularly for the North Pacific, and for the purse-seine fishery by the physical practicalities of onboard sampling.

395. Shark status indicators in four main classes were assessed: range based on fishery interactions, catch composition, catch rates and biological indicators of fishing pressure (e.g. median size, sex ratio). For blue sharks, which dominate longline catches in most regions, declines in catch rates were observed in nominal and standardized analyses for the northern hemisphere. In the southern hemisphere catch rates declined in the nominal analysis but increased in the standardized analysis in recent years. Both significant increases and decreases in blue shark size were identified. Data for mako sharks in the northern hemisphere were comparatively sparse, although this species is known to be commonly found there. Catch rate analysis showed different trends in different regions and no significant size trends. Oceanic whitetip sharks were once commonly caught by both longline and purse-seine fisheries in tropical waters but their presence in observer samples has become increasingly rare over time. Catch rate analyses of data from both longline and purse-seine fisheries showed clear, steep declines in abundance.

Declining median size trends for oceanic whitetip sharks were observed in all regions and sexes in both fisheries until samples became too scarce for analysis; these trends were significant in the core habitat areas in tropical waters. Silky sharks comprise the largest proportion of the shark catch in both longline and purse-seine fisheries in the western tropical WCPO. Silky shark catch rates follow an upward then downward trajectory for both longline and purse-seine fisheries. Most catches in both fisheries were juveniles, and within the core habitat of the western tropical WCPO significant declines in median sizes were identified for both sexes in both fisheries. The three thresher shark species have divergent, but not necessarily distinct, distributions that, in combination with low sample sizes, produced no clear catch trends for the group. A significant decrease in median size was identified for thresher sharks in tropical areas, most of which are expected to be bigeye thresher sharks.

Discussion

396. It was noted that observer data held by SPC is an amalgamation of data across all fleets that have provided data. There have been changes in some fleet practices over time, and while some of those have been considered in this analysis, other factors were not able to be considered due to limited data. Most observer data were concentrated within EEZs, but some occurred on the high seas. It was unknown as to what amount of observer data was available within archipelagic waters. CCMs interested in examining differences in shark catches by fishing method were advised to ask SPC for assistance because many country reports produced by SPC contain a section on sharks.

397. An industry representative expressed concern that many conservation measures for sharks and other bycatch species have been developed and adopted without consultation with industry. Costs to comply with such measures can be quite high, and industry would like to have input in order to develop practical approaches that would minimize impacts to domestic fleets.

398. There was some discussion on the size of sharks caught by the longline and purse-seine fisheries, and SC7 was directed to Annexes 7 and 8 in SC7-EB-WP-01 for additional information. In general, smaller sharks were caught in purse-seine fisheries than longline fisheries.

399. Noting declines of blue sharks in the North Pacific, the USA mentioned that some analysis had been done on blue sharks using Hawaii longline observer data, and suggested that this information could be presented next year at SC8.

c. Information relevant to the CMM on sharks

400. S. Clarke presented a snapshot status of key shark species in the WCPO and their potential mitigation options (SC7-EB-WP-04). This document synthesized all of the shark assessment work completed to date under the WCPFC's Shark Research Plan, and discussed existing and potential CMMs for sharks. The current state of eight of the WCPFC's key shark species (blue; shortfin and longfin mako; oceanic whitetip; silky; and bigeye, common and pelagic thresher sharks) in the WCPO is summarized. Various measures implemented to reduce shark mortality due to fishing are examined, including the existing WCPFC shark CMM and alternative measures applied by WCPFC members in national waters. Measures currently applied by other RFMOs are evaluated using WCPO observer data. Conclusions regarding the status of stocks and the effectiveness of current management measures are presented.

Discussion

401. SC7 thanked SPC for its work on compiling and analyzing information on key shark species in the WCPO. Japan noted that the earthquake and tsunami in March 2011 resulted in losses of 30–40% of their fishing vessels, and destruction of one of their major fishing ports and associated processing plants. Some Japanese surface longline vessels continue to operate, but the coastal gill net fishery has completely

stopped operations. Japanese industry believes it will take at least three years to recover to the point at which they can begin processing shark meat again. Japan further noted that shark meat is an important historical industry, and is committed to encouraging full use of retained sharks.

402. A CCM expressed support for inclusion of the shark research plan into the strategic plan as well as support for the use of risk-based assessments if traditional stock assessments are unable to be carried out due to data limitations. In this case, they further support a more detailed analysis planned for 2012 and look forward to a well-considered and constructive approach to revising the shark CMM in 2012. The same CCM expressed support for a “no retention” and “prompt release unharmed” clause for oceanic white tip sharks for longline fisheries that have not already banned wire traces, or implemented compatible measures with equivalent effect, and the replacement of a “fin to carcass ratio” with a requirement that sharks are landed with fins attached. The CCM also noted that the development of training materials on how to best release sharks would be useful because bringing sharks onboard can be dangerous for fishing crew. SC7 was reminded that there is a paragraph in the existing shark CMM, encouraging research on developing methods to avoid or reduce shark bycatch. CCMs were also urged to provide data on key shark species to comply with data provision requirements of the Commission. Some CCMs felt that a revision of the shark CMM is necessary in order to reduce fishing mortality on blue and oceanic whitetip sharks, and to more closely monitor the status of other key shark species. Another CCM noted that it currently has a no retention ban for striped marlin for commercial vessels, and that this has not seemed to impact the fishing, and believed a no retention policy could help to reduce fishing mortality of oceanic whitetip sharks.

403. Some CCMs encouraged collaboration in the timely provision and analysis of data on shark species for scientific purposes. They thanked SPC for progress on development of a shark database, and urged all CCMs and stakeholders to provide shark data in compliance with relevant data provision rules of the Commission in the duration of the research plan’s implementation. The importance for reporting key shark species was re-emphasized as this was a compulsory requirement under the shark CMM and also under the Commission binding rules on data provision. Some CCMs continued to support the plan’s aim to explore, compile and better coordinate existing shark research and data, and to improve shark catch data.

404. Some CCMs further stated that SC7 was tasked to review CMM 2010-07 specifically paragraphs on: data provision, fin to carcass ratio, need for revised or new CMMs, and update advice on stock status of key shark species. SC7 has been asked to review the progress of the Shark Research Plan, including plans for shark stock assessments. SC members had a number of proposals that they wished to be reflected in SC7’s advice, including:

- a) support and encourage shark data collection and provision for assessment purposes by all CCMs;
- b) support ban on targeting or incidental purse-seine setting and catch of whale sharks in the WCPO; and
- c) support reduction in fishing mortality on oceanic whitetip and blue sharks in the North Pacific, and close monitoring of fishing mortality of other key shark species.

405. CCMs expressed concern for whale sharks. One CCM pointed out that under Agenda Item 5.2, that discussion should focus on eight key species, and suggested that whale sharks be discussed under Agenda Item 5.5.

Recommendations

406. SC7 is concerned about the steep declining standardized catch rates and size trends of oceanic whitetip shark caught by longline and purse-seine fisheries in the WCPO. This species should be

prioritized for further investigation in the second year of the Commission's Shark Research Plan in order to provide a better understanding of fishery impacts on this species.

407. SC7 recommended that WCPFC8 consider mitigation measures for oceanic whitetip sharks in the Convention Area and blue sharks in the North Pacific on the basis of existing information, both presented to SC7 and available from other studies.

408. The current Shark Research Plan is scheduled to conduct a stock assessment on oceanic whitetip sharks and silky sharks for SC8 and on blue sharks for SC9.

409. Recognizing the considerable body of work on shark catch mitigation, including non-retention and live-release, deeper hook deployment on longliners (for epipelagic species), use of circle hooks, and prohibition on targeting, finning and wire leaders, SC7 further recommended that SC8 consider investigations into the effectiveness of mitigation measures for sharks.

410. SC7 recommended that WCPFC adopt the process for designating WCPFC key shark species for data provision and assessment.

5.3 Seabirds

Summary of SC7-EB-WP-07 (“Distribution of seabird bycatch at WCPFC and the neighboring area of the Southern Hemisphere”)

411. Y. Inoue presented a paper on the distribution of seabird bycatch in WCPFC Convention Area and in neighboring areas of the Southern Hemisphere. This paper describes the distribution of bycatch CPUEs of those species in the Southern Hemisphere ocean, and examined their spatial and seasonal patterns. Data from scientific observer programmes, data from fishing boats for high school training, and data from chartered research boats were used for the analyses. Bycatch CPUE (number of seabirds/1,000 hooks) was calculated by species or species groups, and its spatial distribution was presented by 5 x 5 degree blocks. Seabird bycatch CPUEs were the highest in the Tasman Sea in the WCPFC Convention Area, but the value was smaller than that in high interaction areas beyond the WCPFC Convention Area.

412. In the southern WCPFC Convention Area, bycatch CPUE of albatrosses was observed to be greater than that of petrels. Albatross species, mostly wandering albatrosses, black-browed albatrosses, Buller's albatrosses and shy albatrosses were caught in the Tasman Sea. White-chinned petrels and flesh-footed shearwaters, which are thought to dive deeper than albatrosses and are frequently caught as bycatch in the Atlantic and Indian oceans, were not caught in the Tasman Sea. Albatrosses, which are a higher conservation risk, are exclusively caught in the area south of 25°S. With data from the WCPFC Convention Area, the capture of white-chinned petrels did not statistically account for the simultaneous capture of albatrosses and giant petrels.

413. Previous studies showed that the interaction of white-chinned petrels with baited hooks exceeded the bycatch of albatrosses in pelagic longlines off South African waters, and relatively lower CPUEs of total albatrosses in the WCPFC Convention Area than the others could be at least partially attributed to this fact. However, in the case in the Tasman Sea, albatrosses with higher conservation risks (e.g. wandering albatrosses) were by-caught without diving seabirds. It is likely that the bycatch mechanism in the Tasman Sea differs from that off South Africa. To clarify the mechanism, more data and research are needed in the Tasman Sea.

Discussion

414. SC7 thanked Japan for the valuable presentation of these data, and noted that the data highlight some previously little known areas for seabird bycatch. Clarification was sought on the species caught most frequently by the Japanese fleet: black-browed albatrosses were caught in the highest numbers in the WCPFC Convention Area, but wandering albatrosses were the species caught in highest numbers in the Tasman Sea. The authors clarified that it was the CPUE of wandering albatrosses that was higher. SC7 noted that the differentiation between systems with and without white-chinned petrels, as described in the paper, could be useful in relation to refining effective mitigation measures. Some CCMs noted that the paper proposes that the Tasman Sea differs from other areas in not having a white-chinned petrel dominated system. However, other species of diving petrel occur in the area, and SC7 supported Japan's conclusion that further research in the Tasman Sea would be valuable.

415. The presenter was also queried on whether there was any consistency in mitigation measures applied in all three oceans. The presenter indicated that the data they have obtained show there is consistency in the mitigation measures applied in each ocean, but that they have only been used in recent years because the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) required seabird mitigation.

416. SC7 noted that the GLM undertaken in the paper was preliminary and that there may be other appropriate methods with which to analyze the data. Clarification was sought on whether the observer data were representative of the commercial fleet as a whole, and whether the analysis had been able to take into account spatial variations in the use of bycatch mitigation measures. The majority of data are from the CCSBT fishery and are representative of the spatial distribution of the fleet, although not covering all seasons. The presenter noted that CCSBT vessels would have used tori lines, but agreed that the data could be affected by historical changes in the use of mitigation measures, and noted that Japan plans further analyses on the dataset in the future.

417. SC7 noted that the paper identifies seabird bycatch as occurring south of 25°S, confirming the results of the recent WCPFC ERA for seabirds (presented to SC6). SC7 also noted a recent publication by Chinese Taipei, documenting seabird bycatch occurring in the South Pacific from 25°S. SC7 noted that these data should be considered in relation to a future update of the existing seabird CMM, and that data from other fleets are needed because important data gaps remain. SC7 also noted that the currently-available analyses aggregate data to a 5 x 5 degree grid, and that it would be valuable to examine these further at a finer spatial scale. CCMs supported the recommendation in the paper that an integrated approach between the Pacific, Atlantic and Indian oceans — with regard to seabird bycatch mitigation — would be useful.

Summary of SC7-EB-WP-09 (“A comparison of two blue-dyed bait types for reducing incidental catch of seabirds in the experimental operations of the Japanese southern bluefin tuna longline”)

418. D. Ochi presented a comparison of two blue-dyed bait types for reducing the incidental catch of seabirds by the Japanese southern bluefin tuna longline fishery. This document reported on an experiment to evaluate the effects of blue-dyed squid and fish baits for reducing the incidental catch of seabirds by Japanese longline fishery survey cruises. The surveys were conducted on the *Matsuei-maru No. 3* in 2001, *Fukuseki-maru No. 33* in 2002 and *Fukuryu-maru No. 21* in 2003 off South Africa in the Southern Ocean. Squid and fish (sardine, striped mullet and mackerel) were used as bait during the surveys. Results showed that the incidental catch of seabirds was lower for both blue-dyed squid and fish baits than for non-dyed baits. A marked difference was recorded in the catch rate of seabirds by the *Fukuseki-maru No. 33*, and no seabirds were taken by the *Matsuei-maru No. 3* and *Fukuryu-maru No. 21* when blue-dyed baits were used. Both blue-dyed squid and fish baits were effective in reducing the incidental catch of seabirds as compared with both non-dyed squid and fish baits. The results also indicate that deploying a

combination of blue-dyed bait and tori-lines is quite effective in avoiding seabird bycatch by the tuna longline fishery.

Discussion

419. SC7 thanked Japan for this analysis. Clarification was sought on whether the dataset also included data on the effectiveness of blue-dyed bait in reducing seabird bycatch during gear retrieval. The presenter noted that in the case of the Japanese longline fishery, few birds are caught on the haul. This is considered to be due to the fact that hooks are retrieved rapidly from depth to deck. For future experiments on the effectiveness of blue-dyed bait, it was noted that an effective experimental design may be to alternate dyed and un-dyed baits, to reduce potentially confounding variables. If the experimental design is not reviewed it may cause the SC to reach the wrong conclusions, hence incorrect advice. The segmentation to be used for collecting the data should be revised to alternating blue-dyed bait and normal-colored bait so that data are independent and not biased.

Summary of SC7-EB-WP-10 (“Seabird interaction rates estimated from observer data (2004–2011) in the Hawaii-based shallow- and deep-set longline fisheries”)

420. K. Bigelow presented an analysis of seabird interaction rates estimated from observer data (2004–2011) in the Hawaii-based shallow- and deep-set longline fisheries. Seabird interactions have occurred in both the shallow-set fishery (swordfish targeting) and deep-set fishery (tuna targeting) US longline fisheries that are based in Hawaii. Part 1 of the US Annual Report of the WCPFC (2010) contains estimates of observations for all USA longline fisheries, and this report characterizes observed seabird interactions and operational attributes of Hawaii-based longline fleet disaggregated by shallow sets (n=10,297 sets), deep sets at or north of 23°N (n=10,263) and south of 23°N (n=15,675). The report analyses observer data from 2004 to May 2011, a period after which substantial mitigation methods were mandated in the fisheries. The annual observed interaction rate in the shallow-set fishery, which does not use a line shooter, averaged 0.044 seabirds/1,000 hooks (2004–2010 range=0.009–0.066). The annual observed interaction rate in the deep-set fishery, which uses a line shooter at or north of 23°N, averaged 0.009 (range=0.002–0.014) and 0.002 (range=0.001–0.005) to the south of 23°N. The ratio of seabird interaction rate between the shallow-set fishery and deep-set fishery is 4.73 and 22.91 for deep sets at or north of 23°N and south of 23°N, respectively.

Discussion

421. SC7 welcomed the detailed description of fishery operations presented in this paper. However, some CCMs commented that the two fisheries described in the paper differ in several respects, including time of set, and that it is therefore not possible to conclude from this paper whether a line shooter is, or is not, an effective bycatch mitigation measure for seabirds. The results may have been more informative if data could have been collected for analysis from deep setting vessels that have line shooters and those that fish without line shooters. The presenter suggested that currently there are no fishermen deploying deep sets when not using line shooters, because attaining a deep longline set (deepest hook ~ 250 m) with a monofilament longline is impossible. The industry transitioned from rope to monofilament gear 20 years ago.

