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Modification introduced to the input fishery data for Stock Synthesis III model used in the 2010 Pacific bluefin tuna stock assessment

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Summary

In last 2010 stock assessment, fork length frequency distributions in “Northern part of set net fishery (F7)” and “Other fishery (F13)” were used as input data into Stock Synthesis 3 model. In last ISC PBF WG meeting (preparatory meeting for the coming full stock assessment in 2012), introduction of weight frequency data to replace the length data for the above mentioned two fleets was recommended, because weight frequency data were richer in volume than length frequency data in these fisheries. Therefore, definition of weight bin size was needed. In this document, we propose definition of weight bin size, based on recommendation by the last ISC PBF WG meeting (Jan.-Feb. 2012).

Substantial changes were introduced to the size data used in the previous assessments, for “Japanese purse seine fishery catching adult PBF operated in Pacific Ocean (F4)” and “Troll fishery (F5)”. Those changes are described in this paper.

1. Definitions of weight bins for fleet 7 and 13

In past, the weight records of individual fish had been converted to lengths using a weight-length relationship to create the length compositions to be input to Stock Synthesis 3 (SS3). In last data preparation workshop of PBF WG, fork length distributions were also prepared for preliminary SS3 runs, for “Northern part of set net fishery (F7)” and “Other fishery (F13)” (Kai and Takeuchi, 2012; Abe et al., 2012). However, length frequency data in these fisheries were less adequate than weight data. Coverage rates of fish with weight records attained 99.9 % in F7 and 100 % in F13; owing to use of the sales slips, while those of length measurements were 1.2 % and 20.9 %, respectively (Table 1). Moreover, it is apparent that most of the length measurements of fish were biased toward larger size. Most of the smaller sized fish (< 50 cm) were not measured, even though obvious mode in weight frequencies appeared at the weight class smaller than 8 kg, corresponding to 50 cm in FL (Abe et al., 2012). As the results, use of weight frequency data was recommended by ISC PBF WG intead of length data.

In order to define the weight bin size, weight-age relationship were calculated based on both the length-age relationship (Shimose et al., 2012) and weight-length relationship (Kai et al., 2007). The weight-age relationship is given in Figure 1, and the weight bin size corresponding to age classes are proposed in Table 2. Weigh values of each bin are given in 0.1 kg, according to the recommendation of last PBF WG.

The weight unit recorded in sales slip is either 0.1 kg or 1 kg. The 6.3 % in F7 and 83.3 % in F13 of the weight data are available in 0.1kg intervals, conversely, 93.7 %,

16.7 % occurred with 1 kg unit. To calculate using mixed data of both 0.1 kg and 1 kg unit, the weight frequency bins are defined by rounding to the closest kg class. The other option is to adopt 0.1kg and ignore data recorded in kg. However, if this is done, 83.3% of the data for F13 will be lost. For this reason, it was considered more desirable to include all the data by adopting 1 kg definition for bins even if this may create some bias in the bins (Table 3).

2. Using "superperiod" for fleet 4

Input data of fleet 4 is fitted as superperiod, that is, length composition of season 4 was combined with that of season 1 in the next year. They are fitted to predicted combined length frequency data of season 4 and season 1 in the following year, for reason that the target size fish in both seasons was very similar.

3. Additional data for fleet 5

In 2010 stock assessment, PBF WG did not include any sizes exceeding 160 cm fork length measured in troll fishery (F5). Because most of fish caught by the fishery are 0-age fish, and target size are obviously less than 160 cm fork length. This time, all of the fish (include over 160 cm) was used as input data for SS3 in principle not to exclude any data.

Reference

Abe M, Yamazaki I and Kanaiwa M (2012) Preliminary analysis of catch at size for Pacific bluefin tuna, *Thunnus orientalis*, landed by Other fishery (Fleet 10). ISC/12-1/PBFWG/06

Kai M (2007) Reviews of weight-length relationships on PBF. ISC/07/PBF-WG2/02

Kai M and Takeuchi Y (2012) Update and re-examination of the estimation of catch at size of Pacific Bluefin tuna *Thunnus orientalis* caught by Japanese set-net fishery. ISC/12-1/PBFWG/05.

Shimose T and Takeuchi Y (2012) Updated sex specific growth parameters for Pacific bluefin tuna *Thunnus orientalis*. ISC/12-1/PBFWG/12.

Table 1. Number of weight and length measurement data and those coverage rates for “Northern part of set net fishery (F7)” and “Other fishery (F13)”.

