COMMISSION
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Honolulu, Hawaii, USA
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REFERENCE DOCUMENT FOR THE REVIEW OF CMM 2017-08 AND DEVELOPMENT OF HARVEST STRATEGIES UNDER CMM 2014-06
Pacific Bluefin Tuna (*Thunnus orientalis*)

WCPFC15-2018-16
9 November 2018

Paper prepared by the Secretariat

A. INTRODUCTION

1. The purpose of this paper is to provide a quick reference guide to the recommendations of the Scientific Committee (SC), the Northern Committee (NC) and the Technical and Compliance Committee (TCC) of relevance to the discussions on the development of a harvest strategy for Pacific bluefin tuna stock. It lists the recommendations drawn from the summary reports of SC14, NC14 and TCC14, including the adopted Harvest Strategy 2017-02 and the outcomes from the 3rd Joint IATTC-WCPFC NC Working Group meeting on the management of Pacific bluefin tuna as Attachments.

B. SCIENTIFIC COMMITTEE RECOMMENDATIONS

Stock status and management advice (*Paragraphs 263 – 267, SC14 Summary Report; Refer to* **Attachment 1** *for the details*)

2. SC14 noted the following stock status from ISC:
   a) No biomass-based limit or target reference points have been adopted to evaluate the overfished status for PBF. However, the PBF stock is overfished relative to the potential biomass-based reference points evaluated (SSB_{MED} and $20\%SSB_{F=0}$).
   b) No fishing intensity-based limit or target reference points have been adopted to evaluate overfishing for PBF. However, the PBF stock is subject to overfishing relative to most of potential fishing intensity-based reference points evaluated.

3. SC14 noted that the total PBF catch in 2017 was 14,707 mt, 11% increase from 2016 and 9% increase from the average 2012-2016. PBF is caught by various fishing gears including purse seine, longline, set net, troll, pole-and-line, handline and recreational fisheries.

4. SC14 advises the Commission to note the current very low level of spawning biomass (3.3% B_0), the current level of overfishing, and that the projections are strongly influenced by the inclusion of a

relatively high but uncertain recruitment in 2016. The majority of CCMs recommended a precautionary approach to the management of Pacific Bluefin tuna, especially in relation to the timing of increasing catch levels, until the rebuilding of the stock to higher biomass levels is achieved.

5. SC14 noted the following conservation advice from ISC:

After the steady decline in SSB from 1995 to the historical low level in 2010, the PBF stock appears to have started recovering slowly. The 2016 stock biomass is below the two biomass rebuilding targets adopted by the WCPFC while the 2015-2016 fishing intensity (spawning potential ratio) is at a level corresponding to the initial rebuilding target.

The 2018 base case assessment results are consistent with the 2016 model results. However, the 2018 projection results are more optimistic than the 2016 projections, mainly due to the inclusion of the relatively good recruitment in 2016, which is above the historical average level (119%) and twice as high as the median of the low recruitment scenario (which occurred 1980-1989).

Based on these results, the following conservation information is provided:

a) The projection based on the base-case model mimicking the current management measures by the WCPFC (CMM 2017-08) and IATTC (C-16-08) under the low recruitment scenario resulted in an estimated 98% probability of achieving the initial biomass rebuilding target (6.7%SSBF=0) by 2024. This estimated probability is above the threshold (75% or above in 2024) prescribed by the WCPFC Harvest Strategy 2017-02 (**Attachment 2**). The low recruitment scenario is more precautionary than the recent 10 years recruitment scenario.

b) The Harvest Strategy specifies that recruitment switches from the low recruitment scenario to the average recruitment scenario beginning in the year after achieving the initial rebuilding target. The estimated probability of achieving the second biomass rebuilding target ($20\%SSB_{F=0}$) 10 years after the achievement of the initial rebuilding target or by 2034, whichever is earlier, is 96%. This estimate is above the threshold (60% or above in 2034) prescribed by the WCPFC Harvest Strategy. However, it should be recognized that these projection results are strongly influenced by the inclusion of the relatively high, but uncertain recruitment estimate for 2016.

The Harvest Strategy 2017-02 adopted by WCPFC guided projections conducted by ISC to provide catch reduction options if the projection results indicate that the initial rebuilding target will not be achieved or to provide relevant information for potential increase in catch if the probability of achieving the initial rebuilding target exceeds 75%. The projection results showed that the probability of achieving the initial rebuilding target was above the level (75% or above in 2024) prescribed in the WCPFC Harvest Strategy. Accordingly, the ISC examined some optional scenarios with higher catch limits, which can be found in Appendix 1 of the PBF 2018 stock assessment report (SC14-SA-WP-06).

Research needs

Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment on stock biomass, monitoring of recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

C. NORTHERN COMMITTEE RECOMMENDATIONS

6. The 3rd Joint Working Group Meeting between NC and IATTC was held during NC14 and the results will be reported to NC14 and IATTC. NC14 received the report of the Joint WG Meeting (**Attachment 3**), where the Joint WG agreed to recommend the future actions as described in the report. The NC considered this recommendation but there was no consensus.

7. NC14 requested the Chair to request the Commission that the NC holds a short meeting on the fringe of WCPFC15 to remove the reservation by Japan on items 1-3 on the outcome of the Joint WG and to adopt the outcome of Joint WG.

D. TECHNICAL AND COMPLIANCE COMMITTEE RECOMMENDATIONS

8. [Provisional CMR report and Executive Summary] TCC14 recommended that WCPFC15 review and revise, as appropriate, the following obligations, noting that more information related to these recommendations is contained in the Provisional CMR:

e. CMM 2016-04, paragraph 3 (2).

(TCC14 draft summary report, para 98)

Attachment 1

PACIFIC BLUEFIN TUNA (*Paragraphs 263 – 267, SC14 Summary Report*)

Provision of scientific information

Stock status and trends

1. SC14 noted that ISC provided the following conclusions on the stock status of Pacific bluefin tuna.

> The base-case model results show that: (1) SSB fluctuated throughout the assessment period, (2) SSB steadily declined from 1996 to 2010; and (3) the slow increase of the stock continues since 2011 including the most recent two years (2015-2016). Based on the model diagnostics, the estimated biomass trend for the last 30 years is considered robust although SSB prior to the 1980s is uncertain due to data limitations. Using the base-case model, the 2016 SSB (terminal year) was estimated to be around 21,000 t in the 2018 assessment, which is an increase from 19,000 t in 2014 (Table PBF-1 and Figure PBF-11).
>
> Historical recruitment estimates have fluctuated since 1952 without an apparent trend. The low recruitment levels estimated in 2010-2014 were a concern in the 2016 assessment. The 2015 recruitment estimate is lower than the historical average while the 2016 recruitment estimate (15.988 million fish) is higher than the historical average (13.402 million fish) (Figure PBF-4, Table PBF-1-1). The uncertainty of the 2016 recruitment estimate is higher than in previous years because it occurs in the terminal year of the assessment and is mainly informed by one observation from the troll age-0 CPUE index. The troll CPUE series has been shown to be a good predictor of recruitment, with no apparent retrospective error in the recruitment estimates of the terminal year given the current model construction. As the 2016 recruits grow and are observed by other fleets, the magnitude of this year class will be more precisely estimated in the next stock assessment. The above average recruitment estimated in 2016 had a positive impact on the projection results.
>
> Estimated age-specific fishing mortalities (F) on the stock during the periods 2012-2014 and 2015-2016 compared with 2002-2004 estimates (the base period for the WCPFC Conservation and Management Measure) are presented in Figure PBF-2. A substantial decrease in estimated F is observed in ages 0-2 in 2015-2016 from the previous years. Note that stricter management measures in the WCPFC and IATTC have been in place since 2015.
>
> The WCPFC adopted an initial rebuilding biomass target (the median SSB estimated for the period 1952 through 2014) and a second rebuilding biomass target (20%$SSB_{F=0}$ under average recruitment), without specifying a fishing mortality reference level.[1] The 2018 assessment estimated the initial rebuilding biomass target to be 6.7%$SSB_{F=0}$ and the corresponding fishing mortality expressed as SPR of $F_{6.7\%SPR}$ (Table PBF-2). SPR is the ratio of the cumulative spawning biomass that an average recruit is expected to produce over its lifetime when the stock is fished at the current intensity to the cumulative spawning biomass that could be produced by an average recruit over its lifetime if the stock was unfished. Because the projections include catch limits, fishing mortality is expected to decline, i.e., $F_{x\%SPR}$ will increase, as biomass increases.