422. SC7 noted that controlled experiments provide the most reliable source of information on the effectiveness of bycatch mitigation measures. At the same time, SC7 acknowledged that seabird bycatch mitigation research is costly, and that the desire to establish a robust experimental design is often constrained by logistical limitations in the fishery.

423. SC7 noted that the paper identified the fact that most birds were caught by the shallow-set fishery during gear retrieval, which takes place after sunrise, and that most birds were released alive but injured.

Clarification was sought on whether there was a reason that fishermen chose to haul after sunrise, and whether there are data available on the degree of seabird injury or post-release survival. Time of haul is believed to relate to the time needed for fishermen to rest between operations. The USA has considered refining its categorization for injured birds, but concluded that this introduces problems of subjectivity between observers.

424. Some CCMs stated that the current CMM continued to provide the basis for adequate protection to seabirds in areas where interactions have historically occurred. However, some CCMs welcomed current recent research and trials on weighted branch lines, use of dead baits and live baits, use of blue-dyed bait, location of latitudinal boundary, and deep setting line shooter. The main outstanding issue was the lack of information on implementation of key elements, including technical specifications for mitigation measures. Some CCMs reiterated that current technical specifications for the mitigation measures in CMM 2007-04 should remain in place until further information or proposals to modify the technical specifications were further discussed through SC process.

425. In addition, some CCMs noted that spatial risk indicators with longline fisheries in the WCPO require gathering further information to enable areas where high levels of interaction occur to be identified. Some CCMs also noted low interactions in subtropical and tropical regions, and the suggestion to shift the latitudinal line northwards to 25°S. These CCMs look forward to considering further information on this issue to assess whether such a shift is required.

426. SC7 reaffirmed its recommendation from SC6 that the TCC may want to consider treating the North Pacific and South Pacific separately in future revisions of CMM 2007-04, as long as such a revision is based on advice accepted by the SC, and does not weaken the existing measure. It was noted that the consideration of seasonal patterns, such as those presented in SC7-EB-WP-07, was useful, and that this should be considered in working towards a revision of the current seabird measure, which could perhaps be considered at SC8.

427. SC7 welcomed the data submitted by members at this meeting. Several members noted that a key issue was a lack of data, including data on the implementation of the existing seabird bycatch mitigation measure. It was also noted that the WCPFC ERA for seabirds has identified areas where more data need to be collected, and that consideration of further information is needed in order to consider whether a shift of latitudinal boundary is required. Some CCMs welcomed further analysis, but expressed the view that current data do not suggest the need to extend CMM 2007-04 into equatorial waters.

428. Finally, it was noted by SC7 that in relation to improving the existing seabird CMM, the key issue is the current limitations of the data. Moreover, there is an onus on flag states to demonstrate that they do not have a problem in relation to seabird bycatch. CMMs were encouraged to consider how improvements may be made to the observation and recording of seabird interactions for inclusion in national country reports.

Recommendations

429. SC7 noted that no management recommendations were formulated, and so management recommendations from SC6 are still current.

430. SC7 encouraged further research and the exchange of information intersessionally with a view toward evaluating the effectiveness of CMM 2007-04 at SC8.

5.4 Sea turtles

431. No issues on sea turtles were discussed.

5.5 Other species and issues

a. Guidelines for the release of encircled animals

432. Following an introduction to the project by V. Restrepo (International Seafood Sustainability Foundation, ISSF), D. Itano (Pelagic Fisheries Research Program, PFRP) presented the status of the purse-seine bycatch mitigation project and research cruises funded by ISSF with notes on the development of best practices for the live release of encircled animals (SC7-EB-WP-11). The status and future plans of the ISSF-funded project were described; the project will support research cruises on purse-seine vessels in all oceans to conduct FAD associated bycatch reduction research. A steering committee consisting of scientists from all tuna RFMO regions agreed to prioritize research on the reduction of fishing mortality of bigeye tuna and tunas of undesirable size, and pelagic sharks that are taken in associated sets, while research on other bycatch species (marine turtles, other finfish) will also be addressed. The steering committee agreed that the project should be conducted in all ocean basins that are exploited by large-scale tropical purse-seine fisheries in order to test the influence of local oceanographic conditions on potential solutions to bycatch reduction.

433. A list of potential research activities was developed to investigate potential mitigation measures that could be implemented: a) before arriving at a FAD; b) immediately before the set; c) after the set during net retrieval; and d) from the vessel after catch loading has commenced. The planning of research priorities and cruises has been assisted by a series of Skippers Workshops in Europe, Africa, Latin America and the WCPO to benefit from the knowledge of purse-seine captains and crew who are highly experienced with FAD fishing in their respective regions. Research cruises have been completed in the western Indian Ocean and the EPO, and are being planned for implementation in the eastern Atlantic and the WCPO for early 2012. The project will also assist in the development of best practices for the live release of encircled animals (whale sharks, manta rays and mobula rays) as well as procedures for the safe handling and live release of oceanic sharks. In a related development, the government of PNG has provided funding to the WCPFC to be applied toward FAD bycatch mitigation research. The ISSF project steering committee will meet again in San Diego, California during 21–23 August 2011 to review progress to date and refine research priorities and plan the Atlantic and WCPO cruises.

Discussion

434. Japan outlined a draft guideline of best practice for dealing with whale sharks in purse-seine nets with an emphasis on releasing whale sharks as quickly as possible without endangering the crew. These draft guidelines are contained in Attachment H.

435. CCMs noted that Japan's proposal was a good starting point for further consideration.

436. Some CCMs noted that papers prepared by SPC indicated that "it is clear that purse-seine sets on whale sharks are a combination of both targeted sets and inadvertent capture. Interactions with toothed whales appear to be mostly incidental rather than the set targeted specifically at these animals. On the other hand, most sets on baleen whales appear to be targeting a specific interaction, even if temporary, between the whales and tuna" (WCPFC7-2010-IP/01). Some CCMs informed SC7 that they will be proposing a ban on targeted sets on whale sharks and cetaceans at WCPFC8.

437. FFA members noted that they had submitted a proposal to WCPFC7 to prohibit purse-seine sets on whale sharks, and while they continue to support that measure they noted the need for release guidelines. They thanked Japan and the presenter for the information provided.

438. Some CCMs noted that there was a considerable body of work on the release of cetaceans, in particular dolphins and porpoises, which has led to the development of standard practice to release these animals but that no similar standards had been developed for the release of whale sharks.

439. Some CCMs advised that sets associated with whale sharks were banned under a PNA measure that took effect 1 January 2011. As part of this measure, PNA procedures require that if a whale shark is inadvertently encircled in the purse-seine net, the master must ensure that all reasonable steps are taken to ensure its safe release, including stopping the net roll and not recommencing fishing operations until the shark has been released.

440. Given the range of circumstance that the handling guidelines should cover, it was agreed that an electronic working group, led by the Ecosystem and Bycatch convenor, be established to review (by email) the development of a proposal to be put forward for consideration by TCC7 and WCPFC8.

441. With regard to the ISSF bycatch mitigation project, some CCMs noted the importance of consulting with coastal states in developing and undertaking activities under this project.

442. It was noted that CCMs, including all relevant coastal states, will be incorporated into the notification and planning process leading up to the bycatch reduction research to be implemented in the region.

Recommendations

443. SC7 recommended:

- a) avoiding any mortality of whale sharks and cetaceans by fishing activities;
- b) the development of best practice guidelines for the release of encircled whale sharks without injury while considering the safety of the crew;
- c) the development of best practice guidelines for the release of encircled cetaceans without injury while considering the safety of the crew; and
- d) that the guidelines mentioned in b and c above be developed by an electronic discussion group led by the convenor of the Ecosystem and Bycatch theme. The results from this group should be forwarded from SC to TCC7 for further consideration by WCPFC8.

b. FAD bycatch mitigation

444. K. Schaefer (IATTC) presented an overview of the 2011 ISSF/IATTC EPO purse-seine research cruise to investigate potential solutions for reducing fishing mortality on undesirable sizes of bigeye and yellowfin tunas and sharks, when associated with drifting FADs (SC7-EB-WP-13). The presentation documented the results of a 73-day research cruise undertaken, during the period 11 May–23 July 2011 to the equatorial eastern EPO aboard the Ecuadorian-flagged purse-seine vessel *Yolanda L.*, under a charter agreement between the vessel owner and ISSF, and in collaboration with IATTC.

445. There were five specific research activities on which the scientific committee of the ISSF bycatch programme agreed to fit within the objectives of the overall project, and should be undertaken during this first cruise to the eastern EPO.

446. The first objective was to test different designs of FADs that do not entangle turtles or sharks, including the potential for using biodegradable materials.

447. The second objective was to evaluate the accuracy of catch predictions by the fishing captain from the tuna aggregations associated with FADs, and the potential improvements in those estimates through the use of additional complimentary equipment and methods.

448. The third objective was to determine whether there were spatial and/or temporal differences in the behavior of skipjack, bigeye and yellowfin tunas within aggregations associated with FADs, in order to reveal potential opportunities for avoiding the capture of undesirable sizes of bigeye and yellowfin tunas, and other non-target species, while maximizing the capture of skipjack tuna.

449. The fourth objective was to investigate the behavior of tunas and sharks captured within a purse-seine net to determine if species-specific aggregations occur, and the spatial and temporal characteristics of such aggregations, if they exist.

450. The fifth objective was to determine the at-vessel mortality, post-release survival, and the physiological, biochemical, and molecular responses of sharks incidentally captured by purse-seine vessels.

Discussion

451. The Chair noted that the SC had an opportunity to provide input into future experiments conducted within the ISSF purse-seine bycatch mitigation study because it will be conducted in the WCPO.

452. A CCM asked what depth the remotely operated underwater vehicle (ROV) could be deployed. It was noted that the maximum dive depth of the ROV was 200 m, but that it had only been deployed to a maximum depth of around 80 m with tuna schools in the EPO. It was also noted that below 50 m it was too dark to work effectively and that the sound of the ROV dispersed the tuna. Drop cameras may, therefore, be more effective in the future.

453. A CCM noted that the focus of purse-seine, FAD bycatch mitigation was the reduction of the catch of juvenile bigeye, and that work relating to limiting the depths of nets in the Philippines has shown some positive results.

454. A CCM noted the important collaboration with industry in conducting the project but noted that the cost of chartering vessels was beyond the ability of some CCMs to undertake. It was also noted that ISSF intends to charter vessels within the region when similar studies are undertaken in the WCPO.

455. A CCM asked whether there was any information in relation to shark and turtle mortality due to entanglement in regular FADs, and the duration that regular FADs could expect to last as compared with “eco-FADs”. The likelihood of FAD loss was considered to be low given the regular “exchange” of FADs among fishers, so it is not realistic to believe that many FADs are lost and pose a risk of “ghost” fishing. It was also noted that very low numbers of turtle entanglements have been recorded by IATTC observers where FADs are lifted as a normal part of purse-seine operations and the aprons checked by observers.

456. FFA members noted the importance of food security to Pacific Island states and territories, especially the volume of discards of food fish by tuna fisheries and the volumes of important non-tuna species taken by tuna fisheries. These concerns were captured in the recommendation below.

Recommendations

457. SC7 noted the importance of food security issues and that these should be considered in the strategic research plan of the SC. It was suggested that the starting points be:

- a) a preliminary assessment of the volumes of food fish discarded in regional tuna fisheries, especially in tropical fisheries near developing states (conducted by an agency such as SPC); and
- b) a proposal for the WCPFC to look further at the impact of tuna fishing on key food stocks, noting that Resolution 2005-03 identified mahi mahi, rainbow runner and wahoo as important for sustainable livelihoods.

a. Kobe III Bycatch Working Group Report

458. S. Nicol presented SC7-EB-WP-14, which reports on the first meeting of the Kobe joint technical working group on bycatch, and provides a provisional summary of progress on implementing the Kobe II recommendations for review intersessionally by the SC. The presentation outlined the 12-month work plan for the technical working group. Activities include:

- a) harmonizing data collection, which will specify the minimum data standards and data fields that should be collected across all RFMOs with a view to allowing interoperability;
- b) developing harmonized identification guides and release protocols for seabirds, sharks, sea turtles and marine mammals;
- c) identifying and recommending research priorities for collaborative work on bycatch by RFMOs;
- d) progressing the WCPFC bycatch mitigation information system database website to encompass needs of all RFMOs; and
- e) RFMOs collaborating on ERAs for sharks.

459. The future of the working group will be determined by RFMOs after completion of this work plan.

Discussion

460. A CCM expressed concern with regard to the fact that there was no limit on the number of participants in the working group. However, the working group was unlikely to become unwieldy because the specific interests of members will be focussed over a range of issues. It is, therefore, intended to maintain open participation in the working group to all members and to review its progress in 12 months' time.

461. A CCM reiterated the importance of the inclusion of food security-related issues into the Ecosystem and Bycatch Management Working Group

d. Summary of SC7-EB-WP-12 (“Review of the Chinese scientific observer programme in the Pacific Ocean in 2010”)

462. D. Xiaojie (China) presented a review of the Chinese scientific observer programme in the Pacific Ocean during 2010. During 2010, observers were trained and dispatched to four Chinese longline vessels operating on the high seas of the central and eastern Pacific Ocean.

- a) Trip 1 covered the time period 26 August–19 December 2010, in the areas of 10°21' N to 9°46' S, and 178°58'E to ~152°15'W.
- b) Trip 2 covered the time period 25 September–17 January 2011, in the areas of 3°46'S to ~9°26'S, and 149°52'W to ~154°19'W.

- c) Trip 3 covered the time period 2 October 2010–13 January 2011, in the areas of 6°00'N to ~10°49'S, and 169°05'W to ~146°50'W.
- d) Trip 4 covered the time period 13 October 2010–19 February 2011, in the areas of 4°38'N to ~14°45'S, and 178°01'E to ~130°07'W.

463. Observers collected all of the catch data by longline fishing gear. Observers also measured bycatch information, including discards.

Discussion

464. The initiative of China in placing observers onboard vessels was commended by SC7, particularly given the large size of the Chinese longline fleet.

465. A CCM asked whether photographs had been taken to assist in species identification because the figures presented in relation to the catch of some sharks — for example oceanic white-tip sharks — appear to be higher than expected. Another CCM concurred with this observation because the high incidence of oceanic whitetip sharks appeared to be atypical for longline vessels operating the gear configuration of the vessels being observed (using line shooters and deep sets). Misidentification of these sharks seemed possible. It was noted that photos were not being taken but that observers were trained for one week, which included species identification prior to undertaking trips, and were given SPC identification manuals.

466. A CCM noted that only 80% of the catch was recorded and asked whether line retrievals were observed for their entire duration or only partially. China advised that observers overall worked for about 80% or more of the time taken for line retrievals due to their long duration.

467. A CCM asked whether there were plans to increase the level of observer coverage on Chinese longline vessels. China advised that observers had been deployed only on large freezer vessels undertaking lengthy trips from bases on the mainland, and were not onboard smaller ice boats operating offshore. There was an intent to deploy observers on small offshore vessels in the future, and in 2011 the number of observers was increased in order to meet the minimum WCPFC observer requirements. China advised that it will conduct observer programmes according to WCPFC requirements.

468. A CCM sought information on the level of mortality of captured turtles. China advised that the best practice protocols and hook removal equipment developed in the USA are provided to captains and crew. Observers record the condition and fate of turtles, including the hook location, and observations are made for each animal (including carapace size). Use is made of the SPC training material for recording this information.

469. Given the endangered status of leatherback turtles, interest was expressed in the high number of leatherback turtle bycatch relative to other species recorded by Chinese observers. Two CCMs noted that the incidence of leatherback turtle catch rates seemed higher than expected, particularly given the gear configuration used by the vessels. This appeared to be an atypical high incidence in the areas where the vessels were operating but the possibility of leatherback migration routes was discussed. A CCM further suggested that observers collect data on the hook number on which the turtles are caught and the condition of the turtles on capture and release. Moreover, it was noted that turtle interactions were also an opportunity to tag turtles.

