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Review of the setting of SS3 in previous PBFT stock assessment meetings

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Introduction

In July, 2010, the ISC Pacific Bulefin Tuna Working Group (PBFWG) met in Nanaimo, Canada and updated the stock assessment of PBF to the most recent up to 2007, adding data of 2006 and 2007. A full stock assessment meeting is scheduled to be held in May 2012. Purpose of this document is to review the possible setting of full stock assessment and the ranges of sensitivity analysis.

Definition of fisheries

The definitions of fisheries of PBFT, currently adopted are shown in Table 1 (Ichinokawa et al., 2010), which include ten fleets and seventeen CPUE series agreed at the 2010 PBFWG.

For Tuna Purse Seine fishery, Abe et al. (2011) discussed the possibility to divide Fleet 3 into Japan Sea fishery and Pacific Ocean fishery. As for the Japanese longline fisheries (JLL), Ichinokawa (2011) re-considered the selectivity and seasons (see. ISC/11-1/PBFWG/13). It is to find the possibility for an option to divide the JLL into spawning season and non-spawning season in the definition of CPUE series.

Biological Parameters

Growth parameters

As seen in the Table 2, there are several options of growth curve parameters、L-infinity and K.　In ISC 2010 meeting, Growth curve parameters proposed by Shimose et al (2008) were used. Since then, new parameters have been proposed by Shimose et al. (2009) and Shimose and Tanabe (2011).

Furthermore, at the previous ISCWG on PBF, 2011, Shimose and Tanabe (ISC/11-1/PBFWG/11) reported new parameters for sex combined and sex specific cases. The most recent results of Shimose et al. (ISC/12-1/PBFWG/12) are also available for sex diffeomorphic case, if the WG prefer to introduce sex structure in stock assessment.

Natural Mortality

Validity of current setting of natural mortality for 0-age fish is reviewed by Iwata et al. (2011) and Iwata et al. (ISC/12-1/PBFWG/13). Those papers concluded that the current value 1.6 is appropriate. The natural mortalities for older ages are also important. Since, Teo (ISC/11-1/PBFWG/10) conducted sensitivity runs by changing natural mortality values for fish of age 4+ (M4+). The result indicated that the stock trends would be very different if M2+ were 0.25 or less. Because of these observations he recommended to keep adult M smaller or equal to 0.25, value used currently, if the other model configuration are not significantly changed. Therefore the fishing mortality for the older age classes has to be reviewed again. Two documents, Whitlock and Block (ISC/10-1/PBFWG/05) and Oshima (ISC/11-1/PBFWG/08) would provide with basis for such review.

Catch error

For the CV of catch error is currently assumed to be 0.01. However, the author of SS model recommends larger values, for example 0.05 or 0.1 to enable numerical stability in calculations. This setting has to be discussed and concluded before the model is run. .

CPUE (Troll) selectivity

Fishery selectivities are considered to be reflected by size specific CPUE. However, Ichinokawa et al. 2012, (ISC/12/PBF-1/11), is proposing a revised troll CPUE series, using subset of troll catch and effort data, which represents only age 0 fish. Accordingly the selectivity for troll has to be reviewed as to whether the length specific selectivity currently used to be continued or assume selectivity of 1 for age 0 fish and 0 for other ages. .

Sensitivity analysis

Let us consider the available options for natural mortality.

For the natural mortality for 0-age class, 1.8 and 1.3 were tested in the sensitivity runs at ISC-PBWG2010 meeting. Probably, these values can be reviewed. Although, Ms for fish of M2+ has been studied carefully at the PBF WG meeting in 2009 in Ishigaki, these can be reviewed briefly at the session, including those to be used in the sensitivity runs.

Other consideration

The stock synthesis (SS) model has been updated from Version SS 3.10b to SS 3.23b, since the previous stock assessment, 2010 and the new version would be used in 2012. The useful functions may have become available by this update. Therefore, at PBF WG, ISC 2012, the new functions of SS should be kept in mind in considering model structures.

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Table 1. Definition of fishery and related matters (Table 1. in Ichinokawa et al. 2010)