[1] The IATTC has adopted the first rebuilding target, the second target is to be discussed at a future IATTC meeting.

The Kobe plot shows that the point estimate of the SSB_{2016} was 3.3%$SSB_{F=0}$ and the 2016 fishing mortality corresponds to $F_{6.7\%SPR}$ (Figure PBF-3).

Table PBF-3 provides an evaluation of stock status against some common reference points. It shows that the PBF stock is overfished relative to biomass-based limit reference points adopted for other species in WCPFC (20%$SSB_{F=0}$) and is subject to overfishing relative to most of the common fishing intensity-based reference points.

Figure PBF-4 depicts the historical impacts of the fleets on the PBF stock, showing the estimated biomass when fishing mortality from respective fleets is zero. Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleets, in particular those targeting small fish (ages 0-1), have had a greater impact, and the effect of these fleets in 2016 was greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fleet has had a limited effect on the stock throughout the analysis period, because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish.

2. SC14 noted the following stock status from ISC:

Based on these findings, the following information on the status of the Pacific bluefin tuna stock is provided:

1. **No biomass-based limit or target reference points have been adopted to evaluate the overfished status for PBF. However, the PBF stock is overfished relative to the potential biomass-based reference points evaluated (SSB_{MED} and 20%$SSB_{F=0}$, Table PBF-3 and Figure PBF-3).**
2. **No fishing intensity-based limit or target reference points have been adopted to evaluate overfishing for PBF. However, the PBF stock is subject to overfishing relative to most of potential fishing intensity-based reference points evaluated (Table PBF-3 and Figure PBF-3).**

3. SC14 noted that the total PBF catch in 2017 was 14,707 mt, 11% increase from 2016 and 9% increase from the average 2012-2016. PBF is caught by various fishing gears including purse seine, longline, set net, troll, pole-and-line, handline and recreational fisheries. The detailed catch information by fishery is available in ISC 2018 stock assessment (SC14-SA-WP-06).

Management advice and implications

4. SC14 advises the Commission to note the current very low level of spawning biomass (3.3% B_0), the current level of overfishing, and that the projections are strongly influenced by the inclusion of a relatively high but uncertain recruitment in 2016. The majority of CCMs recommended a precautionary approach to the management of Pacific Bluefin tuna, especially in relation to the timing of increasing catch levels, until the rebuilding of the stock to higher biomass levels is achieved.

5. SC14 noted the following conservation advice from ISC:

After the steady decline in SSB from 1995 to the historical low level in 2010, the PBF stock appears to have started recovering slowly. The 2016 stock biomass is below the two biomass

rebuilding targets adopted by the WCPFC while the 2015-2016 fishing intensity (spawning potential ratio) is at a level corresponding to the initial rebuilding target.

The 2018 base case assessment results are consistent with the 2016 model results. However, the 2018 projection results are more optimistic than the 2016 projections, mainly due to the inclusion of the relatively good recruitment in 2016, which is above the historical average level (119%) and twice as high as the median of the low recruitment scenario (which occurred 1980-1989).

Based on these results, the following conservation information is provided:

> **1. The projection based on the base-case model mimicking the current management measures by the WCPFC (CMM 2017-08) and IATTC (C-16-08) under the low recruitment scenario resulted in an estimated 98% probability of achieving the initial biomass rebuilding target (6.7%SSBF=0) by 2024. This estimated probability is above the threshold (75% or above in 2024) prescribed by the WCPFC Harvest Strategy (Harvest Strategy 2017-02) (scenario 0 of Table PBF-4; see also Figure PBF-5 and Figure PBF-6). The low recruitment scenario is more precautionary than the recent 10 years recruitment scenario.**
>
> **2. The Harvest Strategy specifies that recruitment switches from the low recruitment scenario to the average recruitment scenario beginning in the year after achieving the initial rebuilding target. The estimated probability of achieving the second biomass rebuilding target (20%SSBF=0) 10 years after the achievement of the initial rebuilding target or by 2034, whichever is earlier, is 96% (scenario 1 of Table PBF-3, Table PBF-4, and Table PBF-5; Figure PBF-5 and Figure PBF-6). This estimate is above the threshold (60% or above in 2034) prescribed by the WCPFC Harvest Strategy. However, it should be recognized that these projection results are strongly influenced by the inclusion of the relatively high, but uncertain recruitment estimate for 2016.**

The Harvest Strategy adopted by WCPFC (Harvest Strategy 2017-02) guided projections conducted by ISC to provide catch reduction options if the projection results indicate that the initial rebuilding target will not be achieved or to provide relevant information for potential increase in catch if the probability of achieving the initial rebuilding target exceeds 75%. The projection results showed that the probability of achieving the initial rebuilding target was above the level (75% or above in 2024) prescribed in the WCPFC Harvest Strategy. **Accordingly, the ISC examined some optional scenarios with higher catch limits, which can be found in Appendix 1 of the PBF 2018 stock assessment report (SC14-SA-WP-06).**

Research needs

Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment on stock biomass, monitoring of recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

Table PBF-1. Total biomass, spawning stock biomass and recruitment of Pacific bluefin tuna (*Thunnus orientalis*) estimated by the base-case model, where coefficient of variation (CV) measures relative variability defined as the ratio of the standard deviation to the mean.