470. A CCM asked whether line shooters were used on the vessels during the observed trip. It was noted that this was the case.

AGENDA ITEM 6 – DATA AND STATISTICS THEME

471. P. Maru (Cook Islands) convened the Data and Statistics theme. S. Sauni and D. Tagami were selected as rapporteurs for Agenda Items 6.1.a; S. Bishop and J. Amoe were selected as rapporteurs for Agenda Items 6.1.b and 6.1.c; and S. Hoyle and I. Unterweger were selected as rapporteurs for Agenda Items 6.2–6.4.

6.1 Data gaps

a. Data gaps of the Commission

472. P. Williams (SPC-OFP) presented SC7-ST-WP-01 (“Scientific data available to the Western and Central Pacific Fisheries Commission”).

473. This paper reports on the major developments over the past year with regard to filling gaps in the provision of scientific data to the Commission.

474. All CCMs with fleets active in the WCPFC Convention Area have now provided 2010 annual catch estimates, with the exception of the Vietnamese purse-seine and gillnet fisheries. For the first time, several CCMs provided estimates for key shark species (in accordance with the change in requirements to include key shark species catches). In general, the timeliness of the provision of aggregate catch and effort data continues to improve with nearly all CCMs providing data by the deadline of 30 April 2011. The quality of aggregate data provided has also improved with a reduction in the number of notes assigned to aggregate data in recent years. Some CCMs provided aggregate shark species catch data (e.g. Japan for 1994–2009; Chinese Taipei 2007–2010) for the first time. The key gaps in aggregate catch and effort data include:

- incomplete spatial coverage in the Chinese longline aggregate data (see SC7-ST-IP-03);
- missing shark species data for most CCMs;
- missing aggregate catch and effort data from the Philippines, Indonesia and Vietnam; and
- lack of tuna catch in Spanish longline aggregate data.

475. With respect to operational catch and effort data, all Pacific Island CCMs have now provided authorization to SPC to release their historical operational data to the WCPFC; the USA and EU-Spain have indicated that operational data for their longline fleets will be released for submission to the WCPFC in the near future.

476. With respect to Regional Observer Programme (ROP) data, the following were significant developments in the past year:

- All Pacific Island CCMs have now provided authorization for SPC to release their ROP data to WCPFC.
- Authorization for ROP data from the two subregional observer programmes (US Multilateral Treaty and FSM Arrangement) to be provided to WCPFC has been granted.
- WCPFC and SPC-OFP received the following provisions of observer data in recent months:
 - ROP trip data for a Chinese Taipei longline vessel fishing in 2009/2010;
 - ROP trip data for US longline vessel fishing in 2010;
 - observer data to SPC-OFP for 30+ trips conducted on Philippine purse-seine vessels operating in Philippine waters (non-ROP trips) in 2010;
 - observer data to SPC-OFP for six trips conducted on Vietnamese longline vessels operating in Vietnamese waters (non-ROP trips);
 - WCPFC observer data provisions.

477. However, there is now a significant backlog in ROP data provision and processing, mainly due to overwhelming stress on the resources of national and regional observer programmes, and the requirements for 100% coverage of the purse-seine fishery. Improving the provision of scanned data from national programmes to SPC-OFP remains a significant challenge.

478. WPEA OFM, which provides support to the Philippines, Indonesia and Vietnam with respect to establishing tuna fishery data collection and management systems, is now into the second of a three-year term. Over the past year, the main developments have been:

- more comprehensive port sampling, cannery and logsheet data from the Philippines;
- logsheet, port sampling and observer data provisions from Vietnam (for the first time); and
- logsheet and port sampling provisions from Indonesia (for the first time in more than a decade).

479. However, there remains significant work to improve the coverage and quality of logsheet, port sampling and observer data, and the reliability of annual catch estimates for certain gear types. For Indonesia, the main data gap is the exclusion of catches from archipelagic waters in its annual catch estimates. For the Philippines, the main data gap is the reliability of historical estimates for its small-scale artisanal hook-and-line fisheries (70,000 mt/year), and for Vietnam, the main data gap is the complete lack of historical annual catch estimates.

480. In regards to the attribution of catch under chartering arrangements, the Solomon Islands notified the WCPFC Secretariat this year that a number of foreign-flagged vessels licensed to fish in Solomon Islands' waters should be considered as chartered to the Solomon Islands. The flag states of these vessels were subsequently contacted and, in at least one case, there appears to be double-counting of catches of these chartered vessels in annual catch estimates and aggregate catch and effort data, which needs to be resolved.

Discussion

481. CCMs noted the importance of accurate and detailed fishery information, including operational level catch and effort data, for more reliable stock assessments. Most CCMs highlighted issues in support of this, including advice from external reviewers of the yellowfin assessment stressing that real progress will be achieved through more data and knowledge, rather than more modelling; and the valuable contribution that operational data made to several assessments this year.

482. CCMs welcomed the progress on data gaps reported in SC7-ST-WP-01, especially with respect to improvements in data from Indonesia, the Philippines and Vietnam, and progress in the provision of operational data from some CCMs. Data on vessel numbers required to be submitted with aggregate catch and effort data to enable WCPFC to produce and release public domain data in accordance with the three-vessel rule was provided by one CCM but have yet to be provided by four other CCMs.

483. SC7 underscored the importance of the timely submission of data and the utility of historical data, particularly with respect to the history of a fishery, to improve stock assessments. SC7 recommended that SC7-ST-WP-01 be forwarded to TCC7 for their consideration. Some CCMs noted the importance of this decision so that the Compliance with Conservation and Management Measures Working Group can consider it as a priority input to the development of the Compliance Monitoring Scheme.

484. SC7 noted that while most CCMs provided data by 30 April 2011, there were cases where data were incomplete. One CCM explained that while the timeliness of their data submission has improved, the deadline of data submission (30 April) is too early to complete compilation for the longline fishery.

The SPC Secretariat advised that the resubmission of more complete data at a later date (e.g. July) may be too late for the assessments but are still used in analytical work leading up to SC meetings and, therefore, resubmissions of more complete data are encouraged. SC7 also noted that historical data are important and that CCMs should be encouraged to generate historical data that are earlier than what was previously submitted to WCPFC.

485. SC7 noted that a bigeye tuna catch of 4,133 mt taken by Chinese longline vessels in 2009 in Kiribati waters was not reported in the catch for China or Kiribati. A question was raised as to the impact on the overall assessment this year and whether these data would be resubmitted. SC7 recognized the importance of these missing data in projection work that will be carried out after SC7 to better guide management advice. SC7 further noted that this issue should be resolved as soon as possible.

486. SC7 noted that Kiribati has bilateral access arrangements in place that include data provision requirements. The meeting was also advised that China would only make a decision as to whether this catch should be attributed to China through the TCC process. It was also noted that some Chinese longline vessels have moved into the WCPFC Convention Area from the Indian Ocean.

487. SPC-OFP explained that the impact of potential under-reporting of bigeye tuna in 2009 and 2010 would result in more optimistic projections and management advice that would not be an accurate reflection of the actual status.

488. Some CCMs reminded SC7 of a WCPFC7 decision requiring CCMs that are not able to provide scientific data to provide a draft plan to TCC of how impairments to the provision of data will be dealt with. Some CCMs encouraged those CCMs that have yet to notify the Commission of their intent to provide operational catch and effort data to give priority to issues associated with the provision of operational data in the plans they provide to the TCC along with issues associated with reporting the vessel number data required to apply the three-vessel rule for data release.

489. SC7 noted reporting on valuable information on scientific data gaps. Some CCMs offered the following suggestions that could add value to the report:

- a) The Report should make it clear that the Scientific Data Rules covered by the report are a binding obligation of Commission Members as this has not always been clearly understood in the past.
- b) The Scientific Data Rules require that aggregated catch and effort data shall be provided in areas of national jurisdiction and high seas. The data gaps report does not seem to cover this requirement.
- c) The report provides information on coverage of this requirement in order to provide more reliable information for scientific analyses of issues such as the projected impact of management options.
- d) Amend the Scientific Data Rules to provide information in the way the aggregated fisheries data are produced.
- e) Note that the recent Kobe III meeting recommended that tuna RFMOs establish a common format for reporting on data gaps, and the WCPFC Secretariat is encouraged to cooperate with other secretariats in this direction, while ensuring that the data gaps report continues to serve the scientific data needs of WCPFC.

490. The WCPFC Secretariat reminded SC7 that WCPFC7 adopted the Kobe II recommendation on the immediate action to prohibit tuna vessels transferring between RFMO areas. This action would provide useful background information to tuna vessels that move from the Indian Ocean to the Pacific Ocean.

491. Some CCMs noted that the problems with longline bigeye catch data, which are indicated in the data gaps report and information paper (SC7-ST-IP-03), indicate very serious failings with the monitoring of the current system of flag-based bigeye catch limits. This is a serious problem for SC because stock projections show that it is clearly more difficult to assess the impact of current measures when the SC is not able to get an accurate estimate of the level of longline bigeye catches.

492. SC7 was asked to consider adopting a better process for submitting data earlier than the 30 April deadline to allow more time for conducting assessments.

Recommendations

493. SC7 recommended that SC7-ST-WP-01 be forwarded to the TCC, so that the Compliance with Conservation and Management Measures Working Group can consider it as a priority input to the development of the Compliance Monitoring Scheme.

494. SC7 recommended that CCMs consider the implications of adding text in “Scientific data to be provided to the Commission” Section 5 (the provision of aggregated size data) to be consistent with the requirement to provide information on statistical methods used to produce other types of fishery data (i.e. Section 1 – Annual catch estimates, and Section 4 – Aggregated catch and effort data). CCMs are requested to report their progress on this issue to SC8. The recommended text to be added in Section 5 is:

“The statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data.”

495. SC7 recommended that CCMs consider the implications of adding text in “Scientific data to be provided to the Commission” to ensure that scientists are provided with information on changes in the way fishing takes place; information that is not captured in the available data. CCMs are requested to report their progress on this issue to SC8. The recommended text to be added to Sections 3, 4 and 5 in this document is:

“Information on operational changes in the fishery that are not an attribute in the data provided are to be listed and reported with the data provision.”

496. SC7 noted delays in the provision of complete data sets by the 30 April deadline in accordance with WCPFC data rules, “Scientific data to be provided to the Commission”. CCMs are encouraged to develop better processes to provide data to WCPFC earlier than the 30 April deadline, to allow for earlier development of stock assessments and sufficient time for CCMs to consider them in advance of SC meetings.

497. SC7 noted the importance of historical data to reduce uncertainties in the scientific work of the Commission, and recommended that CCMs consider ways to improve the submission of historical data, and its use for scientific purposes.

498. SC7 encouraged the WCPFC Secretariat to cooperate with other tuna RFMOs to establish a common format for reporting on data gaps, as recommended at the Kobe III meeting.

499. SC7 noted the catch attribution issues relating to Chinese longline catches in Kiribati waters and the under-reported catches stemming from 2009 and 2010 by these Chinese vessels licensed to fish in

Kiribati. SC7 encouraged China to resubmit its data for 2009 and 2010. SC7 noted that Kiribati has not been provided with complete records for these data, by China, but would submit it to the Commission if it was provided to Kiribati. China claims to have met all of its data reporting obligations according to the agreement between Kiribati and China. Noting the influence of the unclaimed bigeye catches (approximately 4,000 mt in 2009) on the bigeye assessment and projection outcomes for WCPFC8, SC7 forwarded this to the TCC for its consideration. SC7 further noted that any projections produced would be more accurate with these data included.

500. SC7 noted the increase of Chinese vessels in the WCPFC Convention Area from waters beyond the WCPO. SC7 further noted that Kobe II recommendations state that tuna fishing vessels should not be transferred between different RFMO areas, unless in accordance with the rules of that RFMO.

b. Species composition of purse-seine catches

Summary of SC7-ST-WP-03 (“Report on Project 60: Collection and evaluation of purse-seine species composition data”)

501. T. Lawson (SPC-OFP) presented SC7-ST-WP-03. A summary of the paper is provided below.

502. A consultancy agreement between WCPFC and SPC for a project on the collection and evaluation of purse-seine species composition data was first established in April 2009. The project continued into April 2010 and April 2011. From August 2010 until March 2011, observers were contracted to do paired grab and spill sampling during six trips on purse-seine vessels from Chinese Taipei, Korea and the USA. However, one trip was unsuccessful because the grab sampler disembarked prior to fishing, and four were unsuccessful because a) the crew would not allow the spill sampler to follow the correct sampling protocol, and b) the spill sampler did not effectively communicate with the crew. This situation will improve with the recent recruitment by SPC-OFP of a Data Collection Officer for a two-year period with funding from New Zealand. The Data Collection Officer’s initial role will be to undertake spill sampling during paired sampling trips, following which he or she will be responsible for organizing paired sampling trips, and the briefing and debriefing of the spill samplers. Paired sampling onboard a Japanese purse-seine vessel was under discussion when the tsunami hit Japan in March 2011; following the disaster, these trips were postponed.

Discussion

503. SC7 acknowledged the work completed to date on Project 60, and general support was expressed for the continuation of the work with inclusion of further data to correct for possible biases.

504. Inclusion of purse-seine species catch composition information was identified as important data for inclusion in stock assessments of all tropical species. Because the current stock assessment used the spill sample-corrected data, there was concern regarding the uncertainty of the estimate of selectivity bias for larger fish and the implications of this bias on the current stock assessment. Because work to date has come primarily from trips with small fish on anchored FADs, it was agreed that further work needs to collect data from un-associated schools to allow sampling of larger fish that will provide better estimates.

505. Some Members noted with disappointment the lack of effectiveness of project activities, and supported the proposals for SC to recommend the no-cost extension for the project to January 2012 and to review the financial status of Project 60 at SC8.

506. To improve the availability and use of purse-seine composition data, SC7 suggested the scope of work for Project 60 be amended to include the provision of a plan for improvement of the availability and use of purse-seine catch composition. This plan should form the basis of the recommended review of the project to be conducted at SC8. Some Members preferred that this plan be made available for consideration at WCPFC8.

507. Japan offered to support future comparison of species composition through paired sampling of catch through grab and spill sampling on Japanese vessels with port sampling of landing categories. The three regions where these comparisons are possible are Japan, American Samoa (Pago Pago) and Solomon Islands (Noro). The project is looking to put new data collection officers in Noro to do these comparisons.

508. SC7 noted that SPC receives ISSF cannery data on a quarterly basis, and recommended better understanding on species sorting for possible use in data analysis. It was reported that SPC continues to receive ISSF data and it is appreciated because there has been limited use of it in the past. One of the issues is when there are categories of small fish (i.e. whether there is species sorting and catches by species in the smallest category of fish in some cannery data that are received). Data from new ISSF participating companies were received last year.

Recommendations

509. SC7 noted the importance of this work and so recommended a no-cost extension of Project 60 through 2012. The SC will review the financial status of the project at SC8.

510. SC7 requested that the scope of work for Project 60 be amended to include the provision of a plan for improving the availability and use of purse-seine catch composition data, applying the results from the project. This plan should form the basis for the recommended review of the future of the project to be conducted at SC8. This plan should be available for consideration by the Commission at WCPFC8.

Summary of SC7-ST-WP-02 (“Misreporting of purse-seine catches of skipjack and yellowfin”)

511. J. Hampton presented SC7-ST-WP-02. A summary of the paper is provided below.

512. This paper compares logsheet-declared estimates of species composition, in particular the percentage of skipjack in purse-seine sets (%SKJ), with independent estimates provided by observers. The main findings are:

- a) The %SKJ in observed associated sets is substantially higher on logsheets compared with estimates derived from the visual estimates of purse-seine catch by species by observers.
- b) The %SKJ in observed unassociated sets is also over-reported on logsheets in comparison with observers' estimates, but the difference is not as great as for associated sets.
- c) For many fleets, the frequency of associated sets declared on logsheets as containing 90–100% skipjack appears to be unrealistically high (~63% of sets as declared on logsheets, compared with ~23% of sets as recorded by observers).
- d) The visual estimates of species composition provided by observers are reasonably consistent with their sampling data.
- e) These results support the current methodology of estimating the three-species (skipjack, yellowfin, bigeye) species composition of purse-seine catches using observer sampling data (corrected for grab sampling selectivity bias), as compared with the previous method of using sampling data to disaggregate only yellowfin and bigeye tunas.

