

# The input data format for Pacific Bluefin tuna stock

# assessment conducted by Stock Synthesis.

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#### 1 Introduction

Stock Synthesis (SS; Methot and Wetzel 2013) modeling framework has been used for the Pacific Bluefin Tuna (PBF) stock assessment since it was formally adopted as a replacement for the VPA modelling in the 2008 assessment (ISC, 2008). SS is an Integrated Analysis that embraces advantages of virtual population analysis and production model (Methot and Wetzel, 2013).

SS also accepts variable data sources like fishery data, age data, mark and recapture data and environmental data as input data. The PBF stock assessment uses catch, size composition and indices. However, these input data allow pairs of units (ex. weight/number for catch, length/weight for size composition). PBFWG members and modelers could be confused by the data units if those were not specified.

This document provides the explanations for PBF stock assessment input data and proposes the submission formats for the PBF assessment data to be compiled into SS input data file.

#### 2 Input data format

#### 2.1 Temporal Stratification

In the stock assessment for PBF, "fishing year" is defined as July 1st through June 30th of the following calendar year. Unless otherwise indicated, the term "year" in this document refers to the fishing year. The time period in the assessment of PBF is started from 1952, with catch and size composition data compiled quarterly as follows; Season 1: July-September, Season 2: October-December, Season 3: January-March, and Season 4: April-June. Relationships between calendar year, fishing year, and year class are shown in Table 1.

#### 2.2 Retained catch and unaccounted removal

Both units of catch in weight and number are used for the catch data in the PBF stock assessment. The catch unit in number was firstly applied for US sport fishery on 2012 assessment (ISC 2011). In the 2020 PBF stock assessment, the catches in weight were used in 20 fleets and the catch in number are used in 5 fleets (ISC 2020). For catch in weight, catch amount (metric ton) are compiled quarterly. For catch in number, catch number (x1000 individuals) are compiled quarterly. The WG members are encouraged to specify the unit of the catch in the data submission format (See Appendix 1). The different value of coefficient of variation (CV) are set for the retained catch or unaccounted removals (e.g. discard and post release mortality). The CV value for retained

catch and unaccounted removal has been assumed as 0.1 and 0.3, respectively. See Appendix 1 for the submission format of catch data.

#### 2.3 Size composition

#### 2.3.1 Size composition

In the PBF stock assessment, both units of length and weight are used for the size composition inputs. The only length composition had been used by 2010 stock assessment, and the weight composition has been introduced in 2012 assessment by applying the generalized size composition function (ISC 2012). In 2020 stock assessment, length compositions were used in 22 fleets and weight compositions were used in 3 fleets (ISC 2020). The WG members are encouraged to choose the corresponding data submission format depending on the unit of the size composition data (See Appendix 2 and 3).

The size compositions are raw data or Catch-at- size raised to each fishery total catch and compiled in defined bins by quarter. Each bin (bin<sub>i</sub>) is compiled as following.

#### $bin_i \le x < bin_{i+1}$

where x is length data measured fork length (FL) to the nearest centimeter (cm) or weight data measured weight to the nearest kilogram (kg). The lower boundary of each length or weight bin is used to define the bin. The smallest and largest bins work as accumulators (Methot et al., 2019). However, to avoid the selectivity parameter (such as ascending slope or peak of the double normal selectivity) being close to the boundaries of the assumed range, the observed size data at the smallest bin are added to the second smallest bin. The length bins of 2, 4, and 6 cm width were used for 16-58, 58-110, and 110-290 cm FL, respectively. Composition data in weight were binned in a range of bin sizes (0, 1, 2, 5, 10, 16, 24, 32, 42, 53, 65, 77, 89, 101, 114, 126, 138, 150, 161, 172, 182, 193, 202, 211, 220, 228, 236, 243, and 273 kg). The bin strategy attempted to create two bins for each age between 0 and 15 (Fujioka et al. 2012). See Appendix 2 for the submission format of length composition data and Appendix 3 for the submission format of weight composition data. Input sample size are used for the weighting of the expected values for observation (Methot et al., 2019). In the PBF stock assessment, depending on the corresponding fisheries and available data, the input sample sizes are from four different criteria; "Number of fish measured", "Number of landing wells sampled", "Number of the total month of wells sampled by port", and "Number of haul wells sampled".

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#### 2.4 Abundance index

In the PBF stock assessment, standardized CPUEs from fishery data are used as abundance indices. 12 abundance indices were submitted to the 2020 PBF stock assessment, and 5 out of 12 indices were included in the likelihood function (ISC 2020). The unit of the abundance indices could be in weight (e.g. conventional troll index) or number (e.g. longline indices), the WG members are encouraged to specify the unit of the index in the data submission format (See Appendix 4).