Serial number	Fleet	Short Name	corresponding fisheries	Descriptions (selectivity patterns, data sources etc.)	Weighting factor	Variance adjustment factor for length data
1	FL1	JLL		Flat top selectivity	1	3.27
2	FL2	SPSS		Double normal Selectivity	1	2.1
3	FL3	TPS		Double normal selectivity, share length data with FL4	1	1.83
4	FL4	TR		Double normal selectivity, share length data with FL4	1	3.58
5	FL5	PL		Double normal selectivity	1	1.08
6	FL6	SN		Flat top selectivity	1	1.74
7	FL7	TWLL		Double normal selectivity	1	6.46
8	FL8	EPOCOM		Doublr normal selectivity	1	1
9	FL9	EPOSP		Mirror selectivity in FL9	0	1
10	FL10	OTH		Lenear segment	0.01	2.11
11	S1	JpCLL	JLL	Japanese coastal long line conducting spawning area and season (April to June) (WP 18 in PBF07-2)	5	1
12	S2	JpnDWLL Oshima60 to80	JLL	CPUEs with set by set data in Japanese offshore longlines from 1960's to 1980's (WP 16 in PBF07-2)	0	1
13	S3	JpnDWLL Oshima80 to00	JLL	CPUEs with set by set data in Japanese offshore longlines from 1980's to 2000's (WP 17 in PBF07-2)	0	1
14	S4	JpnDWLL YokawaRe vto74	JLL	CPUEs with aggregated data in Japanese offshore and distant water longliners using all quarters and area until 1974 (Yokawa WP "25+26", revisited)	5	1
15	S5	JppDWLL YokawaRe vfrom75	JLL	CPUEs with aggregated data in Japanese offshore and distant water longliners using all quarters and area until 1975 (Yokawa WP "25+26", revisited)	5	1
16	S6	JppDWLL YokawaOr gto74	JLL	CPUEs with aggregated data in Japanese offshore and distant water longliners using 1 st, 3rd and 4th quarters until 1974 (Yokawa WP "25+26", original)	0	1
17	S7	JppDWLL YokawaOr gfrom75	JLL	CPUEs with aggregated data in Japanese offshore and distant water longliners using 1 st, 3rd and 4th quarters from 1974 (Yokawa WP "25+26", original)	0	1
18	S8	JppDWLL YokawaW P27to74	JLL	CPUEs with aggregated data in Japanese offshore and distant water longliners using 3rd and 4th quarters and selected regions until 1974 (WP 26 in PBF07-2)	0	1
19	S9	JppDWLL YokawaW P27from7 5	JLL	CPUEs with aggregated data in Japanese offshore and distant water longliners using 3rd and 4th quarters and selected regions from 1974 (WP 26 in PBF07-2)	0	1
20	S10	JpnTrollC hinaSea	TR	CPUEs of Japanese troll fisheries in Nagasaki prefecture (Sea of Japan and east china sea) from 1980 to 2007	1	1
21	S11	JpnTrollPa cific	TR	CPUEs of Japanese troll fisheries in Kochi prefecture (Pacific side) from 1980 to 2005	0	1
22	S12	JpnTrollAv erage	TR	Simple average of S10 and S12 from 1980 to 2005	0	1
23	S13	TWLL	TWLL	CPUEs of Taiwanese longline from 1998 to 2007	5	1
24	S14	USPSto82	EPOCOM	CPUEs in US purse seine until 1982	1	1
25	S15	MexPSto9 8	EPOCOM	CPUEs in Mexico purse seine from 1963 to 1998	0	1
26	S16	MexPSto0	EPOCOM	CPUEs in Mexico purse seine from 1999 to	0	1
27	S17	Ussports	EPOSO	CPUEs in US sports from 1995 to 2005	0	1

Table 2. Base case of updates stock assessment of 2010 PBF working group, available options, and the setting options at full stock assessment in 2012 (Edit Table 1. in Anon. 2011) .

	2010	Available options	Full stock assess. in 2012
SS version	SS-V3.10b	SS-V3.23b	
Year definition	July to June	July to June calendar year	July to June
Time step	Quarter	Quarter	Quarter
Stock	Single spawning		Single spawning population
Area	Single	Single 2areas (E&W)	Single for assessment; two area for research
Number of age class	21(0-20)	21(0-20) ?	21(0-20) -default; 21-25 lumped
Ngender	Single sex	Single sex 2 sex	Single sex; explore two-sex model
Fishery definition	See other sheet	separate tuna PS separate JLL	separate tuna PS, separate JLL # of fisheries could be reduced: JPN-PL & JPN-
Natural mortality	Age specific,year is Age0 =:1.6 Age 1=0.386 Age2+=0.25	Age specifc, year is time step Agespecific, linear interporation Sex specific	Age specifc, year is time step Explore Agespecific, linear interporation Sensitivity run with direct estimate (Rebecca's) Further updated analysis will be made at the 2012 WS
Maturity	Age specific Age3=0.2 Age4=0.5 Age 5+=1.0	?	Wait for papers on maturity Age3=0.2 Age4=0.5 Age 5+=1.0 Sensitivity
Growth curve	Shimose et al. 2008	Shimose et al. 2008 Shimose et al. 2009 Shimose et al. (ISC2012 WP 12) Shimose et al. (ISC2012 WP 12) for two-sex model	Shimose et al. 2009 for single sex model Shimose et sl. (WP11) for two-sex model Prepare conditional A@L input vectors Explore seasonal change in K
#of growth patterns	1	?	1
#of morphs, sub-morphs	1	1,3,5	1
Functional form of CV growth	CV=F(A)	CV=F(A),F(L),	Pospone decision

Table 2. Base case of updates stock assessment of 2010 PBF working group, available options, and the setting options at full stock assessment in 2012 (Edit Table 1. in Anon. 2011).