513. The apparent consistency between observers' visual and sample-based estimates of species composition is encouraging and may allow greater use of visual estimates to be made in routine fishery monitoring.

Discussion

514. CCMs acknowledged the work completed on the misreporting of purse-seine catches on logsheets and the importance of this work in relation to stock assessments.

515. With respect to the accuracy of observer visual sampling: although species composition will not be 100% accurate there is a large amount of data aggregated over a long time period, and this gives a significant difference in terms of the trends it is showing. Members noted the encouraging conclusion that observer visual and sample-based estimates of skipjack proportions were generally consistent, and recommended further work on using observers' visual estimates of purse-seine species composition in routine fishery monitoring.

516. It was asked if there were any reasons to explain the observed discrepancy of percentage skipjack reported being larger for associated sets than for unassociated sets. Although no definitive answer could be provided, one possible explanation could be that associated sets are primarily smaller fish, and there may be no price differential between species at this size. If no price differential exists then there may be less impetus to report. This issue could be addressed through education with skippers.

517. A suggestion was put forward to use information on species composition from canneries as a comparison. Although this has been considered, a problem with this approach is that possibly the same sort of mixing is occurring in cannery statistics and, thus, these data are not likely to be definitive. Individual records are frequently only partial catches from individual vessels because vessel catches may get split up and go to different canneries, making it increasingly difficult to compare logsheet data with cannery records.

518. With respect to misreporting, several Members requested that SC7-ST-WP-02 be referred to TCC, noting the importance of accurate purse-seine catch composition data for scientific purposes, and requesting that TCC recommend actions to end the misreporting.

519. The convenor noted additional information papers relevant to this agenda item, including SC7-ST-IP-02, SC7-ST-IP-07 and SC7-ST-IP-09.

Recommendations

520. SC7 noted inconsistencies among fleets in the reporting of skipjack and yellowfin+bigeye on purse-seine logsheets, and considering the importance of accurate purse-seine catch composition data for scientific purposes, recommended that SC7-ST-WP-02 be referred to TCC.

c. Data issues with ISC

521. WCPFC's Science Manager, S. Soh, provided a brief report on the progress of reconciling inventories of data holdings of WCPFC and ISC.

522. A WCPFC data holdings inventory was sent to ISC on 4 July 2010. ISC produced a document (SC7-ST-IP-10, "Data holding status of ISC and WCPFC"), noting that data holdings for category 1 (annual catch), 2 (aggregated catch and effort) and 3 (size-frequency) data.

523. SC7 was advised to refer to document SC7-ST-IP-10 for details, and any questions on this matter should be referred to P. Williams (SPC-OFP) or Ren-Fen Wu (ISC).

Discussion

524. There was no discussion under this agenda item.

Recommendations

525. SC7 noted the progress made in reconciling data holdings between ISC and WCPFC, as reported in SC7-ST-IP-10.

6.2 Regional Observer Programme

526. The ROP Manager, K. Staisch, made a brief summary of SC7-ST-IP-08, “Summary of Regional Observer audits”.

527. The ROP Secretariat commenced audits of ROP interim authorized observer programmes in late 2010, and to date, has completed audits on 14 of the 23 countries or organizations that are part of ROP. The remaining audits will be completed late in 2011 and in early 2012. (Refer to Table 1 and 2 of the paper.)

528. The purpose of the audits is to ensure that Commission standards are being applied and/or are being developed and maintained by programmes that wish to gain ROP full authorization before the due date of June 2012.

529. In most cases the programmes audited were well developed and were following the agreed on Commission standards to the best of their ability. However, some areas needed improvement.

530. Since the introduction of the 100% observer coverage for purse-seine vessels, most observer programmes have coped well in supplying observer numbers, but all programmes have said that they require continual training to upgrade observers, and to ensure they have enough for all the demands placed on them by WCPFC’s different gear type coverage requirements.

531. Many debriefing programmes require extra debriefers, and addressing this should be a priority. A lack of funding and recognition of this important aspect of observing has resulted in national programmes having fewer debriefers than they require. Many of the programmes’ trainers have concentrated on ensuring they have enough observers to attain 100% observer coverage. Pacific Island countries have done well in training about 630 observers, thereby ensuring that 100% coverage will be maintained on purse-seine and other gear type vessels. Debriefing programmes cannot be developed overnight, and national programmes are working to increase their debriefing numbers.

532. There is still a need to increase the number of available observers for most programmes, as this will allow for some attrition of observers, as well as being able to cover the expected increased need for observers to satisfy longline and carrier observer coverage requirements.

533. The quality of observers needs to be monitored carefully, as it has been reported that data collections held by SPC indicate that a small percentage of observer data are not useable, because they are collected incorrectly, or not collected at all. This is clearly a waste of valuable resources, and shows the need to ensure that observers trained before the recent introduction of the Pacific Islands Regional Fisheries Observers standards may need to be re-assessed against these standards.

534. Entrance criteria for training needs to be rigidly applied during the initial selection process to ensure that only the best applicants are given positions are trained as ROP observers.

535. Sending data to SPC or WCPFC after each observer trip is extremely important and unfortunately some programmes are having (mainly technical) problems in sending copies of data in a timely manner. SPC and WCPFC ROP have been working hard to rectify this problem by supplying equipment, personnel and other resources to transfer data in a quick and timely manner.

536. There is a need to ensure that observers are covered by insurance when travelling, onboard vessels, and when working as an observer on shore. Many programmes had some insurance for observers, but not all observers were covered for all periods that they worked as observers. This was being looked at and rectified by most programmes where it was found to be a problem.

537. Health exams (i.e. medicals) on observers varied by programme from being comprehensive to non-existent. The Commission does not have a standard for health checks, although it is recommended given the issues that some programmes have had with observers being unfit to carry out trips on vessels because of health constraints. All programmes should adopt a standard that requires observers to have a full health exam (medical) when first trained, and then a regular exam should occur after this. It has been suggested that this should take place every 18 months to 2 years.

538. Even though some programmes may still be deficient in areas of debriefing by the deadline in June 2012 (noting that an estimated 90 debriefers still need to be trained across all programmes), it is the intention to authorize these programmes as standards like this do require time to develop properly, in doing so the Commission ROP will continually check to ensure this area is being developed and is satisfied. It is expected that all debriefing requirements with the help of FFA, SPC, WCPFC and NMFS should be in place within two years.

Discussion

539. SC7 discussed the critical importance of observer debriefing for an effective observer programme, and sought clarification on the progress on the debriefing component of the ROP. The FFA and SPC debriefing format is used for debriefing of all Pacific Island countries; other countries have their own format. Unfortunately, for all Pacific Island countries, with the exception of two programmes, there are only a very small number of debriefers trained and qualified. The process of training debriefers is in place and is ongoing for Pacific Island member country observer programmes. There is a need for a number of dedicated certified debriefers, along with proper facilities, in most Pacific Island countries. It was noted, that the number of debriefers available in most Pacific Island countries is inadequate, and it will take time and money to get these programmes up to a respectable level of debriefing. Most countries are aware of the need to have more debriefers, but in most cases there is no space or funds to allow debriefers to operate. There is ongoing training of debriefers to build up capacity and quality in Pacific Island countries, but it will take two to three years to get the required numbers for comprehensive and accurate debriefing of all observer trips. It was noted that the New Zealand Aid Programme has recently provided funding for an Observer Debriefing Training Officer for the Pacific Islands Regional Fisheries Observers. The position is based at SPC.

540. Some CCMs noted the progress that has been made and the challenges that still must be met. Implementation of the 100% purse-seine observer coverage has required a very substantial effort from FFA members involved and SPC-OFP. These efforts have been strongly supported by a range of donors, particularly New Zealand, which was thanked for its support. It was noted that a large volume of information, including scientific information, is now flowing from the 100% purse-seine coverage. There is a backlog that is being worked on, and there are a range of issues to be addressed (which is mainly the responsibility of the TCC) to ensure that ROP is fully effective. Some CCMs were pleased to read of the

new developments in electronic data capture and entry onboard, and observer information systems to make data more accessible. Overall, the establishment of the ROP and the implementation of 100% observer coverage has been a massive undertaking, but it is clearly a very important asset for improving the availability of scientific information. For this, SPC-OFP, WCPFC and national administrations involved deserve huge credit.

Recommendations

541. SC7 noted SC7-ST-IP-08 and the progress made in auditing the ROPs.

6.3 West Pacific East Asia Oceanic Fisheries Management Project

542. WCPFC's Assistant Science Manager, A. Beeching, provided a brief summary of the WPEA OFM Project.

543. A brief review of the Steering Committee Meeting for the WPEA OFM Project noted the presence of the UNDP Regional Technical Adviser, J. Padilla. Project finances were found to be in good order, and a very recent independent audit of the Commission, which included individual projects such as this one, was deemed to satisfy the needs of the main project funder (GEF). An application has been submitted for a further support from Korea. Individual country reports for Indonesia, the Philippines and Vietnam listed activities and associated costs to date, and briefed the Steering Committee on potential issues. The project's annual work plan and budget for 2012 will be completed by the end of 2011. Once a draft terminal evaluation report is submitted in mid-2012, it will be possible to submit a proposal for a second project, which funders indicate would be well received if it linked with other GEF-funded initiatives such as the FFA/SPC OFM project

Discussion

544. Some CCMs thanked GEF for providing funding for this important project and thanked UNDP for its oversight. CCMs also acknowledged, with appreciation, the work of SPC and WCPFC, and congratulated Indonesia, the Philippines and Vietnam for the progress to date.

Recommendations

545. SC7 noted the progress made through the WPEA OFM Project as outlined in SC7-ST-IP-12, and supported the continuation of this work.

6.4 Tagging initiatives

546. J. Hampton made a brief presentation on the activities of the PTTP Steering Committee during SC7. He noted that project activities, and past and future work plans were outlined in SC7-ST-IP-05.

547. It was noted that the report of the Fifth Steering Committee meeting for the PTTP has been posted for several days for consideration by meeting participants.

Discussion

548. There was no discussion on this agenda item.

Recommendations

549. SC7 adopted SC7-ST-WP-04, the Summary Report of the Fifth Steering Committee Meeting for the PTPP.

AGENDA ITEM 7 – COOPERATION WITH OTHER ORGANIZATIONS

10.1 The status of cooperation and relations

550. The WCPFC Secretariat detailed the organizations with which WCPFC has a formal relationship, and then updated SC7 on the status of cooperation and relations with other organizations since SC6. These included an MOU between WCPFC and the North Pacific Anadromous Fisheries Commission (NPAFC) signed in December 2010; a Memorandum of Cooperation on the Cross Endorsement of Regional Observers signed with IATTC in July 2011; and following KOBE III, WCPFC is participating in the regular posting of the Consolidated List of Authorized Fishing Vessels of all registered fishing vessels in tuna RFMOs. The Commission has directed the Secretariat to undertake a review of the MOU with ISC, which will be addressed at WCPFC 8.

Discussion

551. Some Members expressed that they place a high degree of importance on updating the MOU between WCPFC and ISC because the amendments that were prepared by the Secretariat and presented to WCPFC6 in Tahiti in 2009 were a good way of better defining the relationship between the two organizations, including the relationship between ISC and this committee. These countries expressed disappointment that there has been no progress on this issue, especially because it was recommended by the independent review of science, which was accepted by the Commission. They urged the Secretariat and ISC members to progress this issue before WCPFC 8.

552. A statement was communicated to SC7 from SEAFDEC, which reads:

“The Southeast Asian Fisheries Development Center or SEAFDEC is an inter-governmental organization established in 1967, with the aim to promote sustainable fisheries development in the Southeast Asian Region. Taking into account the importance of tuna fisheries in the Region that serve to increase the economic and livelihoods, SEAFDEC has developed several programs to support the 4 major tuna countries namely Indonesia, the Philippines, Thailand and Vietnam especially on improving the national tuna statistic as well as reduction of by-catch issues in longline fisheries since 2008. SEAFDEC will continue our collaborative works with members by strengthening the existing program including enhancing the capacity on observer program, species composition in tuna cannery etc. SEAFDEC also looks forward to cooperate with the WCPFC secretariat in near future to ensure our implementation will benefit not only to our member countries but also support the WCPFC requirement.”

AGENDA ITEM 8 – SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

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

553. FFA members, 15 of whom are small island developing states (SIDS), stated that many CCMs here will be aware that the inclusion of this item is required by the WCPFC Rules of Procedure: specifically, Rule 2.

554. FFA members noted for the Committee some of the benefits they have received as SIDS. The annual SPC stock assessment and data workshops have been greatly beneficial to them and they would like to see that their participation in such workshops is maintained.

555. The source of funding for FFA members' attendance to these workshops has been made possible through the JTF, which is administered by the WCPFC Secretariat. For their other special requirement needs, funding has been provided through the Special Requirement Fund established in pursuant to Regulation 7 of the WCPFC financial regulations.

556. One important emerging obligation that will also begin to put more responsibility on SIDS and Territories pertains to bycatch mitigation and implementation. FFA members would like to ask if this could also form part of the assistance usually provided annually to SIDS and territories. In order to avoid duplication, perhaps as a starting point, a list of existing capacity building programmes related to bycatch issues could be established and, where possible, the coordination of new capacity building programmes be facilitated through the Commission.

557. FFA also conveyed its appreciation to those CCMs that have contributed to the Special Requirement Fund, in particular the USA, Australia and Chinese Taipei for their individual contributions made during the 2010/2011 fiscal year.

558. FFA members expressed their appreciation for the financing of capacity building activities by JTF over the last couple of years. There were 10 projects supported by JTF in 2011 compared with 11 projects in 2010. They also noted that JTF has also provided a co-financing support to WPEA OFM in Indonesia, the Philippines and Vietnam.

559. Tonga, aware that phase 1 ends soon, wished to offer on behalf of CCMs, thanks to Dr Suzuki for administering the fund to date.

AGENDA ITEM 9 – FUTURE WORK PROGRAMME AND BUDGET

9.1 Strategic Research Plan of the Scientific Committee

560. SC7 formulated an informal small group (ISG) to develop a draft Strategic Research Plan for 2012–2016, facilitated by D. Kirby (Australia). SC7 reviewed the draft Strategic Research Plan provided by the ISG and adopted it (Attachment I).

9.2 Review of the Scientific Committee work programme

561. WCPFC's Science Manager presented a progress report on SC's 2010 work programme activities (other than science services from SPC-OFP).

- a) Project 14 — The progress the WPEA OFM Project was reviewed at the Third Project Steering Committee meeting. The continuation of the project was supported with allocated funds of USD 25,000 used in the co-financing of the project.
- b) Project 35 — SC7 reviewed SC7-SA-WP-01 ("Bigeye tuna age, growth and reproductive biology") as an output of this project, and supported continuation of biological sampling and analysis.

- c) Project 39 — SC7 reviewed SC7-SA-WP-05 as the output of this three-year project (“Regional study of the stock structure and life history characteristics of South Pacific albacore”). The final report will be submitted by the end of August 2011.
- d) Project 42 — Because of the importance of tag recovery, the 2011 Pacific-wide tagging project fund (USD 10,000) supported a locally based Tag Recovery Officer in Pohnpei, FSM.
- e) Project 57 — SC7 reviewed SC7-MI-WP-03 and SC7-MI-WP-04, which were funded from the 2010 budget. The 2011 budget (USD 20,000) has been secured for any further research on reference points requested by SC7 in 2011.
- f) Project 60 — SC7-ST-WP-03 was reviewed as the output of this project (“Collection and evaluation of purse-seine species composition data”). This project will continue but no funding support is required.
- g) Project 61 — As requested by the Commission (Para 101, WCPFC7 Summary Report), SPC-OFP participated in ISC’s data preparation workshop for the North Pacific striped marlin stock assessment in January and May 2011 funded from the 2010 budget.
- h) Project 64 — New Zealand provided a progress report on this project (“Collation of South Pacific striped marlin data and CPUE analysis”), and project outputs will be presented at SC8.
- i) Unobligated budget of USD 30,000 has been secured for any further research requested by SC7 in 2011.
- j) Research results on FAD bycatch mitigation funded by PNG (USD 25,000) will be provided at SC8 as part of ISSF’s Purse Seine Bycatch Mitigation Project and research cruises.