Fishing year	Total biomass (t)	Spawning stock biomass (t)	CV for SSB	Recruitment (x1000 fish)	CV for R
1952	150825	114227	0.51	13352	
1953	146228	107201	0.49	21843	0.17
1954	147385	96239	0.49	34556	0.15
1955	152230	83288	0.50	14106	0.19
1956	169501	76742	0.49	34261	0.11
1957	188830	82975	0.46	12574	0.15
1958	208078	108677	0.41	3436	0.30
1959	214898	147004	0.39	7963	0.22
1960	218055	155183	0.39	7745	0.21
1961	211262	168125	0.39	23323	0.10
1962	197361	151993	0.42	10794	0.18
1963	181329	129755	0.45	27615	0.10
1964	169581	114448	0.45	5827	0.32
1965	159109	100628	0.46	11584	0.35
1966	144866	95839	0.44	8645	0.44
1967	121987	89204	0.44	10803	0.38
1968	107216	83374	0.45	13656	0.24
1969	93223	69074	0.47	6413	0.30
1970	81816	57958	0.48	7120	0.40
1971	71900	49980	0.48	12596	0.34
1972	67819	43035	0.46	22742	0.17
1973	65474	37205	0.44	11058	0.27
1974	65059	29896	0.44	13570	0.17
1975	63515	27733	0.38	11011	0.18
1976	66532	30485	0.30	9171	0.32
1977	64320	36220	0.25	25078	0.17
1978	69199	33382	0.25	15057	0.26
1979	69609	28007	0.29	11509	0.20
1980	71313	30757	0.25	7584	0.27
1981	72109	28867	0.21	11703	0.13
1982	53715	25408	0.21	6965	0.21
1983	31185	15086	0.29	10078	0.15
1984	33147	12813	0.31	9231	0.20
1985	36319	12846	0.28	9601	0.19
1986	35877	15358	0.23	7857	0.19
1987	31609	14632	0.25	6224	0.22
1988	33868	15709	0.25	8796	0.14
1989	38189	15519	0.25	4682	0.28
1990	46388	19468	0.23	18462	0.09
1991	61501	25373	0.21	11803	0.11
1992	70077	32022	0.20	4426	0.17
1993	79910	43691	0.18	4365	0.18
1994	90135	51924	0.19	28350	0.04
1995	103322	67152	0.18	17414	0.09
1996	98854	66841	0.18	17564	0.06
1997	99196	61069	0.19	10919	0.10
1998	95373	60293	0.19	15014	0.08
1999	91963	56113	0.20	23450	0.05
2000	87384	53835	0.21	14335	0.06
2001	76182	50222	0.21	15786	0.05
2002	77727	47992	0.20	13509	0.06
2003	74204	47569	0.19	7769	0.09
2004	68407	40707	0.20	26116	0.04
2005	63042	33820	0.21	14659	0.06
2006	50197	27669	0.23	11645	0.06
2007	43558	22044	0.24	21744	0.04
2008	41169	16754	0.27	20371	0.04
2009	35677	13011	0.27	8810	0.07
2010	33831	12188	0.25	15948	0.05
2011	34983	13261	0.23	13043	0.06
2012	37451	15892	0.20	6284	0.09
2013	39113	18107	0.20	11874	0.06
2014	38918	19031	0.19	3561	0.14
2015	38322	19695	0.20	7765	0.13
2016	41191	21331	0.22	15988	0.21
Average (1952-2016)	89579	53722	0.31	13402	0.17
Median (1952-2014)	71900	43035	0.25	11703	0.16

Table PBF-2. Spawning stock biomass and fishing intensity of Pacific bluefin tuna (*Thunnus orientalis*) in 1995 (recent high biomass), 2002-2004 (WCPFC reference year biomass), 2011 (biomass 5 years ago), and 2016 (latest) to those of the adopted WCPFC biomass rebuilding targets. SPR is used as a measure of fishing intensity; the lower the number the higher the fishing intensity that year.

	Initial rebuilding target	**Second rebuilding target**	**1995 (recent high)**	**2002-2004 (reference year)**	**2011 (5 years ago)**	**2016 (latest)**
Biomass (%SSBF=0)	SSB median1952-2014 = 6.7%	20%	10.4%	7.1%	2.1%	3.3%
SPR	6.7%	20%	5.1%	3.4%	4.9%	6.7%

Table PBF-3. Ratios of the estimated fishing intensities mortalities (Fs and 1-SPRs for 2002-04, 2012-14, 2015-16) relative to potential fishing intensity-based reference points, and terminal year SSB (t) for each reference period, and depletion ratios for the terminal year of the reference period for Pacific bluefin tuna (*Thunnus orientalis*).

	F_{max}	F0.1	Fmed	Floss	(1-SPR)/(1-SPRxx%)				Estimated SSB for terminal year of each reference period	Depletion ratio for terminal year of each reference period
					SPR10%	SPR20%	SPR30%	SPR40%		
2002-2004	1.77	2.47	1.04	0.78	1.07	1.21	1.38	1.61	40,707	6.3%
2012-2014	1.47	2.04	0.86	0.65	1.05	1.19	1.36	1.58	19,031	3.0%
2015-2016	1.32	1.85	0.78	0.58	1.02	1.15	1.32	1.54	21,311	3.3%

Table PBF-4. Future projection scenarios for Pacific bluefin tuna (*Thunnus orientalis*).

Scenario #	WPO					EPO*3		Catch limit Increase			
	Fishing mortality*1	Catch limit				Catch limit					
		Japan*2		Korea		Taiwan	Commercial		Sports	WPO		EPO	
		Small	Large	Small	Large	Large	Small	Large		Small	Large	Small	Large
0*4	F	4,007	4,882	718		1,700	3,300		-	0%		0%	
1	F	4,007	4,882	718		1,700	3,300		-	0%		0%	

*1 F indicates the geometric mean values of quarterly age-specific fishing mortality during 2002-2004.

*2 The Japanese unilateral measure (transferring 250 mt of catch upper limit from that for small PBF to that for large PBF during 2017-2020) would be reflected.

*3 Fishing mortality for the EPO commercial fishery was assumed to be high enough to fulfill its catch upper limit (F multiplied by two). The fishing mortality for the EPO recreational fishery was assumed to be the F2009-11 average level.

*4 In scenario 0, the future recruitment were assumed to be the low recruitment (1980-1989) level forever. In other scenarios, recruitment was switched from low recruitment to average recruitment from the next year of achieving the initial rebuilding target.

Table PBF-5. Future projection scenarios for Pacific bluefin tuna (*Thunnus orientalis*) and their probability of achieving various target levels by various time schedules based on the base-case model.

Scenario #	Catch limit Increase				Initial rebuilding target			Second rebuilding target		Median SSB (mt) at 2034
	WPO		EPO		The year expected to achieve the target with >60% probability	Probability of achiving the target at 2024	Probability of SSB is below the target at 2024 under the low recruitment	The year expected to achieve the target with >60% probability	Probability of achiving the target at 2034	
	Small	Large	Small	Large						
0*1	0%		0%		2020	98%	2%	N/A	3%	74,789
1	0%		0%		2020	99%	2%	2028	96%	263,465

*1 In scenario 0, the future recruitment were assumed to be the low recruitment (1980-1989) level forever. In other scenarios, recruitment was switched from low recruitment to average recruitment from the next year of achieving the initial rebuilding target.

Table PBF-6. Expected yield for Pacific bluefin tuna (*Thunnus orientalis*) under various harvesting scenarios based on the base-case model.

Scenario #	Catch limit Increase				Expected annual yield in 2019, by area and size category (mt)				Expected annual yield in 2024, by area and size category (mt)				Expected annual yield in 2034, by area and size category (mt)			
	WPO		EPO		WPO		EPO		WPO		EPO		WPO		EPO	
	Small	Large	Small	Large	Small	Large	Small	Large	Small	Large	Small	Large	Small	Large	Small	Large
0	0%	0%	0%		4,477	4,384	3,530		4,704	6,133	3,457		4,704	6,211	3,451	
1	0%	0%	0%		4,477	4,384	3,530		4,745	6,202	3,665		4,747	6,640	3,703	