	2010	Available options	Full stock assess. in 2012
Amin	0		0
Amx	3		3 (revisit this choice)
L-W	Kai et al. 2007		Kai et al. 2007
Length bin definition	see other sheet		Explore wider pop. length bin for younger ages
Catch unit	Weight		Weight/numbers ex: EPO-sport (numbers), fraction of JP-LL Fleet 2 may have possibility
Catch error	assumed to be exact	0.1, 0.05	assumed to be exact Sensitivity run with error in catch
F-method	3 (solve catch eq)		3 (solve catch eq) - catch exact 2 - sensitivity run
iteration	5	5 7 or 3	5
upperF	5	5 smaller F is better?	Explore reason for high F estimates in Epo (aroud 5, first qrt)
CPUE likelihood	t(df=30)	t(df=30) lognormal	t(df=30) lognormal
CPUE (JLL) selectivity	Same selectivity for all age class	Age dependent selectivity (separate 0-1 age to other class)	Same selectivity for all age class
CPUE lambda	5 for LL 1 for other	5 for LL 1 for other 1 for all	Postpone decision
CPUEcv	Lowest CV is set as 0.2		Revisit input CV
effN for LenComps	scale to have same effN to FL8		Postpone decision, exploratory work new data
SRR	B-H	B-H, 2-line	B-H, explore H-S model, retune model w different h values explore Sheperd S-R (to be available soon v3.2)
R0	Estimated	estimated	estimated
Steepness	1 (with sensitivity tests)		1 (with sensitivity tests), run estimate h, profile
sigmaR	0.6		0.6, run estimate
1st year of main Rdev	1946	1946 or no Rdev	revisit
R0 offset	Estimated	extend earlier year ?	estimated
SR auto correlation	No	w/Auto correlation	
Initial F	LL, tuna PS, troll with eqC	LL, tuna PS, troll with eqC no initial eqC	Estimate Finit without fitting to EqC
Diagnostics of the model	Bootstrap,		Same method is used, and try MCMC.

Table 3. Sensitivity analysis setting in the 2010 PBFT meeting (Table 2 in Ichinokawa et al. 2010)

Categories	Base case	Sensitivity	
Biological Parameters (growth)			
CV at age-0 (L1)	fixed, 0.25	0.15	
CV at age-0 (L1)	fixed, 0.08		
L at Lmin	fixed, 21.5		
L_inf & k	fixed, Shimose et al. (2008)	Lower K	
		Higher K	
		Shimose et al. (2009)	
Bioloical Parameter			
Mature at age	fixed, 0.2 for age 3, 0.5 for age 4	0.2 for age 4, 0.5 for age 5 and 1 for >6 ages	
steepness	fixed, 1	fixed, 0.8	no possitive define
Biological Parameters (M)			
Natural Mortality	Fixed, 1.6 for 0-age, 0.386 for 1-age, 0.25 for >1 age	Ms>3 years old is 0.27	
		Ms>3 years old is 0.2	
		Ms>1 years old is 0.29	
		Ms>1 years old is 0.31	
		Ms>1 years old is 0.23	
		Ms>1 years old is 0.21	
		Ms>1 years old is 0.19	
		Ms of 0-1 year old is 1.80 and 0.46	
		Ms of 0-1 year old is 1.30 and 0.30	
		Ms used in 2006 with VPA	
		Michael's M	
		Ray's M	not converged
		Ms used in 2008 stock assessment	
Assumption of Recruitment			
S-R function form	1, Beverton - Holt	4, CAGEAN-like unconstrainted recruitment	
Sigma R	fixed, 0.6	Fixed, 1	
Term for estimating recruitment deviations	1946-2006	Estimated from 1951 to 2006	
		Estimated from 1941 to 2006	
CPUE			
Weighting factors	5for JLL CPUE, and 1 for others	1 for all CPUEs	
Survey data of CPUE series		Add aditional CPUE of 25	
		Add aditional CPUE of 26	
		Add aditional CPUE of 27	
		Replace CPUEs of 14 and 15 with 12 and 13	
		Replace CPUEs of 14 and 15 with 12 and 13	
		Replace CPUEs of 14 and 15 with 12 and 13	
		Replace CPUEs of 17 with 21	
		Replace CPUEs of 17 with 22	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove Jp-CLL)	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove Jp-DLL52-74)	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove Jp-DLL75-92)	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove Jp-DLL52-92)	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove Jp-Troll)	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove Tw-LL)	
		Remove CPUE of JLL(Remove Jp-CLL)(Remove US PS)	
Equilibrium catch			
Assumption of equilibrium catch	Fixed referring Mu to et al. 2008.	Twice of all equilibrium catch	
	The fisheries with equilibrium catch are FL 1, FL 3 and FL 4.	Half of all equilbirium catch	
		Twice of purseseine fisheries	
		Half of purse seine fsheries	
		Twice of troll fisheries	
Length data			
weighing lambda	same weiting factor used in 2009 (Anon. 2009a)	All length lambda is 1	
	Details are shown in Table 1	Length lambda is re-weighting one time	
		Removelength data (Jp-LL)	
		Removelength data (Jp-smallPS)	
		Removelength data (Jp-tunaPS)	
		Removelength data (Jp-troll)	
		Removelength data (Jp-PL)	
		Removelength data (Jp-SetNet)	
		Removelength data (Tw-LL)	
		Removelength data (EPO-PS)	