	Number of			
	weight measurement (coverage)	length measurement (coverage)	weight measurement each 0.1 kg (coverage)	weight measurement each 1 kg (coverage)
Fleet 7	142,317	1,771	8,978	133,339
	99.9%	1.2%	6.3%	93.7%
Fleet 13	165,077	34,519	137,506	27,627
	100.0%	20.9%	83.3%	16.7%

Table 2. The first decimal place of weight bin values at each age class in “Northern part of set net fishery (F7)” and “Other fishery (F13)”.

Age	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	
Weight (kg)	0~	0.5~	2.1~	5.1~	9.8~	15.9~	23.5~	32.4~	42.4~	53.2~	
Age	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	
Weight (kg)	64.7~	76.6~	88.9~	101.2~	113.6~	125.8~	137.8~	149.5~	160.9~	171.9~	
Age	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	
Weight (kg)	182.4~	192.5~	202.1~	211.2~	219.9~	228~	235.7~	243~	249.8~	256.1~	
Age	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0
Weight (kg)	262.1~	272.9~	282.2~	290.3~	297.3~	303.3~	308.5~	312.9~	316.7~	320~	322.7~

Table 3. Weight bin values at each age class which rounded to the nearest kg in “Northern part of set net fishery (F7)” and “Other fishery (F13)”.

Age	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Weight (kg)	0~	1~	2~	5~	10~	16~	24~	32~	42~	53~
Age	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
Weight (kg)	65~	77~	89~	101~	114~	126~	138~	150~	161~	172~
Age	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5
Weight (kg)	182~	193~	202~	211~	220~	228~	236~	243~	250~	256~
Age	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0
Weight (kg)	262~	273~	282~	290~	297~	303~	309~	313~	317~	320~	323~

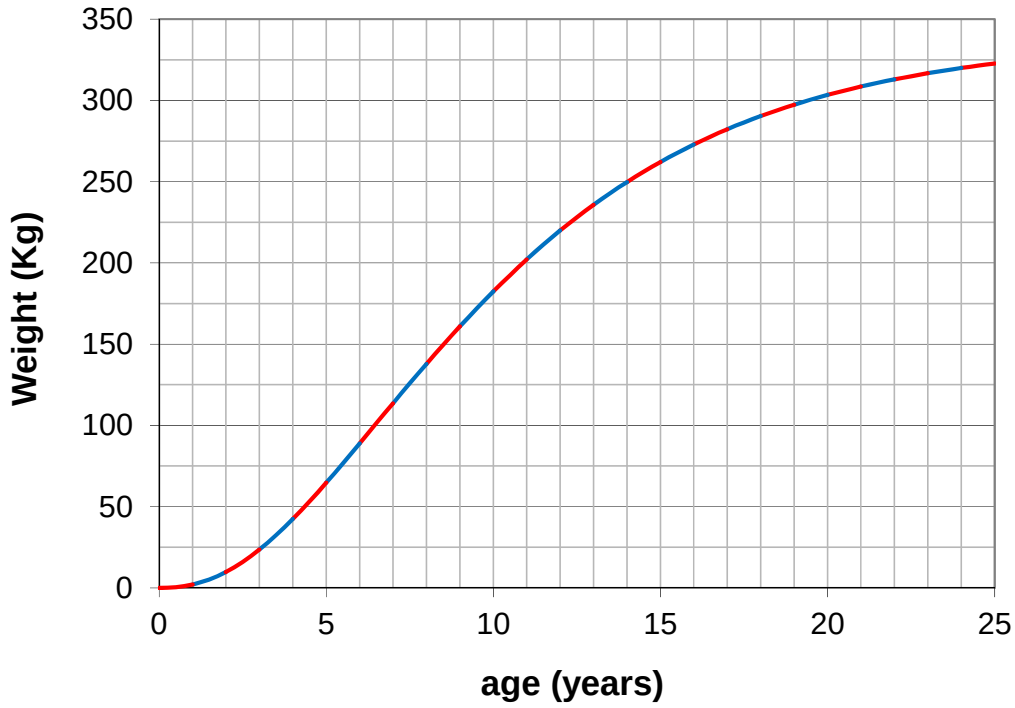

Figure 1. Weight-age relationship for Pacific bluefin tuna calculated by length-age relationship (Shimose et al., 2012) combine with weight-length relationship (Kai et al., 2007). Red and blue colors indicate weight ranges each age class, respectively.