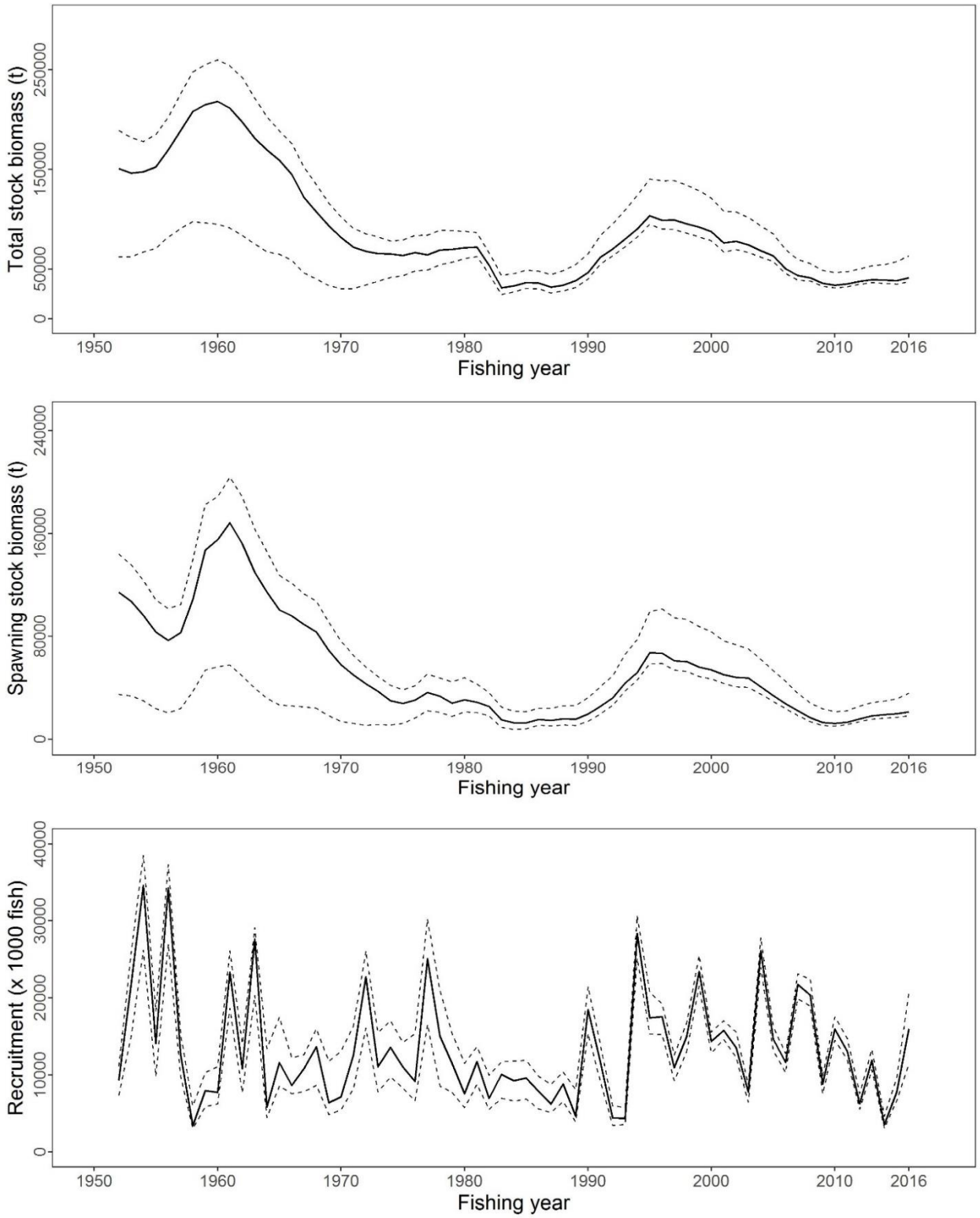

Figure PBF-1. Total stock biomass (top), spawning stock biomass (middle) and recruitment (bottom) of Pacific bluefin tuna (*Thunnus orientalis*) from the base-case model. The solid lines indicate point estimates and the dashed lines indicate the 90% confidence intervals.

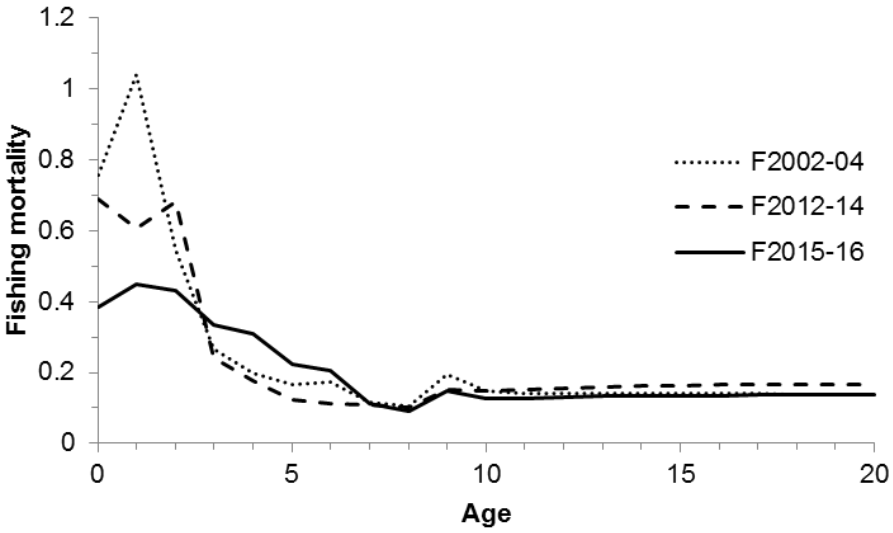

Figure PBF-2. Geometric means of annual age-specific fishing mortalities of Pacific bluefin tuna (*Thunnus orientalis*) in 2002-2004 (dotted line), 2012-2014 (dashed line), and 2015-2016 (solid line).

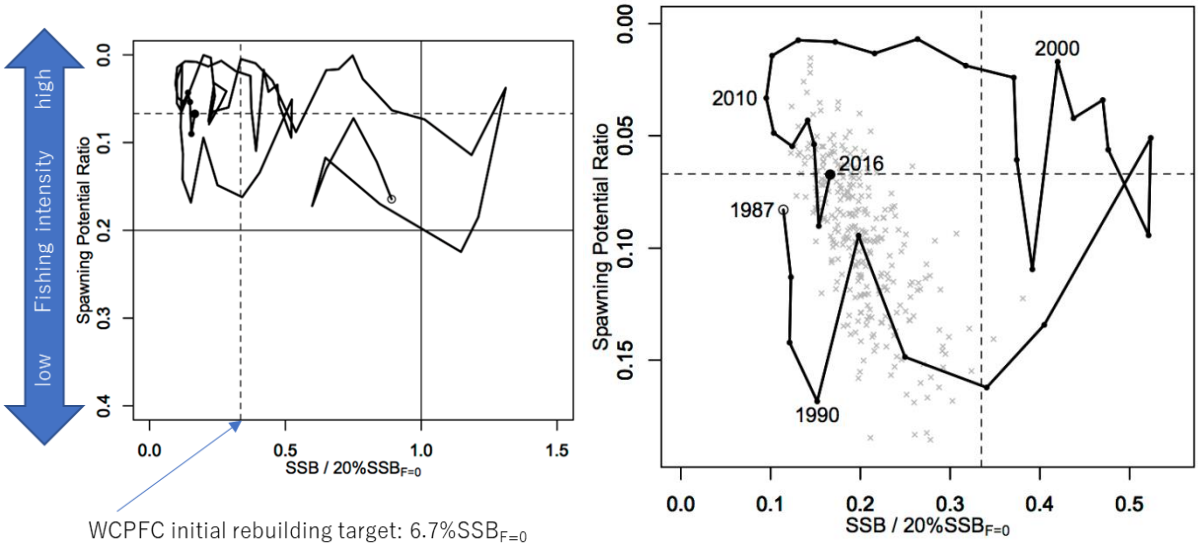

Figure PBF-3. Kobe plots for Pacific bluefin tuna (*Thunnus orientalis*). X axis shows the annual SSB relative to 20%SSB$_{F=0}$ and the Y axis shows the spawning potential ratio as a measure of fishing intensity. Solid vertical and horizontal lines in the left figure show 20%SSB$_{F=0}$ (which corresponds to the second biomass rebuilding target) and the corresponding fishing intensity, respectively. Dashed vertical and horizontal lines in both figures show the initial biomass rebuilding target (SSB$_{MED}$ = 6.7%SSB$_{F=0}$) and the corresponding fishing intensity, respectively. SSB$_{MED}$ is calculated as the median of estimated SSB over 1952-2014. The left figure shows the historical trajectory, where the open circle indicates the first year of the assessment (1952) while solid circles indicate the last five years of the assessment (2012-2016). The right figure shows the trajectory of the last 30 years, where grey dots indicate the uncertainty of the terminal year.