Discussion

562. SC7 agreed to refine the list of the SC work programme that was established at SC3 (Attachment O of the SC3 Summary Report) intersessionally and review it at SC8.

9.3 Development of 2012 work programme and budget, and projection of the 2013–2014 provisional work programme and indicative budget

563. The indicative science services provider budget for 2012 is USD 792,000.

564. Annex 1 of the 2012 MOU with the science services provider may contain additional activities, including:

- a) Indicator papers for bigeye, yellowfin or skipjack tunas for those years when a stock assessment is not conducted. Japan offered its support, and it was noted that it may be possible to consider western Pacific striped marlin CPUE standardization at the same time.
- b) Possible production of stock status indicators for South Pacific swordfish, noting that this may be confirmed at WCFPC8 when data available for this work may be better evaluated.

565. SC7 identified the following four assessments to be conducted by the science services provider and presented to SC8.

- a) A stock assessment for South Pacific albacore.
- b) A stock assessment for southwestern Pacific striped marlin, noting that the assessment would have a smaller scope than the recent bigeye assessment, with fewer runs.
- c) Stock assessments for oceanic whitetip and silky sharks.

566. SC7 recently completed stock assessments for the three tropical tuna species (bigeye, yellowfin and skipjack) and stock assessments of those species will not be conducted in 2012.

567. SC7 identified several high priority projects in 2012, including:

- a) The peer review of the bigeye tuna stock assessment. SC7 obligated USD 30,000 in the 2011 budget to conduct the peer review.
- b) Scientific support for the Management Objectives Workshop to identify and evaluate candidate LRPs (SPR and biomass). SC7 obligated USD 20,000 in the 2011 budget (scoping the use of reference points) for this project.
- c) Scientific support for the Management Objectives Workshop to identify and evaluate candidate target reference points, especially for skipjack. SC7 requested the Commission to carry over the USD 30,000 in the 2011 budget, and obligate USD 30,000 in the 2012 budget. (Technical support for the Management Objectives Workshop) for this project.
- d) The development of harvest control rules for the Management Objectives Workshop. SC7 proposed USD 30,000 in the 2012 budget for this project.
- e) Bigeye aging and maturity project.

568. The proposed ageing and maturity project would collect samples in 2012/2013 for subsequent analysis in 2014/2015, noting that the latter phase would be more costly than the earlier one. This project requires an allocation of USD 55,000 for 2012. Work on depletion-based reference points requires more detailed information on spawning biomass and that simultaneous gonad and otolith sampling of bigeye could be funded prior to the next bigeye stock assessment, perhaps prioritizing research in Region 4, where less information has been gathered to date.

569. SC7 recommended that Project 60 be granted a no-cost extension for 2012.

570. SC7 recommended that the SC work programme and budget for 2012 and indicative budget for 2013 and 2014, be as follows in Table 1.

Discussion

571. On behalf of PNA, FSM expressed its appreciation for the extension of the JTF.

Table 1. List of Scientific Committee work programme titles and budget for 2012, and indicative budget for 2013–2014, which require funding from the Commission’s core budget (in USD)

Research activity/Project with priority	2012	2013	2014
Project 14. WPEA OFM	25,000	25,000	25,000
Project 35. Refinement of bigeye parameters	55,000	70,000	75,000
Project 42. Pacific-wide tagging project	10,000	10,000	10,000
Technical support for Management Objectives Workshop (target reference points)	carried over (30,000)		
Harvest control rules	30,000	30,000	
SUBTOTAL	120,000	135,000	110,000
UNOBLIGATED BUDGET	76,000	83,000	91,000
SPC-OFP BUDGET	792,000	871,200	958,320
GRAND TOTAL	988,000	1,089,200	1,159,320

AGENDA ITEM 10 – ADMINISTRATIVE MATTERS

10.1 Rules of procedure

572. The Chair opened a discussion on proposals to alter the rules of procedure. None were proposed.

10.2 Peer review of stock assessments

573. SC7 formulated an ISG to develop the process for the peer review of the 2011 bigeye tuna stock assessment, facilitated by M. Miyake (Japan).

574. The ISG to review the organization and prepare TOR for the 2012 WCPFC peer review presented the results of its studies. SC7 agreed that the peer review of the 2011 bigeye tuna assessment should be conducted in a way that contributes to future bigeye assessments.

575. SC7 agreed that the peer review panel should be composed of three independent reviewers. This panel will be selected and contracted early enough so that 2011 assessment results (possibly including all of the input data, modeling software, output of basic runs as well as all the sensitivity runs), can be given to the panel for advanced reviewing.

576. SC7 agreed that in 2012, the panel will hold a workshop to review the 2011 assessment and provide advice for future assessment work. The workshop will spend approximately two days on peer review of the 2011 assessments, and a further three days on reviewing and advising on various aspects of subsequent assessments.

577. Regarding the participants in the workshop, SC7 decided to limit attendance to peer review panel members and scientists directly involved in the bigeye assessments.

578. The peer review panel should send the draft report of its results to SPC for review and response. Once it is finalized, the report and response from SPC should be submitted to the WCPFC Executive Director, in advance of SC8 where it will be considered.

Formation of the peer review panel

579. The peer review panel should be composed of three scientists that have significant expertise and experience on all aspects of stock assessments, preferably in relation to tuna stock assessments. The reviewers should not be directly involved with current WCPFC bigeye assessments. The peer review contract may be offered to individuals. The WCPFC Secretariat will approach IATTC to request the provision of a reviewer.

Selection procedure and timeframe

580. While keeping the selection procedures open, transparent and time-efficient, SC7 agreed that the procedures given below will be followed:

- a) Each CCM may recommend one candidate through their official WCPFC contacts by 15 October 2011.
- b) The Chair and Vice-Chair of the Commission, the SC Chair and the Executive Director will select five candidates for short listing, and circulate the shortlist with their curriculum vitae to all official WCPFC contacts by 1 November 2011.
- c) The official WCPFC contacts will rank the five candidates with scores 1 (most preferred) to 5 (less preferred), and submit these rankings to the WCPFC Science Manager by 20 November 2011.

581. The three candidates who receive the lowest scores will form the peer review panel, and will subsequently be contracted. If any of the three individuals are unable to undertake the review, the shortlisted candidate with the next lowest score will be invited to join the peer review panel. The peer review panel should be finalized by 15 January 2012.

Budget

582. The peer review panel will be composed of three reviewers in total and the total allocated budget is USD 30,000.

583. SC7 reviewed the draft peer review process and adopted it for the Commission's consideration and endorsement. The adopted TOR for the review are provided in Attachment J.

10.3 Future operation of the Scientific Committee

584. R. Campbell chaired this session, which was tasked with reviewing the performance of the new meeting structure adopted for SC7, and if required, recommending revisions to be applied to future SC meetings. He outlined a number of options for improving the performance of future SC meeting and following discussion of these options the following recommendations were adopted:

- a) Hold the Data and Statistics theme before the Stock Assessment theme.
- b) Add blocks of time to the indicative schedule where draft recommendations developed by the theme conveners are reviewed and adopted.
- c) A small group (led by the Management Issues theme convener) to review intersessionally the option of moving agenda items presently within the Stock Assessment theme on discussion and adoption of management advice and implications for each species to an agenda item within the Management Issues theme.

- d) SC8 to retain the process adopted for SC7 that important papers within the Biology, Methods, and Fishing Technology themes are to be presented either at the SPC Pre-Assessment Workshop or at the SC meeting within the most appropriate theme. SC8 is to decide on the future need of retaining the Biology, Methods, and Fishing Technology themes.
- e) A review of the time allocated to each theme to be undertaken when the indicate schedule for SC8 is prepared.
- f) A document on the “Guidelines for theme conveners and SC chairs” is to be drafted intersessionally. This task will be led by the SC Chair in consultation with the SC Vice-Chair and theme convenors.

10.4 Next meeting

585. SC8 is provisionally scheduled for 7–15 August 2012, with the venue to be determined intersessionally and agreed on at WCPFC8.

10.5 Selection of officers

586. P. Maru will end her first term as Vice-Chair of the SC in December 2011. SC7 deferred the selection of a new Vice-Chair to WCPFC8.

587. After serving for over 10 years, P. Dalzell has resigned as the convener of the Ecosystem and Bycatch theme. SC7 selected J. Amoe (Fiji) as a co-convener and the second co-convener will be determined intersessionally before SC8. SC7 appreciated P. Dalzell’s hard work and enormous contribution to the work of the Commission.

588. Noting the workload of the SC Chair (N. Miyabe), who currently also co-convenes the Stock Assessment theme, M. Ogura was selected to replace him as co-convener of the Stock Assessment theme. The USA will consider providing a co-convener for SC8.

AGENDA ITEM 11 – OTHER MATTERS

589. Three documents were selected for consideration by SC7, as requested by the Commission (Para 424 of the WCPFC7 Summary Report). Documents related to whale sharks (WCPFC-2010-DP-09) and cetaceans (WCPFC-2010-DP-17 [Rev 2]) were reviewed under the Ecosystem and Bycatch theme session, and document WCPFC-2010-30 was noted, but no comments were received.

AGENDA ITEM 12 – ADOPTION OF THE REPORT OF THE SEVENTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

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

590. SC7 adopted the Summary Report for SC7. The Secretariat was requested to prepare an Executive Summary to assist with presentation of this report to other subsidiary bodies and to the Commission.

AGENDA ITEM 13 – CLOSE OF THE MEETING

591. The SC Chair thanked all participants for their contributions to the meeting, and in particular noted the efforts of the theme conveners and ISG facilitators.

592. Ueta Fa'asili, the representative from Samoa, spoke on behalf of FFA member countries and thanked the FSM Government, the WCPFC Secretariat, the convenors and rapporteurs for their hospitality and hard work.

593. S. Retalmai, the representative from FSM, thanked the Secretariat and expressed appreciation to all staff and participants who contributed to meeting outcomes. He also expressed his appreciation to the SC Chair, SC Vice-Chair, and the WCPFC Executive Director.

594. The Executive Director, G. Hurry, thanked all participants for making the meeting a success, and thanked the FSM Government for its logistical support to the meeting. He also appreciated the efforts made by the Commission staff and all participants.

595. The meeting closed at 19:30 on Thursday, 17 August 2011.

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

**Scientific Committee
Seventh Regular Session**

**Pohnpei, Federated States of Micronesia
9–17 August 2011**

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

**Scientific Committee
Seventh Regular Session**

**Pohnpei, Federated States of Micronesia
9–17 August 2011**

KEYNOTE SPEECH – GOVERNOR OF POHNPEI

To the Chair of the Scientific Committee, Dr Naozumi Miyabe, The Manager of the SPC-Oceanic Fisheries Programme, Dr John Hampton, The Executive Director of WCPFC, Professor Glenn Hurry, and the representatives of Members, Cooperating Non-members and Participating Territories of the Commission, Observers, Ladies and Gentlemen.

Kaselehlie and welcome to Pohnpei. The Commission has been part of our lives here now since 2004 and it's my pleasure to welcome you to our islands. For many of you who have been here before, I welcome you back. This year I understand we have two of the Commission's meetings here in Pohnpei, and this is indeed an honor as it brings considerable benefits to a range of businesses in our community.

Pohnpei is the largest of the four states of the Federated States of Micronesia and it includes the national capital and national government offices, as well as the largest and most active business community in Micronesia. We are proud to host what we anticipate will be a very successful meeting in support of the management of tuna and tuna-like species in the western and central Pacific Ocean. The importance of these marine resources to all small island states, including the FSM, cannot be overstated.

I understand that our tuna fisheries in the western and central Pacific Ocean harvest around 60% of the world's tuna. Total tuna catch has been increasing and a provisional total tuna catch in the Convention Area was estimated at 2.4 million mt in 2010, the second highest annual catch on record.

I am a fisherman myself and those sorts of figures in terms of the numbers of individual fish that are caught worry me. You may not know but here in Pohnpei people catch and use a lot of skipjack and yellowfin tuna as part of their normal diet. These fish are really important to us and I encourage you to visit the local markets while you're here to see for yourself. Without access to these local fish, a lot of our people, not just in Pohnpei but across the Pacific, are going to go hungry. So what I want from the scientists gathered here today is a promise that when you decide how much of our tuna people can catch commercially in the future that you make sure there is enough left for us in Pohnpei to eat.

I am somewhat reassured to know that the well regarded Secretariat of the Pacific Community (SPC) scientists are monitoring the health of these tuna fish stocks. I know that the SPC provides scientific advice on these stocks to the Commission and to the Forum Fisheries Agency and to the PNA or Parties to the Nauru Agreement in Majuro, and this is good because it means you all get a consistent message on the health of our fish.

This year, the SPC will be presenting stock assessments for all four of the main tuna species targeted by industrial fisheries in our region's waters. That is, skipjack tuna, yellowfin tuna, bigeye tuna and albacore tuna. It is now the job of the Scientific Committee at this SC7 to agree to scientific advice in support of the sustainable management of these fisheries to provide food and income for the foreseeable future.

Thank you for this opportunity to provide these brief remarks. I wish you a positive, productive and constructive meeting and an enjoyable stay in beautiful Pohnpei.....and don't forget: you take good care of my fish!