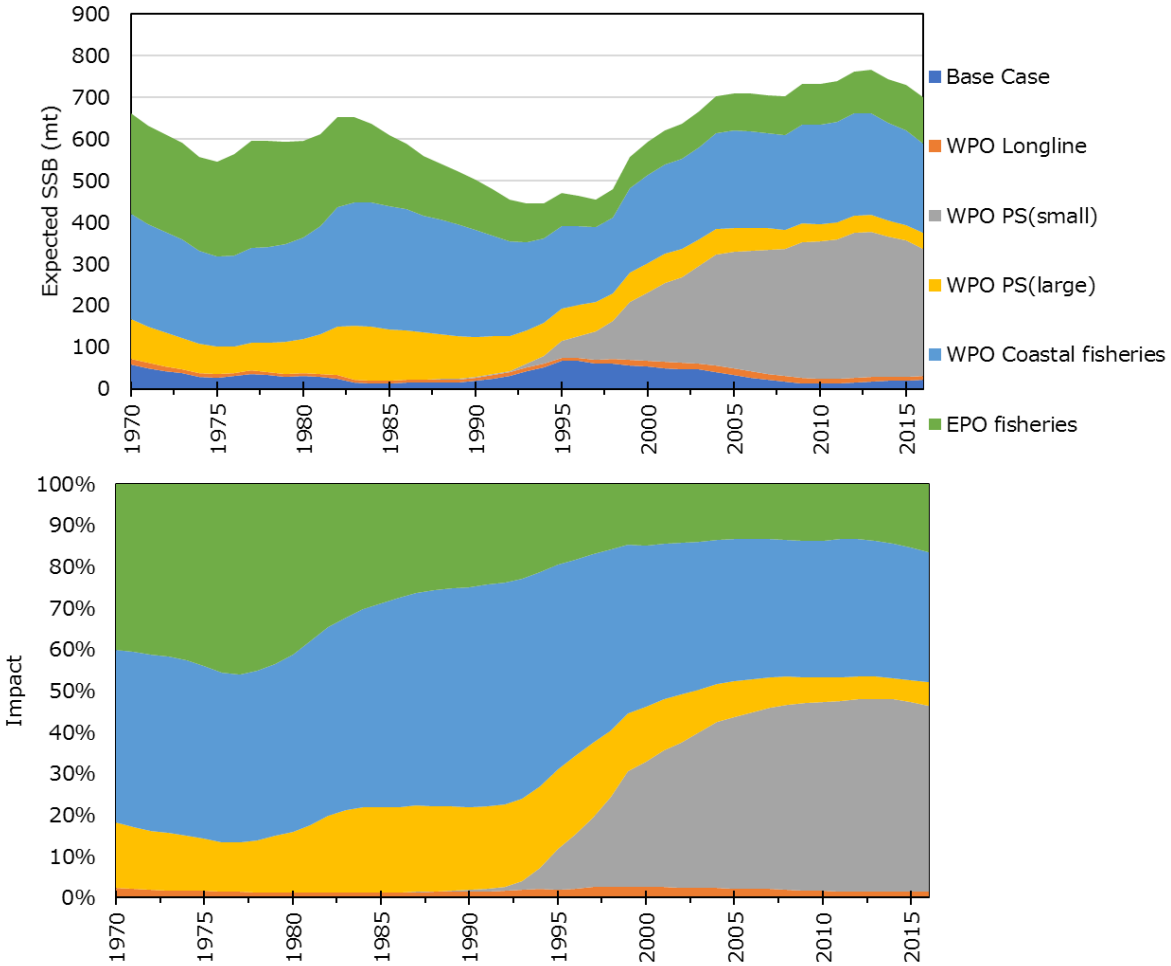

Figure PBF-4. Trajectory of the spawning stock biomass of a simulated population of Pacific bluefin tuna (*Thunnus orientalis*) when zero fishing mortality is assumed, estimated by the base-case model. (top: absolute impact, bottom: relative impact). Fleet definition; WPO longline: F1, F12, F17. WPO purse seine for small fish: F2, F3, F18. WPO purse seine: F4, F5. WPO coastal fisheries: F6-11, F16, F19. EPO fisheries: F13, F14, F15.

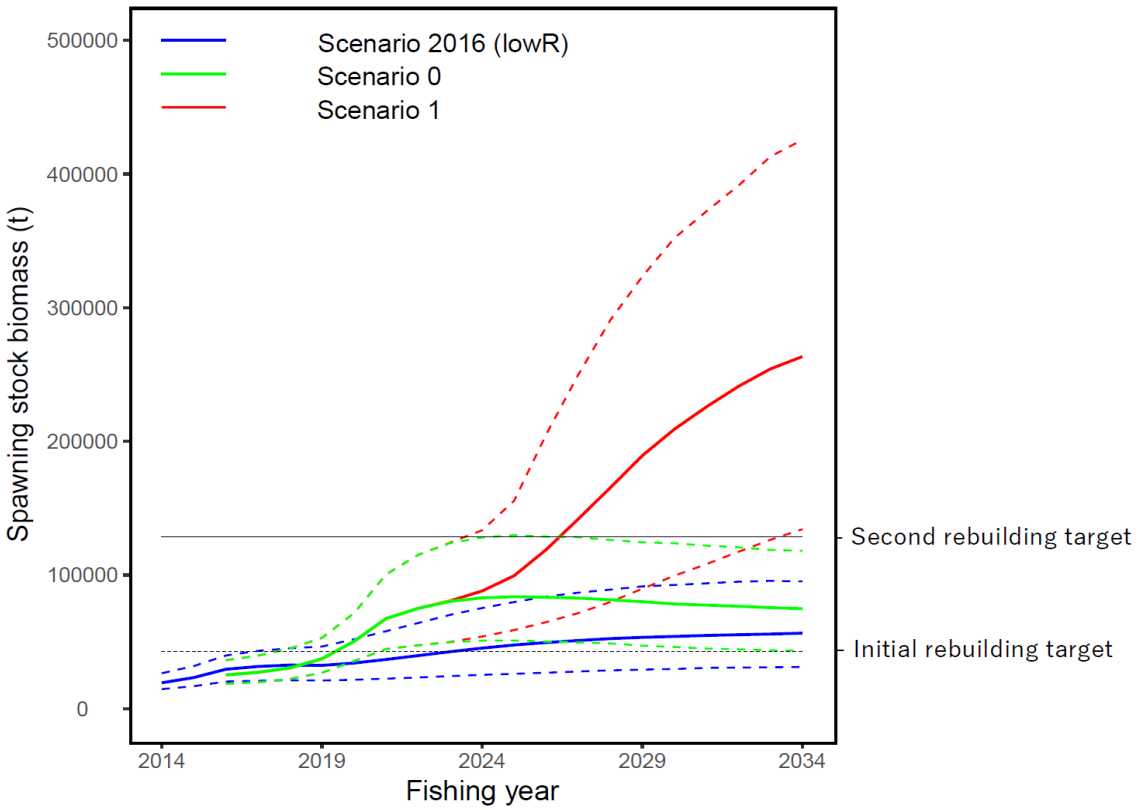

Figure PBF-5. Comparison of future SSB of Pacific bluefin tuna (*Thunnus orientalis*) under the current management measures assuming low recruitement using the 2016 assessment (scenario 2016 lowR), assuming low recruitment using the 2018 assessment (scenario 0), and assuming a shift of the recruitment scenario from low to average after achieving the initial rebuilding target using the 2018 assessment (scenario 1).

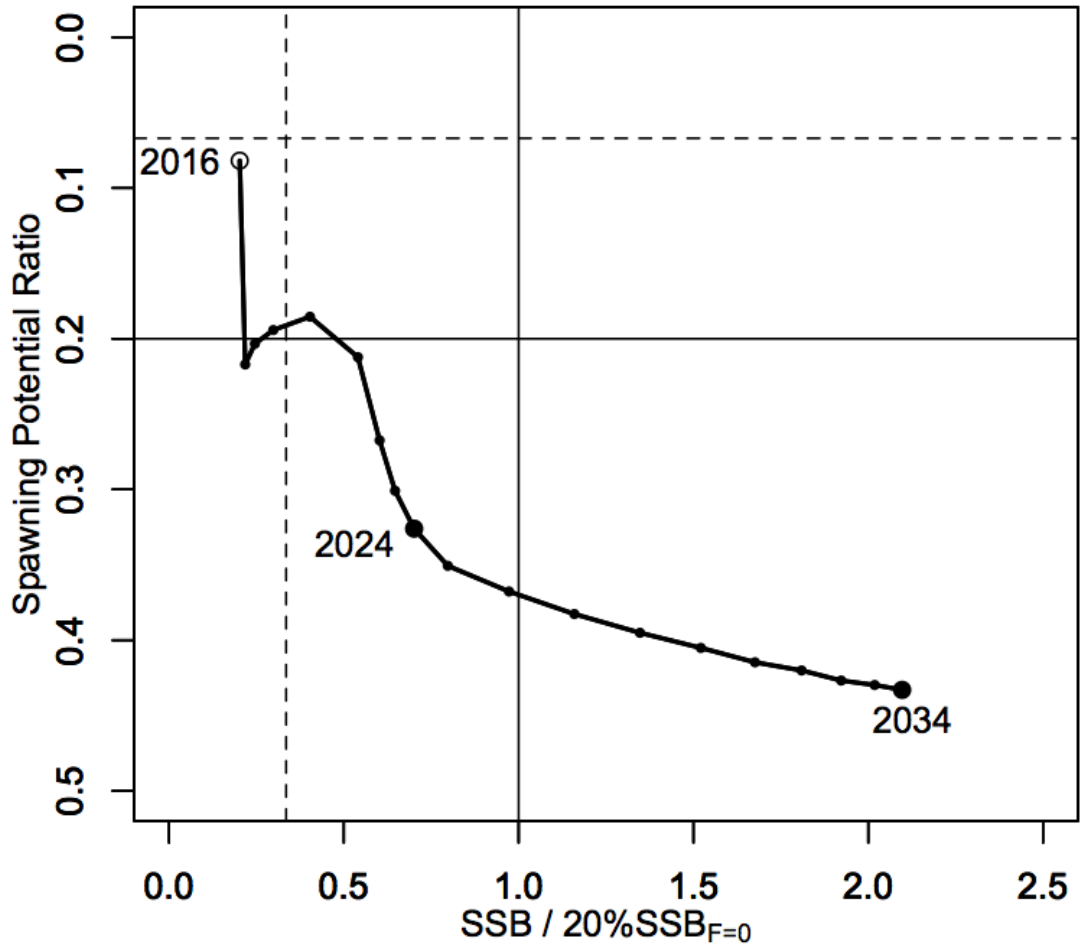

Figure PBF-6. A projection result (scenario 1 from Table PBF-4) for Pacific bluefin tuna (*Thunnus orientalis*) in a form of Kobe plot. The X axis shows the SSB value relative to 20%$SSB_{F=0}$ (second rebuilding target) and the Y axis shows the spawning potential ratio as a measure of fishing intensity. Vertical and horizontal solid lines indicate the second rebuilding target (20%$SSB_{F=0}$) and the corresponding fishing intensity, respectively, while vertical and horizontal dashed lines indicate the initial rebuilding target (SSB_{MED} = 6.7%$SSB_{F=0}$) and the corresponding fishing intensity, respectively.

Attachment 2

COMMISSION
FOURTEENTH REGULAR SESSION
Manila, Philippines
3 – 7 December 2017

HARVEST STRATEGY FOR PACIFIC BLUEFIN TUNA FISHERIES

Harvest Strategy 2017-02

Introduction and scope

This harvest strategy has been prepared in accordance with the Commission's Conservation and Management Measure on Establishing a Harvest Strategy for Key Fisheries and Stocks in the Western and Central Pacific Ocean.

Although the provisions of this harvest strategy are expressed in terms of a single stock, they may be applied to multiple stocks as appropriate and as determined by the Northern Committee.

1. Management objectives

The **management objectives** are, first, to support thriving Pacific bluefin tuna fisheries across the Pacific Ocean while recognizing that the management objectives of the WCPFC are to maintain or restore the stock at levels capable of producing maximum sustainable yield, second, to maintain an equitable balance of fishing privileges among CCMs and, third, to seek cooperation with IATTC to find an equitable balance between the fisheries in the western and central Pacific Ocean (WCPO) and those in the eastern Pacific Ocean (EPO).

2. Reference points

Because steepness in the stock-recruitment relationship is not well known but the key biological and fishery variables are reasonably well estimated,[2] the stock of PBF is to be treated as a Level 2 stock under the Commission's hierarchical approach for setting biological limit reference points.

2.1 Rebuilding targets

Initial rebuilding target: The initial rebuilding target for the PBF stock size is the median SSB estimated for the period 1952 through 2014, to be reached by 2024 with at least 60% probability.

[2] See the information provided by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (WCPFC-NC9-2013/IP-03) in response to a request made by the Northern Committee at its Eighth Regular Session (Attachment F of the report of NC8).

Recruitment scenario during initial rebuilding period: The low recruitment scenario (resampling from the relatively low recruitment period (1980-1989)) or the recent recruitment scenario (resampling from the last 10 years), whichever is lower, will be used for the ISC's SSB projections until 2024 or until the SSB reaches the initial rebuilding target, whichever is earlier.
The ISC is requested to periodically evaluate whether the recruitment scenario used during the initial rebuilding period is reasonable given current conditions, and to make recommendations on whether a different scenario should be used. If ISC recommends a different scenario, this will be considered by the NC.

Second rebuilding target: The second rebuilding target for the PBF stock size is $20\%SSB_{F=0}$[3], to be reached by 2034, or 10 years after reaching the initial rebuilding target, whichever is earlier, with at least 60% probability.

However, if: (1) the SSB reaches the initial rebuilding target earlier than 2024; (2) ISC recommends a recruitment scenario lower than the average recruitment scenario; and (3) the SSB projections indicate that the second rebuilding target will not be achieved on this schedule, the deadline for rebuilding may be extended to 2034 at the latest.

Also, if there is a recommendation from the Northern Committee that $20\%SSB_{F=0}$ is not appropriate as the second rebuilding target, taking into account consideration from IATTC, scientific advice from ISC, IATTC or WCPFC SC, and socioeconomic factors, another objective may be established.

Recruitment scenario during second rebuilding period: After the initial rebuilding target is reached and until the second rebuilding target is reached, the recruitment scenario to be used for the SSB projections will tentatively be the average recruitment scenario (resampling from the entire recruitment period).

The ISC is requested to periodically evaluate whether the recruitment scenario used during the second rebuilding period is reasonable given current conditions, and to make recommendations on whether a different scenario should be used. If ISC recommends a different scenario, this will be considered by the NC.

2.2 Development of reference points

The Northern Committee will develop more refined management objectives as well as limit reference point(s) and target reference point(s) through MSE process specified in Section 6.

3. Acceptable levels of risk

Until the stock is rebuilt, the Northern Committee will recommend conservation and management measures as needed to ensure rebuilding in accordance with the probabilities specified in sections 2.1 and 5 for each of the two rebuilding targets.