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SC7 AGENDA

AGENDA ITEM 1 OPENING OF THE MEETING

- 1.1 Welcome address**
- 1.2 Meeting arrangements**
- 1.3 Issues arising from the Commission**
- 1.4 Adoption of agenda**
- 1.5 Reporting arrangements**
- 1.6 Intersessional activities of the Scientific Committee**

AGENDA ITEM 2 REVIEW OF FISHERIES

- 2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries***
- 2.2 Overview of Eastern Pacific Ocean (EPO) fisheries**
- 2.3 Annual Report (Part 1) from Members, Participating Territories and Cooperating Non-Members (CCMs)**
- 2.4 Reports from regional fisheries bodies and other organizations**

AGENDA ITEM 3 STOCK ASSESSMENT THEME

- 3.1 WCPO bigeye tuna**
 - 3.1.1 Review of research and information
 - a. Review of Project 35
 - b. Review of 2011 stock assessment
 - 3.1.2 Provision of scientific information
 - a. Status and trends*
 - b. Management advice and implications*
- 3.2 WCPO yellowfin tuna**
 - 3.2.1 Review of research and information
 - 3.2.2 Provision of scientific information
 - a. Status and trends*
 - b. Management advice and implications*

- 3.3 Requests from CMM 2008-01**
 - a. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries*
- 3.4 WCPO skipjack tuna**
 - 3.4.1 Review of research and information
 - 3.4.2 Provision of scientific information
 - a. Status and trends*
 - b. Management advice and implications*
- 3.5 South Pacific albacore**
 - 3.5.1 Review of research and information
 - a. Review of Project 39
 - b. Review of 2011 stock assessment
 - 3.5.2 Provision of scientific information
 - a. Status and trends*
 - b. Management advice and implications*
- 3.6 South Pacific swordfish**
 - 3.6.1 Review of research and information
 - 3.6.2 Provision of scientific information
 - a. Status and trends*
 - b. Management advice and implications*
- 3.7 Southwest Pacific striped marlin**
 - 3.7.1 Review of research and information
 - 3.7.2 Provision of scientific information
 - a. Status and trends*
 - b. Management advice and implications*
- 3.8 North Pacific striped marlin**
 - a. Status and trends*
 - b. Management advice and implications*
- 3.9 Northern stocks**
 - 3.9.1 North Pacific albacore (CMM 2005-03)
 - a. Status and trends*
 - b. Management advice and implications*
 - 3.9.2 Pacific bluefin tuna (CMM 2010-04)
 - a. Status and trends*
 - b. Management advice and implications*
 - 3.9.3 North Pacific swordfish
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 - b. Management advice and implications*

AGENDA ITEM 4 MANAGEMENT ISSUES THEME*

- 4.1 Terms of Reference**
- 4.2 Limit reference points for the WCPFC**
- 4.3 Review of CMM 2008-01**

4.4 Management Objectives Workshop

AGENDA ITEM 5 ECOSYSTEM AND BYCATCH MITIGATION THEME

- 5.1 Ecosystem effects of fishing**
- 5.2 Sharks***
- 5.3 Seabirds***
- 5.4 Sea turtles***
- 5.5 Other species and issues**
 - a. Guidelines for the release of encircled animals
 - b. FAD bycatch mitigation

AGENDA ITEM 6 DATA AND STATISTICS THEME

- 6.1 Data gaps**
 - a. Data gaps of the Commission
 - b. Species composition of purse-seine catches
 - c. Data issues with the ISC
- 6.2 Regional Observer Programme (ROP)**
- 6.3 West Pacific East Asia Oceanic Fisheries Management Project (WPEA)**
- 6.4 Tagging initiatives (PTTP)**

AGENDA ITEM 7 COOPERATION WITH OTHER ORGANISATIONS

- 7.1 The status of cooperation and relations**

AGENDA ITEM 8 SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

- 8.1 Consideration of the special requirements of developing States pursuant to Part VIII of the Convention**

AGENDA ITEM 9 FUTURE WORK PROGRAM AND BUDGET

- 9.1 Strategic Research Plan of the Scientific Committee**
- 9.2 Review of the Scientific Committee Work Programme**
- 9.3 Development of 2012 Work Programme and budget, and projection of 2013-2014 provisional work programme and indicative budget***

AGENDA ITEM 10 ADMINISTRATIVE MATTERS

- 10.1 Rules of Procedure**
- 10.2 Peer review of stock assessments***
- 10.3 Future operation of the Scientific Committee**
- 10.4 Next meeting***
- 10.5 Selection of SC officers**

AGENDA ITEM 11 OTHER MATTERS

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

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

AGENDA ITEM 13 CLOSE OF MEETING

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ABBREVIATIONS AND ACRONYMS USED BY THE WCPFC

ALB	albacore (<i>Thunnus alalunga</i>)
B_{current}	average biomass over the period 2006–2009
BET	bigeye tuna (<i>Thunnus obesus</i>)
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
B_{MSY}	biomass that will support the maximum sustainable yield
CCM	Members, Cooperating Non-members and participating Territories
the Convention	The Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
the Convention Area	The area of competence of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
CPUE	catch per unit of effort
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
EB-theme	Ecosystem and Bycatch Mitigation theme
EEZ	exclusive economic zone
EPO	eastern Pacific Ocean
ERA	ecological risk assessment
ETBF	Eastern Tuna and Billfish Fishery (Australia)
EU	European Union
F	fishing mortality rate
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
F_{current}	average fishing mortality rate over the period 2006–2009
FFA	Pacific Islands Forum Fisheries Agency
F_{MSY}	fishing mortality that will support the maximum sustainable yield
FSM	Federated States of Micronesia
$F_{\text{SSB-ATHL}}$	fishing mortality that maintains spawning

	stock biomass (SSB) above the average level of its ten historically lowest points (ATHL)
GEF	Global Environment Facility
GLM	general linear model
GT	gross registered tonnage
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ID	Indonesia
IOTC	Indian Ocean Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISSF	International Sustainable Seafood Foundation
JTF	Japan Trust Fund
LL	longline
LRP	limit reference point
m	meters
MFCL	MULTIFAN-CL (a stock assessment modeling approach)
M_{FMT}	maximum fishing mortality threshold
MOU	memorandum of understanding
MSE	management strategy evaluation
M_{SST}	minimum stock size threshold
MSY	maximum sustainable yield
mt	metric tonnes
NPAFC	North Pacific Anadromous Fisheries Commission
PFRP	Pelagic Fisheries Research Program (Hawaii, USA)
PH	Philippines
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PTTP	Pacific Tuna Tagging Programme
RFMO	regional fisheries management organization
RMI	Republic of the Marshall Islands
SA-theme	Stock Status theme group
SB	spawning biomass
SEAPODYM	spatial ecosystem and population dynamics model
SIDS	small island developing state
SKJ	skipjack tuna (<i>Katsuwonus pelamis</i>)
SPC-OFP	Secretariat of the Pacific Community-Oceanic Fisheries Programme
SPR	spawning potential per recruit
SSB	spawning stock biomass
ST-theme	Data and Statistics theme group
TCC	Technical and Compliance Committee of the WCPFC
TW	Taiwan (Chinese Taipei)

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LIST OF DOCUMENTS

MEETING INFORMATION

WCPFC-SC7-2011/01	Meeting notice and information
WCPFC-SC7-2011/02	Provisional agenda
WCPFC-SC7-2011/03	Provisional annotated agenda
WCPFC-SC7-2011/04	Indicative schedule
WCPFC-SC7-2011/05	Registration form
WCPFC-SC7-2011/06	Guidelines in submitting meeting papers
WCPFC-SC7-2011/07	List of documents
WCPFC-SC7-2011/08	Provisional agenda for Theme Sessions
WCPFC-SC7-2011/09	Provisional agenda for head of delegation (HOD) meeting (1600-1700, 8 August 2011)
WCPFC-SC7-2011/10	Provisional agenda of the PTPP Steering Committee Meeting
WCPFC-SC7-2011/11	Provisional agenda of the WPEA OFM Project Steering Committee
WCPFC-SC7-2011/12	Provisional agenda of the JTF Steering Committee Meeting
WCPFC-SC7-2011/13	Provisional agenda for the Tutorial Session of TUMAS

GENERAL PAPERS

Working Papers

GN-WP-1	Williams, P. and P. Terawasi. Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions – 2010. SPC and FFA
GN-WP-2	IATTC. Tunas and billfishers in the Eastern Pacific Ocean in 2010.
GN-WP-3	Secretariat. Issues arising from the Commission. Secretariat
GN-WP-4	Secretariat. Background information on peer review of the 2011 stock assessment of bigeye
GN-WP-5	Secretariat. Draft Strategic Research Plan
GN-WP-6	Work programme of the Scientific Committee

Information Papers

GN-IP-1	Secretariat. Intersessional activities of the Scientific Committee
GN-IP-2	Z. Suzuki. Status report of the Japan Trust Fund as of August 2011
GN-IP-3	Secretariat. Cooperation with other organizations
GN-IP-4	Secretariat. WPEA OFM Project Steering Committee
GN-IP-5	Secretariat. Summary of 2010-2011 WPEA OFM Project Report
GN-IP-6	Secretariat. WPEA OFM Project Financial Statement
GN-IP-7	Indonesia. WPEA OFM Project Progress Report
GN-IP-8	Philippines. WPEA OFM Project Progress Report
GN-IP-9	Vietnam. WPEA OFM Project Progress Report
GN-IP-10	Secretariat. Conservation and Management Measures (WCPFC7-2010/30)
GN-IP-11	ISC, Report of the 11th Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean.
GN-IP-12	WPEA OFM PSC. Report of the third Session of the WPEA OFM Project Steering Committee Meeting.
GN-IP-13	JTF Coordinator. Report of the Steering Committee Meeting of Japan Trust Fund.

ECOSYSTEM AND BYCATCH MITIGATION THEME

<i>EB THEME – Working Papers</i>	
EB-WP-01	S. Clarke, S. Harley and S. Hoyle. An indicator-based analysis of key shark species based on data held by SPC-OFP. SPC-OFP
EB-WP-02	Shelley Clarke [1], Kotaro Yokawa [2], Hiroaki Matsunaga [2], and Hideki Nakano[2]. Analysis of North Pacific shark data from Japanese commercial longline and research/training vessel records. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, [2] National Research Institute of Far Seas Fisheries, 5-7-1 Orido, Shimizu-ku, Shizuoka-ken, 424-8633, Japan.
EB-WP-03	W. Walsh [1] and S. Clarke [2]. Analyses of Catch Data for Oceanic Whitetip and Silky Sharks reported by Fishery Observers in the Hawaii-based Longline Fishery in 1995-2010. [1] University of Hawaii, Joint Institute for Marine and Atmospheric Research, Pelagic Fisheries Research Program, Honolulu, HI 96722, USA; [2] Secretariat of the Pacific Community, Oceanic Fisheries Programme, Noumea, New Caledonia.
EB-WP-04	S. Clarke. A status snapshot of key shark species in the western and central Pacific and potential mitigation options. SPC-OFP
EB-WP-05	S. Clarke. A Proposal for a Process for Designating WCPFC Key Shark Species for Data Provision and Assessment. SPC-OFP
EB-WP-06	P. Lehodey[1], I. Senina[1], B. Calmettes[1], John Hampton[2], Simon Nicol[2], Peter Williams[2], J. Jurado Molina[2], M. Ogura[3], H. Kiyofuji[3], and S. Okamoto[3]. SEAPODYM working progress and applications to Pacific skipjack tuna population and fisheries. [1] Marine Ecosystem Department, CLS, France; [2] Oceanic Fisheries Programme, SPC, New Caledonia; [3] National Research Institute of Far Seas Fisheries, Japan.
EB-WP-07	Y. Inoue, K. Yokawa, H. Minami, D. Ochi, N. Sato and N. Katsumata. Distribution of seabird bycatch at WCPFC and the neighboring area of the southern hemisphere. Ecologically Related Species Group, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan
EB-WP-08	E. Melvin [1], T. Guy [1] and N. Sato [2]. Preliminary Report of 2010 Weighted Branch-line Trials in the Tuna Joint Venture Fishery in the South African EEZ.

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EB-WP-09	H. Minami, D. Ochi and N. Sato. A comparison of two blue-dyed bait types for reducing incidental catch of seabirds in the experimental operations of the Japanese southern bluefin tuna longline. Ecologically Related Species Group, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency
EB-WP-10	K. Bigelow. Seabird interaction rates estimated from observer data (2004-2011) in the Hawaii-based shallow and deep-set longline fisheries. NOAA Fisheries, Pacific Islands Fisheries Science Center, Honolulu, Hawaii, USA.
EB-WP-11	D. Itano [1] and V. Restrepo [2]. Status of the Purse Seine Bycatch Mitigation Project and research cruises funded by the International Seafood Sustainability Foundation with notes on the development of best practices for the live release of encircled animals. [1] Pelagic Fisheries Research Program, Honolulu, Hawaii, 96822, USA.; [2] International Seafood Sustainability Foundation, P.O. Box 11110, McLean, Virginia, USA 22102
EB-WP-12	Y. Chen, X. Dai, J.F. Zhu and X. Chu. Review of Chinese scientific observer programme in the Pacific Ocean in 2010. Shanghai Ocean University, China.
EB-WP-13	K. M. Schaefer and D.W. Fuller. An Overview of The 2011 ISSF/IATTC Research Cruise for Investigating Potential Solutions for Reducing Fishing Mortality on Undesirable Sizes of Bigeye And Yellowfin Tunas, and Sharks, in Purse-Seine Sets on Drifting FADs. Inter-American Tropical Tuna Commission La Jolla, California, USA
EB-WP-14	WCPFC Secretariat. Report of the First Meeting of the Kobe Process Joint Technical Working Group on Bycatch, La Jolla, CA, July 11, 2011.
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EB-IP-01	Shelley Clarke, Shelton Harley, Lea Protoy and Peter Williams. A progress report on the shark research plan. Oceanic Fisheries Programme, Secretariat of the Pacific Community.
EB-IP-02	T. Lawson. Estimation of Catch Rates and Catches of Key Shark Species in Tuna Fisheries of the Western and Central Pacific Ocean Using Observer Data.
EB-IP-03	L. Fitzsimmons. Bycatch Mitigation Information System. SPC-OFP
EB-IP-04	Valerie Allain [1], Simon Nicol [1], Jeffrey Polovina [2], Marta Coll [3], Robert Olson [4], Shane Griffiths [5], Jeffrey Dambacher [6], Jock Young [6], Jesus Jurado Molina [1], Simon Hoyle [1], Tim Lawson [1], Johann Bell [1]. Report of the international workshop on opportunities for ecosystem approaches to fisheries management in the Pacific Ocean tuna fisheries. [1] SPC-Secretariat of the Pacific Community, BPD5-98848, Noumea, New Caledonia; [2] NMFS-National Marine Fisheries Service, 2570 Dole Street, Honolulu, HI 96822, USA; [3] ICM-CSIC Institut de Ciències del Mar, Passeig Marítim de la Barceloneta, 37-49, 08003 Barcelona, Spain; [4] IATTC-Inter-American Tropical Tuna Commission, 8604 La Jolla Shores Drive, La Jolla, CA 92037-1508, USA; [5] CSIRO-Commonwealth Scientific and Industrial Research Organisation, 41 Boggo Road, Dutton Park, QLD, 4102, Australia; [6] CSIRO-Commonwealth Scientific and Industrial Research Organisation, GPO Box 1538, Hobart, TAS 7001, Australia.
EB-IP-05	J. Jurado-Molina[1], K. Bigelow[2], S. Hoyle[1], S. Nicol[1], K. Briand[1]. Developing a spatially adjusted CPUE for the albacore fishery in the South Pacific. [1] Oceanic

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EB-IP-06	J. Jurado-Molina[1], P. Lehodey[2], I. Senina[2], S. Nicol[1]. SEAPODYM perspectives as management tool for albacore (<i>Thunnus alalunga</i>) in the South Pacific Ocean. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, B.P. D5 - 98848, Noumea, Cedex, New Caledonia.; [2] MEMMS (Marine Ecosystems Modelling and Monitoring by Satellites), CLS, Satellite Oceanography, Division, 8-10 rue Hermes, 31520 Ramonville, France.
EB-IP-07	Melanie Abecassis[1], Patrick Lehodey[2], Inna Senina[2], Jeffrey Polovina[3], Beatriz Calmettes[2], Peter Williams[4]. Application of the SEAPODYM model to swordfish in the Pacific Ocean. [1] Joint Institute for Marine and Atmospheric Research, 1000 Pope Rd, Honolulu, HI 96822, USA; [2] MEMMS (Marine Ecosystems Modelling and Monitoring by Satellites), CLS, Satellite Oceanography Division, 8-10 rue Hermes, 31520 Ramonville, France ; [3] Pacific Islands Fisheries Science Center, NOAA, 2570 Dole Street, Honolulu, HI 96822, USA ; [4] Oceanic Fisheries Program, SPC, New Caledonia.
EB-IP-08	ISC Shark Working Group. Report of the ISC's shark working group workshop, 19-21 April 2011. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean.
EB-IP-09	FFA. FFA Members proposed CMM to prohibit purse seine fishing associated with whale sharks (WCPFC-2010/DP-09).
EB-IP-10	Australia. Proposed CMM mitigating fishing impacts on cetaceans (WCPFC-2010-DP-17 (Rev 2)).

MANAGEMENT ISSUES THEME

<i>MI THEME – Working Papers</i>	
MI-WP-01	J. Hampton, P. Williams. Analysis of purse seine set type behavior in 2009 and 2010. SPC-OFP
MI-WP-02	SPC-OFP. Projections based on 2011 assessments (Excel file). SPC-OFP
MI-WP-03	Ann Preece, Rich Hillary and Campbell Davies. Identification of candidate limit reference points for the key target species in the WCPFC (Consultancy report) CSIRO Marine and Atmospheric Research, P O Box 1538, Hobart, Tasmania 7001 Australia
MI-WP-04	S. J. Harley and N. Davies. Evaluation of stock status of bigeye, skipjack, and yellowfin tunas against potential limit reference points. Oceanic Fisheries Programme, SPC.
MI-WP-05	John Sibert [1], Inna Senina [2], Patrick Lehodey [2]. Prospects for effective conservation of bigeye tuna stocks in the Western Central Pacific Ocean. [1] University of Hawaii, Honolulu, USA; [2] CLS, Marine Ecosystems Department, Ramonville, France.
<i>MI THEME – Information Papers</i>	
MI-IP-01	S. Hoyle, F. Bouyé, and S. Harley. TUMAS: a tool to allow analysis of management options using WCPFC stock assessments. SPC-OFP
MI-IP-02	R. Campbell. Convener's Draft Terms of Reference for Management Issues Theme.