Once the stock is rebuilt, in accordance with Article 6.1(a) of the Convention, the Northern Committee will recommend conservation and management measures as needed to ensure that any target reference

[3] $SSB_{F=0}$ is the expected spawning stock biomass under average recruitment conditions without fishing.

point(s) (once adopted) are achieved on average in the long term, and ensure that the risk of the stock size declining below the B-limit (once adopted) is very low.[4]

4. Monitoring strategy

The ISC will periodically evaluate the stock size and exploitation rate with respect to the established reference points and the report will be presented to the Scientific Committee. Until 2024, while the MSE is being developed (see section 6), the ISC is requested to conduct stock assessments in 2018, 2020 and 2022.

In order to cope with the adverse effects on the rebuilding of the stock due to drastic drops of recruitment: (1) all the available data and information will be reviewed annually, including recruitment data provided by the ISC and in National Reports; and (2) the ISC is requested to conduct in 2019, and periodically thereafter as resources permit and if drops in recruitment are detected, projections to see if any additional measure is necessary to achieve the initial rebuilding target by 2024 with at least 60% probability.

5. Decision rules

Harvest controls rules during initial rebuilding period: The interim harvest control rules below will be applied based on the results of stock assessments and SSB projections to be conducted by ISC.

(a) If the SSB projection indicates that the probability of achieving the initial rebuilding target by 2024 is less than 60%, management measures will be modified to increase it to at least 60%. Modification of management measures may be (1) a reduction (in %) in the catch limit for fish smaller than 30 kg (hereinafter called "small fish") or (2) a transfer of part of the catch limit for small fish to the catch limit for fish 30 kg or larger (hereinafter called "large fish"). For this purpose, ISC will be requested, if necessary, to provide different combinations of these two measures so as to achieve 60% probability.

(b) If the SSB projection indicates that the probability of achieving the initial rebuilding target by 2024 is at 75% or larger, the WCPFC may increase their catch limits as long as the probability is maintained at 70% or larger, and the probability of reaching the second rebuilding target by the agreed deadline remains at least 60%. For this purpose, ISC will be requested, if necessary, to provide relevant information on potential catch limit increases.

Harvest controls rules during second rebuilding period: Harvest control rules to be applied during the second rebuilding period will be decided, taking into account the implementation of the interim harvest control rules applied during the initial rebuilding period.

The Northern Committee will, through MSE development process, develop decision rules related to the limit reference points once adopted including for the case of their being breached.

6. Performance evaluation

Until the stock is rebuilt, the Northern Committee will work with the ISC and the Scientific Committee and consult with the IATTC to identify and evaluate the performance of candidate rebuilding strategies with respect to the rebuilding targets, schedules, and probabilities.

[4] WCPFC13 agreed that any risk level greater than 20 percent to be inconsistent with the limit reference point related principles in UNFSA (as references in Article 6 of the Convention) including that the risk of breaching limit reference points be very low.

The ISC is requested to start the work to develop a management strategy evaluation (MSE) for Pacific bluefin tuna fisheries in 2019 and have a goal of completing it by 2024.

To support development of the MSE, ISC is encouraged to identify at least two experts and NC members are encouraged to provide additional funds for the ISC's work on the MSE.

The Joint WG will start to discuss in 2018, and aim to finalize no later than 2019, guidelines for the MSE, including at least one candidate long-term target reference point (TRP), two candidate limit reference points (LRPs) and candidate harvest control rules (HCRs), which will be provided to the ISC. Those candidate TRPs, LRPs and HCRs will be tested and changed if appropriate during the MSE development process.

In preparation for the Joint WG meeting in 2019, the ISC is requested to organize workshops in early 2018 and 2019 to support the identification of specific management objectives, including level of risks and timelines. The workshops will include managers, scientists and stakeholders, taking into account any recommendations of the Joint WG, and the number of representatives should be relatively small, as it was for the MSE workshop for North Pacific albacore.

In evaluating the performance of candidate target reference points, limit reference points, and harvest control rules, the Northern Committee, in consultation with the ISC and the Scientific Committee, should consider the following criteria:

1. Probability of achieving each of the rebuilding targets within each of the rebuilding periods (if applicable).
2. Time expected to achieve each of the rebuilding targets (if applicable).
3. Expected annual yield, by fishery.
4. Expected annual fishing effort, by PBF-directed fishery.
5. Inter-annual variability in yield and fishing effort, by fishery.
6. Probabilities of SSB falling below the B-limit and the historical lowest level.
7. Probability of fishing mortality exceeding F_{MSY} or an appropriate proxy, and other relevant benchmarks.
8. Expected proportional fishery impact on SSB, by fishery and by WCPO fisheries and EPO fisheries.

Recognizing that developing the operating model and other aspects of the MSE will take time and additional resources, and might require further dialogue between the Northern Committee, the ISC, and the IATTC, while the MSE is in development the ISC is requested to perform this work using the best means at its disposal.

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Outcomes of the 3rd Joint IATTC-WCPFC NC Working Group meeting on the management of Pacific bluefin tuna

The Joint IATTC-WCPFC NC Working Group on the Management of Pacific bluefin tuna recommends that the IATTC and WCPFC NC consider incorporating the following actions in their decisions:

Review of current CMMs

1. To request ISC to review the updated abundance indices, including recruitment index, up to 2017 to evaluate the need to change its scientific advice in 2018.

2. To request ISC to conduct projections of harvest scenarios shown below based on 2018 assessment and provide probability of achieving initial and 2nd rebuilding targets in accordance with paragraph 2.1 of **HS 2017-02**.

Scenarios for catch increase

No.	West Pacific		East Pacific
	Small fish	Large fish	
1	0	600t	400t
2	5%	1300t	700t
3	10%	1300t	700t
4	5%	1000t	500t
5	0	1650t	660t
6	5%		5%
7	10%		10%
8	15%		15%

* 250t transfer of catch limit from small fish to large fish by Japan is assumed to continue until 2020.

** These scenarios will not preempt a decision on allocation of catches between WPO and EPO and the allocation of any increased portion amongst members.

3. To decide in 2019, based upon the above information from ISC, on an increase to the catch limits in accordance with paragraph 5(b) of HS 2017-02 and IATTC Resolution on Pacific bluefin tuna adopted at IATTC93.

MSE

4. To request ISC to provide information regarding candidate LRP and TRP.

Catch Documentation Scheme (CDS)

5. To note the CDS WG Chairman's summary (Annex 1).

6. To schedule another 1-day meeting for CDS in conjunction with the next Joint WG meeting.

Future meeting

7. [deferred to NC]

Annex 1

CHAIRMAN'S SUMMARY OF THE CATCH DOCUMENTATION SCHEME (CDS) TECHNICAL MEETING
September 3, 2018
Fukuoka, Japan

1. Opening of Meeting

1.1 Welcome

1. Mr. Michael Tosatto, Vice Chair of the Northern Committee (NC), opened the CDS technical meeting at 9:30 am.

1.2 Selection of CDS Chair and rapporteur and adoption of agenda

2. The NC Vice Chair asked for nominations to chair the CDS technical meeting. The United States nominated Mr. Shingo Ota from Japan, and the Cook Islands seconded the nomination. The NC Vice Chair handed the meeting over to the CDS Chair. The provisional agenda was adopted (See Appendix A). The United States also agreed to rapporteur the CDS technical meeting.

1.3 Meeting arrangements

2. Development of a Catch Documentation Scheme for Pacific Bluefin Tuna

3. The Chair noted that last year the Joint Inter-American Tropical Tuna Commission (IATTC) - Western and Central Pacific Fisheries Commission (WCPFC) NC Working Group (JWG) agreed on a CDS concept paper, and while the paper laid out a clear objective for a Pacific bluefin tuna (PBF) CDS, there were many issues still to discuss. Japan explained that CDS schemes can be complex, and the purpose of their delegation paper (WCPFC-NC-CDS01-2018/02) was to facilitate discussion on the elements agreed to in last year's CDS concept paper. Japan hoped that discussions this year could help development of a PBF CDS proposal next year.

4. Participants generally supported the development of an electronic scheme recognizing that exemptions may be necessary for select cases (i.e., technical problems in the electronic scheme, trade involving non-members, etc.). Paper forms could be used as a backup, and if an electronic form is created, there should be a mechanism to print forms if needed. The Cook Islands noted that internet in Pacific Island countries can be difficult, and, in their experience, electronic systems are not yet completely reliable.

5. Participants discussed the pros and cons of beginning with an electronic CDS versus transitioning from a paper-based scheme. Some felt that the CDS scheme could begin as a paper-based scheme and transition to electronic, some felt that the scheme should start as an electronic scheme, and some felt that paper-based and electronic options should be developed in tandem. In all cases, participants agreed that the goal is to eventually have an electronic CDS system. Participants noted that flexibility may be necessary in the development and implementation of a CDS, there may be the need for a transition period or phased implementation, and that a PBF CDS could build off of experiences from ICCAT's implementation of their eBCD system.

6. Participants noted that the WCPFC has discussed a Commission-wide CDS for a number of

years, and it's possible that whatever CDS is developed for PBF could model a CDS for adoption by a wider WCPFC. As this meeting was under the umbrella of the JWG, there were discussions that any CDS developed by this group could cover IATTC and WCPFC. Whether this is just a WCPFC-focused PBF CDS or a Pacific-wide PBF CDS, it would be important to have IATTC, and in particular Mexico involved in the development of a PBF CDS. Another possibility suggested was to investigate the potential to piggyback onto the existing ICCAT system, and whether the code or system itself could be licensed or expanded for PBF purposes.

7. Participants generally felt that a PBF CDS should be located with the Secretariat, but that there may be additional personnel needed to help run the system as it will be live 24 hours a day 365 days a year.

8. Participants noted that the development and maintenance of a CDS could be costly and there was some discussion over who should bear the costs for development and maintenance. If this project is seen as a stepping stone for a Commission-wide CDS, then perhaps the burden should be spread across all CCMs; however, if this is limited to PBF, then perhaps the burden should concentrate on those members who are involved in PBF fisheries and trade. Participants felt it would be useful to have some ballpark cost estimates, and Japan offered to ask the ICCAT Secretariat for information on the money spent for development and maintenance of their eBCD system and to report back with this information to the participants to the CDS technical meeting as soon as possible via e-mail. Participants also requested the Secretariat to provide a cost estimate, and the Secretariat said it was not possible to do so at this stage because more details needed to be decided. Some participants felt that it might be helpful to have a conceptual discussion about funding for a PBF CDS at FAC, but Chair concluded that it would be probably enough to report the result of this WG to the annual meeting through NC.

9. The Chair noted that the CDS concept paper adopted last year outlined clear objectives, and Japan noted that the ICCAT and Commission for the Conservation of Southern Bluefin Tuna (CCSBT) CDS systems also contain objectives related to supporting the implementation of CMMs for bluefin tuna.

10. The Cook Islands noted that the concepts of CDS are well described, and the PBF CDS should follow those general standards. Ideally a PBF CDS would cover all transactions of PBF, but it was recognized that tracking domestic flow of PBF was potentially beyond the scope of this CDS. In ICCAT and CCSBT, fish parts other than meat were excluded from their CDS and it was undecided whether it was necessary to include these other fish parts as part of the PBF CDS.

11. Participants briefly discussed definitions (e.g., the difference between transshipment and transfers and between farming and fattening), whether it might be necessary to include a definition of transshipment or not, and whether the CDS should account for trade from closed cycle aquaculture.

12. Participants generally agreed that validation authorities should include government and other authorized institutions, and that these list of validation authorities should be registered through the WCPFC website.

13. Participants generally agreed that it is the responsibility of the flag state to verify that fish are caught in a manner compliant with the rules. In an ideal world, a CDS could help identify and stop product harvested illegally from being traded. However, some participants expressed that the view that the CDS is not a stand-alone measure against IUU fishing. There may be instances where it might be favorable to allow product to be traded (particularly fresh product which has a limited shelf life) while documents are revalidated or investigations of non-compliance are ongoing. CMMs sometimes have mechanisms to address catch overages so a PBF CDS should not necessary block trade since the overage can be addressed in catch limits the following year. At some point, there could be some further discussion

that reports that can be developed to identify potential anomalies or products derived from IUU fishing.

14. There was no consensus on whether artisanal fisheries could receive any special dispensations. In ICCAT, artisanal fisheries have 7 days to validate their catch, and Japan suggested that for some fisheries, validation could occur when the caging occurred rather than when the catching occurred or that validation could occur by fisheries cooperatives authorized to do so. There was also discussion that information from CDS could also be used to validate catch information.

15. Participants generally agreed that the purpose of the PBF CDS is to track commercial catch and trade, and recreational catch should not be included with the understanding that recreational catches are not sold.

16. There are no current tagging programs in place for PBF. If tagging programs were developed in the Pacific, they may be more effective for tracking larger bluefin over smaller bluefin, and would need to be reviewed to ensure that there wouldn't be any loopholes.

17. Participants agreed that each CCM should provide a point of contact to facilitate communication between exporting and importing countries.

18. There was general agreement that the Secretariat could play a large role in the development and management of a PBF CDS as well as in evaluating CDS information for potential CMM violations. An electronic PBF CDS system could be built to provide automatic reports to the Secretariat as well as CCMs. There will need to be some thought put into what information would be available for CCMs and the Secretariat and to ensure that any information would not inadvertently disclose any confidential information.

19. Participants generally agreed that a PBF CDS should allow for some sort of access and use by non-member countries. Participants recognized that there are complex issues around fishing and trade by non-members, and that future discussions on a PBF CDS could benefit by participation by IATTC and Mexico. The participants agreed to request Mexico's participation in future PBF CDS discussions at the JWG.

20. Participants agreed that a PBF CDS should be consistent with FAO guidelines and that there should be coordination between the ICCAT eBCD and a PBF CDS (whether Pacific-wide or separate systems for WCPFC and IATTC).

21. Participants recognized that any future CMM will need to consider impacts to Small Island Developing States (SIDS) and Participating Territories.

22. Participants agreed that there could be a transition period to identify gaps and allow for domestic implementation of any adopted CMM. The length of the transition period depends on whether the PBF CDS starts as paper-based or electronic-based with the latter probably requiring a longer transition period. Implementation could also be staggered for different product types.

23. Participants generally agreed that any forms developed for the PBF CDS should be consistent with the forms used in ICCAT and FAO guidelines, and that instructions should be developed/included for each form. The PBF CDS could consider adopting the ICCAT form.

24. Participants supported the establishment of an intersessional virtual working group, to be led by Japan. It was agreed that objective of the virtual working group will be to progress work on technical issues, including definition of terms, development of forms and instructions, and data to be extracted by

the Secretariat, which will contribute to the development of a draft CMM. Japan expects to produce a draft CMM proposal for review by the virtual working group preferably two months in advance of the next meeting of the PBF CDS Technical Meeting next year.

3 Next Meeting

25. The 2nd PBF CDS Technical Meeting will be a one day meeting in conjunction with the 2019 JWG meeting.

4 Other Business

26. No business was discussed under this agenda item.

5 Report to the Joint WG

27. The Chair will provide a general summary of the CDS Technical Meeting to the JWG.

6 Close of the Meeting

28. The meeting was closed at 5 pm.