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MI-IP-03	WCPFC Secretariat. Draft Objectives for the Workshop on Management Objectives.

DATA AND STATISTICS THEME

<i>ST THEME – Working Papers</i>	
ST-WP-01	P. Williams. Scientific data available to the Western and Central Pacific Fisheries Commission. SPC-OFP
ST-WP-02	J. Hampton and P. Williams. Misreporting of purse seine catches of skipjack and yellowfin-bigeye on logsheets. SPC-OFP
ST-WP-03	T. Lawson and P. Sharples. Report on Project 60: Collection and Evaluation of Purse-Seine Species Composition Data. SPC-OFP
ST-WP-04	PTTP Steering Committee. Report of the PTTP Steering Committee
<i>ST THEME – Information Papers</i>	
ST-IP-01	P. Williams. Estimates of annual catches in the WCPFC Statistical Area. SPC-OFP
ST-IP-02	T. Lawson. Purse-Seine length frequencies corrected for selectivity bias in grab samples collected by observers. SPC-OFP
ST-IP-03	P. Williams. Issues with Chinese longline fleet data submitted by the WCPFC. Oceanic Fisheries Programme (OFP), Secretariat of the Pacific Community (SPC), Noumea, New Caledonia
ST-IP-04	Peter Williams [1], Shelton Harley [1] and Robert Campbell [2]. South Pacific swordfish data available for stock assessments. [1] Oceanic Fisheries Programme (OFP), Secretariat of the Pacific Community (SPC), Noumea, New Caledonia.; [2] CSIRO Marine and Atmospheric Research, Aspendale, Australia
ST-IP-05	S. Nicol[1], B. Leroy[1], S. Caillot[1], J. Hampton[1], A. Lewis[1], A. Williams[1], T. Usu[2], B. Kumasi[2], L. Kumoru[2]. Pacific Tuna Tagging Project progress report and workplan for 2011-2012. [1] Secretariat of the Pacific Community (SPC), Ocean Fisheries Programme (OFP), Noumea, New Caledonia; [2] National Fisheries Authority, Port Moresby, Papua New Guinea.
ST-IP-06	P. Williams. Status of observer data management. SPC-OFP
ST-IP-07	Rafael V.Ramiscal [1], Alma C. Dickson [1], Marlo Demoos[1], William S. de la Cruz [1], Isidro Tananganon [1], Ronald Begonia [1] and Jonathan O. Dickson [2]. Fisheries Observers Preliminary Assessment of Purse Seine / Ring Net Fishing in Phillipine Major Fishing Grounds During the FAD Fishing Closure CY 2010. [1] NMFDC, Bureau of Fisheries and Aquatic Resource (BFAR); [2] Capture Fisheries Division, BFAR, PCA Bldg., Elliptical Road, Quezon City, Philippines
ST-IP-08	Secretariat. Summary of regional observer programme audits
ST-IP-09	S. I. Lee, Z. G. Kim, J. T. Yoo, D. W. Lee, D. N. Kim, D. Y. Moon and H. S. Sohn. Pilot research on species composition of Korean purse seine catch at cannery sites. National Fisheries Research and Development Institute, Busan, Republic of Korea
ST-IP-10	ISC. ISC Data Exchange with WCPFC. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

STOCK ASSESSMENT THEME

<i>SA THEME – Working Papers</i>	
SA-WP-01	S. Nicol [1], S. Hoyle [1], J. Farley [2], B. Muller [3], S. Retalmai [4], K. Sisior [5], A. Williams [1]. Bigeye tuna age, growth and reproductive biology (Project 35) . [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, B.P. D5 - 98848, Noumea, Cedex, New Caledonia. [2] CSIRO Marine and Atmospheric Research, Wealth from Oceans Flagship, PO Box 1538, Hobart, TAS 7001, Australia. [3] Marshall Islands Marine Resources Authority. Box 860, Majuro, Marshall Islands 96960. [4] National Oceanic Resource Management Authority, PO Box PS122, Palikir, Pohnpei, FM 96941, Federated States of Micronesia. [5] Bureau of Marine Resources, Ministry of Natural Resources, Environment and Tourism, PO Box 359, Koror State, PW 96940 Palau.
SA-WP-02	Nick Davies [1], Simon Hoyle [1], Shelton Harley [1], Adam Langley [2], Pierre Kleiber [3], and John Hampton [1]. Stock assessment of bigeye tuna in the western and central Pacific Ocean . [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community; [2] Consultant, Secretariat of the Pacific Community; [3] Pacific Islands Fisheries Science Center, National Marine Fisheries Service, Honolulu, Hawaii, USA.
SA-WP-03	Adam Langley [1], Simon Hoyle [2], and John Hampton [2]. Stock assessment of yellowfin tuna in the western and central Pacific Ocean . [1] Consultant, Secretariat of the Pacific Community; [2] Oceanic Fisheries Programme, Secretariat of the Pacific Community.
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SA-WP-06	S. Hoyle. Stock assessment of albacore tuna in the south Pacific Ocean . SPC-OFP
SA-WP-07	Adam Langley. A preliminary analysis of VMS data from the equatorial purse-seine fleet – the potential application of VMS data in the analysis of purse-seine catch and effort data . Consultant, Oceanic Fisheries Programme, SPC, Noumea.
SA-WP-08	Hoyle et al. Biological inputs and structural assumptions for future stock assessments: a discussion
SA-WP-09	Suguru OKAMOTO ¹ and Hidetada KIYOFUJI ¹ . CPUE of skipjack for the Japanese offshore pole and line using GPS and catch data . 1: National Research Institute of Far Seas Fisheries, Japan.
SA-WP-10	ISC Albacore Working Group. Stock assessment of albacore tuna in the North Pacific Ocean in 2011 . International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
<i>SA THEME – Information Papers</i>	
SA-IP-01	S. Hoyle [1] and H. Okamoto [2]. Analysis of Japanese longline operational catch and effort for bigeye and yellowfin tuna in the WCPO . [1] Oceanic Fisheries Programme, SPC; [2] National Research Institute of Far Seas Fisheries, Japan.
SA-IP-02	SPC-OFP. Report from the pre-assessment workshop in April 2011 .

SA-IP-03	P. Williams. Changes to the data available for stock assessments. Oceanic Fisheries Programme (OFP), Secretariat of the Pacific Community (SPC), Noumea, New Caledonia.
SA-IP-04	Nick Davies[1], Dave Fournier[2], John Hampton[1], Pierre Kleiber[3], Simon Hoyle[1], Fabrice Bouyé[1], and Shelton Harley[1]. Update of recent developments in MULTIFAN-CL software for stock assessment. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia; [2] Otter Research Ltd; [3] Pacific Islands Fisheries Science Center, National Marine Fisheries Service, Honolulu, Hawaii, USA.
SA-IP-05	SPC-OFP. SPC-OFP response to the CIE review of the 2009 yellowfin tuna assessment.
SA-IP-06	S. Hoyle. Research outline for size data in WCPO length-based stock assessments
SA-IP-07	S. Hoyle. Research outline for longline catch per unit effort data
SA-IP-08	S. Harley. Preliminary examination of steepness in tunas based on stock assessment results
SA-IP-09	S. Hoyle and A. Langley. Spatial size data stratification for length-based stock assessments.
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SA-IP-11	Shui-Kai Chang [1], Tzu-Lun Yuan [1] and Simon Hoyle[2] . Standardizations of Taiwanese distant-water longline CPUE up to 2010 for yellowfin and bigeye tunas in Region 6 of WCPO. [1] College of Marine Science, National Sun Yat-sen University, 70 Lien-hai Road, Kaohsiung 804, Taiwan; [2] Secretariat of the Pacific Community, BP D5, 98848 Nouméa, New Caledonia.
SA-IP-12	Hidetada KIYOFUJI ¹ , Hiroshi ASHIDA ¹ , Suguru OKAMOTO ¹ , Toyoho GOSHO ² and Yasuyuki TAKEDA ² . CPUE analyses for skipjack caught by coastal troll fishery around Wakayama prefecture in Japan. 1: National Research Institute of Far Seas Fisheries; 2: Wakayama Research Center of Agriculture, Forestry and Fisheries.
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ANNUAL REPORT – PART 1 – all related with A2.3

Symbol	CCMs
AR-CCM-01	Australia
AR-CCM-02	Canada
AR-CCM-03	China
AR-CCM-04	Cook Islands
AR-CCM-05	European Union
AR-CCM-06	Federated States of Micronesia
AR-CCM-07	Fiji
<i>Covered by its territories</i>	France
AR-CCM-08	French Polynesia
AR-CCM-09	Japan
AR-CCM-10	Kiribati

AR-CCM-11	Korea
AR-CCM-12	Marshall Islands
AR-CCM-13	Nauru
AR-CCM-14	New Caledonia
AR-CCM-15	New Zealand
AR-CCM-16	Niue
AR-CCM-17	Palau
AR-CCM-18	Papua New Guinea
AR-CCM-19	Philippines
AR-CCM-20	Samoa
AR-CCM-21	Solomon Islands
AR-CCM-22	Chinese Taipei
AR-CCM-23	Tokelau
AR-CCM-24	Tonga
AR-CCM-25	Tuvalu
AR-CCM-26	United States of America
AR-CCM-27	Vanuatu
AR-CCM-28	Wallis and Futuna
<i>Covered by USA Annual Report</i>	<i>American Samoa</i>
	<i>Guam</i>
	<i>Northern Mariana Islands</i>
AR-CNM-29	Belize
AR-CNM-30	Ecuador
AR-CNM-31	El Salvador
AR-CNM-32	Indonesia
AR-CNM-33	Mexico
AR-CNM-34	Panama
AR-CNM-35	Senegal
AR-CNM-36	Thailand
AR-CNM-37	Vietnam

NGO and Others

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

**Scientific Committee
Seventh Regular Session**

**Pohnpei, Federated States of Micronesia
9–17 August 2010**

TERMS OF REFERENCE FOR THE MANAGEMENT ISSUES THEME

Terms of Reference for the Management Issues Theme

The overall purpose of the Management Issues Theme is to provide scientific advice to the Commission on management measures, both existing and potential, that can assist the Commission achieve its adopted management objectives. Ideally, the impacts of management measures adopted by the Commission should be considered before implementation and scientific research can help inform the Commission on the utility of potential management options.

Specific functions of the Management Issues theme will include:

- Review and evaluate the potential of existing CMMs in achieving their stated management objectives and the trade-offs associated with reconciling multiple objectives;
- Evaluate the utility of additional management measures on achieving the stated objectives of existing CMMs and the overall management objectives adopted by the Commission;
- Review, evaluate and identify appropriate reference points and harvest strategies that will assist the Commission achieve its management objectives;
- Develop, and review, biological, economic and social performance indicators against which the achievement of management objectives can be assessed;
- Develop, and review, appropriately structured multi-species, multi-fleet, bio-economic and / or ecosystem-based operational models that can be used to evaluate management measures;
- Develop, and review, user-friendly software to assist fishery managers in understanding the implications of potential management measures and longer-term strategies;
- Identify research and data required to support the evaluation of management measures;
- Provide advice and make recommendations to the Commission on the above.

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TERMS OF REFERENCE FOR THE WORKSHOP ON MANAGEMENT OBJECTIVES

Terms of Reference for the Workshop on Management Objectives

The overall aim of the Workshop should be to clarify the Commission's management objectives and assist the Commission understand both the role of appropriate reference points and the process of evaluating potential management measures in the achievement of these objectives.

Specific objectives for the Workshop could include:

- Clarify the Commission's management objectives in terms of biological, economic and social issues (e.g. sustainability of stocks and catches, maintenance of catch rates, profits, and employment, food security etc).
- Assist managers to understand the process required to formally operationalize and quantify management objectives to assist with the provision of scientific advice to the Commission and so that they can be incorporated into methods used to evaluate the utility of management measures.
- Review the role of biological, economic and social performance indicators against which the achievement of management objectives can be assessed;
- Identify and discuss the role played by appropriate reference points in achieving management objectives;
- Provide guidance on identifying stock specific limit and target reference points for the key target species and how assessment uncertainty and appropriate levels of risk can be incorporated.
- If warranted, review the role of feedback decision-rules (or harvest strategies) for updating management measures in response to assessment outcomes and the role and methods used to evaluate management strategies and identify the trade-offs in achieving specific management objectives;
- Clarify to the Commission the role that scientific research and the Scientific Committee can play in this process and, to this end, identify a work program to progress the above tasks.

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**JAPAN DRAFT GUIDELINES FOR THE RELEASE OF
WHALE SHARKS FROM PURSE SEINE NETS**

Japan's Draft Guidelines for the Release of Whale Sharks from Purse Seine Nets

There are potentially three situations for the safe and live release of encircled whale sharks during purse-seine operations. First of all, if fishermen find a whale shark in the net, the net should be rolled up until whale shark cannot swim or move relatively freely.

- **remain in the net until rolling up the net**
 - a. Fishermen attempt to lead the head to approach nearest corkline by rolling up the net under the ventral and tail side.
 - b. Release cork rope of the head side.
 - c. Roll up the net of the tail side to run the head on the corkline.
 - d. Control the net carefully to keep the whale shark calm because if they wriggle, their body could become entangled in the net.
 - e. Wait for escaping from the net themselves (whale sharks swim away from the net).

- **keep pushing the head to escape from the net**

Whale sharks sometimes attempt to escape from the net and keep pushing their head to the net when the net is being rolled up. In this case, fishermen swim and approach the whale shark along with the rope and cut off the net horizontally nearly from their lower jaw. They can escape easily from the cut off point. Fishermen must swim away as fast as possible after cutting off the net without touching the tail fin.

- **entangled in the net**

Whale sharks sometimes become entangled in the net by swimming and twisting their body. If a whale shark cannot escape from the net by itself, the net must be cut off by using a knife attached to a long pole, or the fishermen must step down and cut off the net.

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**STRATEGIC RESEARCH PLAN OF THE SCIENTIFIC COMMITTEE
2012–2016**

Prepared by the Secretariat

I. INTRODUCTION

1. The Convention and the Commission

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC) was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention). The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.

The Commission is tasked with developing and adopting specific measures to promote these objectives, as detailed in Articles 5 and 6 of the Convention. The fundamental duties of the Commission must be supported by science-based information concerning:

- assessments of the impact of fishing on the marine resources of the western and central Pacific Ocean (WCPO);
- protection of biodiversity and promotion of ecosystem based approaches to management;
- minimization of waste, pollution and impacts on both target and non-target or associated or dependent species (NTADS);
- prevention or elimination of overfishing and excess fishing capacity;
- collection, compilation and dissemination of complete and accurate fisheries data and information from national and international research programmes.

To implement and enforce these goals, the Commission is required to utilize the best scientific evidence available. This evidence must then be incorporated into a fishery management regime consistent with the principles of the precautionary approach and in consideration of target species, NTADS, environmental factors and habitats of special concern.

2. The Scientific Committee

Article 11 of the Convention establishes a Scientific Committee, the functions of which are described in Article 12. They include reviewing the results of research, analysis and status assessments of target stocks

or NTADS in the Convention Area and to assist development and assess information resulting from a regional observer programme.³

The Convention requires that the Scientific Committee recommend a research plan to the Commission⁴. The first Strategic Research Plan was prepared as an adaptive research plan to support the Scientific Committee's objective of providing the best available scientific advice. It had an initial period of five years, from 2007 to 2011. This second five-year Strategic Research Plan is prepared for the period 2012 to 2016. It will be used to guide the development of annual work plans of the Scientific Committee and will be periodically reviewed to ensure that it remains responsive to the Commission's needs.

II. RESEARCH PRIORITIES

The Commission has four overall research and data collection priorities:

- Monitoring of fishing activities through the collection, compilation and validation of data from the fishery
- Monitoring and assessment of target stocks
- Monitoring and assessment of NTADS and of the pelagic ecosystems of the WCPO
- Evaluation of existing Conservation and Management Measures (CMMs) and of potential management options

1. Monitoring of fishing activities through the collection, compilation and verification of data from the fishery

Data from the fishery are required to monitor catch and effort, and are an essential input to stock assessment. Increases in data quality and coverage will enable more accurate estimates of catches and are key to reducing uncertainty in stock assessments. Data are also required for tracking fleet dynamics and monitoring changes in the fisheries. A critical role of the Scientific Committee is to promote the collection and compilation of all necessary data and to assist in increasing data accuracy and coverage. Research activities include:

- estimating total fishing effort which includes incremental increases in effective effort, catches and related mortalities of target and non-target species, stratified, as appropriate, by area, time, species or stock, size, sex and other characteristics;
- monitoring the accuracy and coverage of operational-level catch and effort data, aggregated catch and effort data, and size composition data compiled by the Commission, and developing programmes to improve accuracy and coverage and to address data gaps that are identified;
- developing programmes for the collection and compilation of related fisheries data, such as gear and vessel attributes, and other information, that can be used to standardize fishing effort and estimate fishing capacity and changes in effective fishing effort;
- rescuing historical fisheries data and related metadata useful for stock assessment and effort standardization;
- developing draft standards for the collection of operational catch and effort data, port sampling data, observer data and other types of data, as required, including minimum standards for data collection forms;
- developing and testing sampling designs, including sampling protocols, for the collection of these data through observer and port sampling programmes; and

³ Including work undertaken by scientific experts engaged by the Commission under Article 13, and for the observer programme, in conjunction with the Technical and Compliance Committee.

⁴ Article 12(2)(a).

- developing programmes to assist Members, Cooperating Non-members and Participating Territories (CCMs) in meeting data-related Convention obligations.

2. Monitoring and assessment of stocks

Stock assessment and modeling are the primary scientific tools used to estimate the status of fish stocks and to evaluate the effectiveness of CMMs. Structural uncertainty in stock assessment derives, in part, from inaccurate or incomplete data from the fishery, mistaken assumptions about underlying biological and ecological processes, and an incomplete understanding of fishing gear and vessels operations. Statistical uncertainty derives from inadequate sampling protocols and inaccurate measurement of key input data. Addressing uncertainties in stock assessment provides a useful focus for assigning priorities to stock-assessment related components of the Strategic Research Plan.

Stock assessment and modeling

Research activities directly supporting stock assessments include:

- Routine application of existing methods for stock assessment, including the characterisation of statistical and structural uncertainty;
- Improvement of existing methods and development of new methods;
- Identification and refinement of biological reference points for use in stock status determination;
- Use of simulation models for testing stock assessment models and to evaluate the sensitivity of stock assessment results to violation of structural assumptions
- Improvement of data inputs to stock assessment models, in particular analyses to standardize fishing effort or catch-per-unit-effort to provide reliable indices of abundance.

Biological studies

Understanding of key biological processes and the identification and definition of regional variability in these processes in an area as large as the WCPO is required to underpin stock assessments. Enhanced understanding of these processes will reduce structural uncertainty and possible bias in stock assessments.

Required studies include:

- age and growth of pre- and post-recruit segments of the population;
- reproductive parameters and capacity;
- the dependency of natural mortality on age
- length, weight and sex composition in response to environmental and anthropogenic factors;
- characterisation of stock structure;
- movement and migration;
- behavior and habitat utilisation;
- recruitment variability and the environmental influences thereon; and
- tagging studies.

Stock assessments for small pelagic and demersal species of fish benefit greatly from “fishery independent” survey data, which provide information on population size independent of data from the commercial fishery. Such data can reduce the bias and uncertainty in stock assessments. Unfortunately, routine scientific survey methods are not applicable to HMS because of the large geographical scales, the limitations of fish surveying technology and the resultant high costs. Tagging studies on all scales are the closest approximation to fishery independent data currently available to support the WCPFC.

Tagging studies provide information on rates and direction of movement, mortality, habitat utilization, aggregation and vulnerability, all of which are directly used in the stock assessments. Tagging is therefore an important tool for biological and behavioral studies of fish and has special importance in the assessment highly migratory fish stocks. Tagging activities include:

- mass tagging with conventional tags to determine large-scale population movement and mortality rates;
- specialized deployment of data storage tags, both conventional archival tags and pop-up satellite tags, to better define horizontal and vertical habitat preferences;
- deployment of other types of electronic tags to determine small-scale movements or residence times in relation to natural features and floating objects, such as seamounts and fish aggregating devices; and
- implementation of comprehensive tag recovery procedures, and studies (e.g. tag seeding) to estimate the rates of reporting of recaptured tags.

3. Monitoring and assessment of the ecosystem

The ecosystem approach to fisheries requires managers to consider more than the impact of the fishery on single target stocks. Additional considerations include assessing the impact of environmental variability on target stocks, and assessing the impact of the fishery on other species including prey, competitors, NTADS and on habitat. Research activities for the WCPFC include:

- Undertaking periodic ecological risk assessments, using productivity-susceptibility analysis or other approaches, to identify priorities for enhanced monitoring, biological research, stock assessment and management intervention;
- Developing and undertaking the Shark Research Plan, including assessments to determine the status of WCPO shark stocks and the impacts from tuna fisheries; research to better understand shark biology and ecology; and improvement of shark catch data from commercial fisheries;
- establishing ecosystem indicators to monitor the effects of fishing, other anthropogenic effects and natural variability on ecosystem structure, function and biodiversity;
- identifying habitats of special significance,
- quantify fishery impacts, other anthropogenic impacts and the effects of environmental and climate variability and change on ocean ecosystems;
- estimating maximum aggregate yield of all species that can be safely removed from the ecosystem without disrupting ecosystem structure and function;
- identifying oceanographic features, processes and fishing practices that influence the distribution and abundance of fish stocks and their vulnerability to fishing gear;
- investigating trophic (predator/prey) relationships ;
- synthesising data and ideas across disciplines into ecological and ecosystem-based models; and
- conducting bycatch mitigation research including technical options to minimise bycatch and discards, including undesirable sizes of target species, and investigating depredation.
- Use of ecosystem models and related tools to assess the combined effects of fishing, oceanographic variability and socioeconomics in the context of multispecies fisheries and multiple management objectives.
- Assessment of the discards of food fish in industrial fisheries and evaluation of implications for food security.

4. Evaluation of existing CMMs and potential management measures

The impacts of existing and potential CMMs and potential management measures on target stocks, NTADS and the ecosystem as a whole (including socioeconomic impacts) should be considered by the Commission, where possible, before the implementation of such measures, including the potential impact of any conditions and exclusions. Scientific research may inform the Commission when considering management options, through the provision of information on the effectiveness of management measures in achieving their objectives and the trade-offs associated with reconciling multiple objectives.

Further insights can be obtained from computer simulations incorporating uncertainty in our current understanding of population, fishery and ecosystem dynamics. Such simulations may range in complexity from simple projections or equilibrium yield analyses incorporated into single species stock assessment models, to more complex multi-species management strategy evaluation (MSE) models. MSE models consider the stock, fleet and ecosystem dynamics, fishing impacts, data collection, stock assessment, potential management response and the degree of implementation and compliance as a single integrated system. The research required to develop an MSE framework for the WCPFC Convention Area includes:

- Development of an appropriately structured multi-species operational model that incorporates, inter alia, the effects of oceanographic and climate variability and change;
- Development of behavioral models of fleet dynamics, including bio-economic models which integrate resource and fleet dynamics;
- Quantification of management objectives and the development of biological, social and economic performance indicators against which the achievement of management objectives can be assessed;
- Development of candidate feedback decision-rules for updating management measures in response to assessment outcomes;
- Characterisation of uncertainty and risk in the evaluation of management measures;
- Development of computer software, or adaptation of existing software, to integrate the above models with modules simulating data generation, assessment, management response and implementation.
- The development of user-friendly software to assist fishery managers in understanding the implications of potential management measures and longer-term strategies.

III. IMPLEMENTATION AND REVIEW

Monitoring the implementation of this Strategic Research Plan will be the responsibility of the Chair of the Scientific Committee in collaboration with the Executive Director. Members of the Commission, including Cooperating Non-members, Participating Territories, observers, scientific experts and the Secretariat will share responsibility for implementation of the Plan. Opportunities to take responsibility for activities supporting implementation of components of the Plan will be considered at each meeting of the Scientific Committee.

At each regular session of the Scientific Committee the Ecosystems and Bycatch, Management Issues, Statistics, and Stock Assessment Themes will be convened. The Fish Biology, Fishing Technology, and Methods Themes will meet as required by the SC. Issues relating to biology, methods, and fishing technology that are of relevance to the stock assessments to be undertaken in a given year will be considered by the stock assessment preparatory workshop. Theme sessions will review the elements of the Plan relevant to their respective terms of reference and will develop operational work programmes consistent with the Plan. Coordination of the review and work programme development will rest with the Chair of the Scientific Committee in consultation with conveners of the Theme Groups, the manager of the Scientific Services Provider and the Executive Director.

Opportunities to involve individuals and institutions from developing countries and territories should be a strong feature of the implementation of the Plan. Promoting such involvement should be aimed at both utilising available expertise from developing countries and territories, and at providing important opportunities for building scientific and technical capacity within those countries and territories.

Full implementation of the Strategic Research Plan will likely be beyond the means of the Commission's core budget. Extra-budgetary funds from voluntary contributions of Members and other sources will be required and actively sought by the Commission. Nevertheless, adoption of the Plan by the Scientific

Committee and subsequent strong support from the Commission is a prerequisite to securing the necessary extra-budgetary funds.

An independent external review of the Plan may periodically be requested by the SC. The Scientific Committee will be responsible for preparing the terms of reference for the review. The Scientific Committee will present the report of the review to the next regular session of the Commission.

IV. RELATIONS WITH OTHER ORGANIZATIONS

Article 22 of the Convention provides that the Commission will consult, cooperate and collaborate with other relevant organizations, particularly those with related objectives and which can contribute to the attainment of the objective of the Convention. In relation to this Plan, relationships with the following institutions are of particular significance.

1. Technical and Compliance Committee

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Technical and Compliance Committee is consulted on any element of the Plan directly relevant to the functions of the Technical and Compliance Committee. The Executive Director will provide the Technical and Compliance Committee with copies of reports of the Scientific Committee relating to implementation and review of the Plan.

2. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) is informed of relevant elements of the Plan that may have a bearing on the research conducted by the ISC. This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding developed between the Commission and the ISC. The ISC will be invited to participate in each regular session of the Scientific Committee.

3. Inter-American Tropical Tuna Commission

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Director of the Inter-American Tropical Tuna Commission (IATTC) is informed of any element of the Plan directly relevant to the functions of IATTC. This commitment, together with a commitment to collaboration, consultation and coordination, is reflected in the Memorandum of Understanding between the Commission and the IATTC. The MOU provides for collaboration with respect to the collection and sharing of data and information, subject to data sharing protocols of each organization, the development and implementation of joint research initiatives and the harmonization of conservation and management measures. Due to the fact that frozen tagged tuna will move between ocean basins for processing, collaboration with IATTC on tagging programmes would be desirable. Collaboration in developing and implementing joint research activities would also be useful. The IATTC will be invited to participate in each regular session of the Scientific Committee.

4. Secretariat of the Pacific Community – Oceanic Fisheries Programme

As the provider of scientific services, provided for under Article 14 of the Convention, the Secretariat of the Pacific Community – Oceanic Fisheries Programme (SPC-OFP) will have a pivotal role in the Scientific Committee's monitoring, review, implementation and periodic refinement of the Plan. SPC-OFP is a standing member of the Scientific Committee and, as scientific experts to the Commission, has

the capacity to report directly to the Commission on science matters. The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that SPC-OFP is consulted at regular intervals between regular sessions of the Scientific Committee on progress with implementation of the Plan. An MOU between the Commission and SPC-OFP reflects these arrangements.

5. Indian Ocean Tuna Commission

The Executive Director, in consultation with the Chair of the Scientific Committee, will ensure that the Director of the Indian Ocean Tuna Commission (IOTC) is informed of any element of the Plan directly relevant to the functions of the IOTC. Strong similarities exist between the fisheries and fishery management concerns and objectives of each regional fisheries management organization (RFMO). Implementation of research plans by both organizations will benefit from open and transparent communication in many areas, including research related to purse seine and longline fisheries, data collection and verification, illegal, unregulated and unreported (IUU) fleets, capacity and vessel registries. The geographic areas of concern to each party overlap in Southeast Asia, further reinforcing the need for collaboration. Tuna tagging programmes are active within both Commission areas, which will test the ability of both organizations to organize a single, coherent tag recovery and reward system in cooperation with coastal states and distant water fishing nations.

6. Food and Agriculture Organization of the United Nations

The Commission's Rules of Procedures provide for the participation of the Food and Agriculture Organization of the United Nations (FAO) in the meetings of the Commission and its subsidiary bodies. In relation to the Scientific Committee and this Research Plan, potential areas for collaboration include the Coordinating Working Party on Fishery Statistics (CWP, www.cwpnet.org) and the Fishery Resources Monitoring System (FIRMS) which is part of the FAO Fisheries Global Information System (FIGIS, a network of integrated fisheries information). FIRMS draws together a unified partnership of international organizations, regional fishery bodies and, in the future, national scientific institutes, collaborating within formal agreement to report and share information on fisheries resources. For effective fisheries information management, FIRMS also participates in the development and promotion of agreed standards.

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**TERMS OF REFERENCE FOR THE
PEER REVIEW OF THE 2011 BIGEYE TUNA STOCK ASSESSMENT**

Terms of Reference

The Panel would prioritise the tasks listed below. The review panel may comment and make recommendations upon issues additional to those listed below.

1. Evaluate and determine what stock structure is most appropriate for the bigeye tuna stock assessment with consideration of a Pacific wide assessment.
2. Comment on the adequacy and appropriateness of data sources for stock assessment. Evaluate the use (robustness) of modified data from sampling bias studies. Identify data uncertainties and its effects on assessments results. Recommend methods to resolve data uncertainties.
3. Review the assessment methods: determine if they are reliable, properly applied, and adequate and appropriate for the species, fisheries, and available data.
4. Evaluate the assessment model configuration, assumptions, input data and configuration, and primary sources of uncertainty, parameters (fishery, life history, and spawner recruit relationships), determine if data is used appropriately, input parameters seem reasonable and primary sources of uncertainty are accounted for.
5. Particular attention is to be paid to the following;
 - A) Length of older individuals and the impact it has on the stock assessment results.
 - B) Potential for regime shift in recruitment. Consider whether shifts in recruitment are real or are caused by model artefacts.
 - C) Appropriateness of the stock recruitment relationship.
 - D) Availability of bigeye to purse seine and not being available to longline.
 - E) Investigate the cause of residual patterns in the length composition data and determine how it can be resolved.
 - F) The use of CPUE indices in the assessment (purse seine, pole-and-line and/or longline) and consider the regional weighting of these standardized indices.
 - G) Determine if the manner in which the movement and tagging data are modeled is appropriate.
 - H) Determine if the spatial structure of the model is appropriate.
6. Evaluate the adequacy of the sensitivity analyses in regard to completeness and incorporation of results.

7. Comment on the proposed reference points and management parameters (*e.g.*, MSY , F_{MSY} , B_{MSY} , M_{SST} , M_{FMT}); if possible and feasible, estimate values for alternative reference points (or appropriate proxies) and view on stock status.
8. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status. This would include the methods of projection under hypothetical various options in future management measures (*e.g.* on effort, catch, or fisheries)
9. Suggest research priorities to improve our understanding of essential population and fishery dynamics, necessary to formulate best management practices.