When the CV statistically estimated by the CPUE standardization model are less than 0.2, the input CVs for the assessment has been conventionally specified at 0.2 to take a process error with respect to the true abundance trend into account. If the CVs estimated by the standardization model were larger than 0.2, those calculated CV values by the CPUE standardization model may be used for the input value. WG may want to discuss further about the countermeasure to this situation. The WG members are encouraged to input the calculated CV values by the CPUE standardization model in the data submission format (See Appendix 4).

## 3 Reference

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Fishing year	201	8	2019	1	2020		2021				
Season	Season 1 Season 2	Season 3 Season 4	Season 1 Season 2	Season 3 Season 4	Season 1 Season 2	Season 3 Season 4	Season 1 Season 2				
SSB		SSB in 2018		SSB in 2019	SSB in 2020						
Day of birth in SS	Birthday of 2018 yr class		Birthday of 2019 yr class		Birthday of 2020 yr class	Birthday of 2021 yr class					
Recruitment	Recruitment in 2018		Recruitment in 2019		Recruitment in 2020	Recruitment in 2021					
Year class	2018 yr class		2019 yr class		2020 yr class	2021 yr class					
Calender year	2018		2019		2020	2021					
Month	7 8 9 10 11 12	2 1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12				

**Table 1**. Definition of calendar year, fishing year, and year class used in the Pacific bluefin tuna (*Thunnus orientalis*) stock assessment.

# Appendix 1.

Catch data format. Green area should be updated by members. Right side table is same format with data file. The data on left side would be summarized to data file format automatically.

	Country	Japan	#Input							
	Fishery	Longline	#Choose from the I	list						
Data	catch information	retain	#Choose from the I	list						
Content	note (add season, area…)		#Input (in necessa	ary)						
1	Fleet name (If available)	F1JLL	#Choose from the I	list						
	Unit	weight	#Choose from the I	list						
						DO NOT change.	Those cells will be	automatically upda	ated from your inpu	t.
	DO NOT change. FY and FS	c	Subject to input		#_	F1JLL		0		
	Fishing Year	Fishing Season	Calendar Year	Calendar Quarter	Amount (mt)	#Fishing Year	Fishing quarter	Fleet	catch	CV
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1
									1	0.1

#### Appendix 2.

Length composition data format. Green area should be updated by members. The bottom table is same format with data file. The data on upper table would be summarized to data file format automatically.

#### 1cm bin input data

	Country	Japan	#Choose from the list								
	Fishery	Longline	#Choose from the list								
Data	note (add season, area $\cdots)$		#Input (in necessary)								
Content	Fleet name (If you have)	F1JLL	#Choose from the list								
	Unit	length	#Choose from the list								
	Data information	raised number	#Choose from the list								
	DO NOT change.			Cubicat to input							
	FY and FS are automatic	ally culculated from CY and CQ.		Subject to input							
	Fishing year	Fishing quarter	Calendar year	Calendar quarter	sample No.	1	2	3	4	5	6

#### Data file format

DO NOT	Cchange.	This sheet	will be automatical	ly upda	ted from y	our inpu	t.							
#Fleet	year	quarter	size freq nGender	Part	samp	le Nc	16	18	20	22	24	26	28	30
#_	F1JLL	Japan Longli	ne length composit		10									
	1		1	1	0	0	0	0	0	0	0	0	0	0
	1		1	1	0	0	0	0	0	0	0	0	0	0
	1		1	1	0	0	0	0	0	0	0	0	0	0
	1		1	1	0	0	0	0	0	0	0	0	0	0
	1		1	1	0	0	0	0	0	0	0	0	0	0

## Appendix 3.

Weight composition data format. Green area should be updated by members. The bottom table is same format with data file. The data on upper table would be summarized to data file format automatically.

	Country	Japan	#Choose from th							
r	Fishery		#Choose from th	ie list						
Data	note (add season, area $\cdots$ )		#Input (in neces	sary)						
Content	Fleet name (If you have)	F10JSN(HK_AM)	#Choose from th	ie list						
	Unit	weight	#Choose from th	ie list						
	Data information		#Choose from th	ie list						
	DO N FY and FS are automatica	<u>OT change.</u> ally culculated from CY and CQ.								
	Fishing year	hing year Fishing quarter C		Calendar quarter	sample No.	1	2	3	4	- 5

#### Data file format

DO NO	) <u>T change</u> . T	his sheet v	will be automatic								
#Fleet	year	quarter	size freq nGende	er Part	sam	ple No.	0	1	2	5	10
#_	F10JSN(H	IK_AM)Ja	pan weight comp	osition _				10			
	10		10	1	0	0	0	0	0	0	0
	10		10	1	0	0	0	0	0	0	0
	10		10	1	0	0	0	0	0	0	0
	10		10	1	0	0	0	0	0	0	0

## Appendix 4.

Abundance index data format. Green area should be updated by members. The right table is same format with data file. The data on left side would be summarized to data file format automatically.

	Country	#Choose from the list														
Data	Fishery	#Choose from the list														
Content	note (add season, area…)	#Input (in necessary)														
Content	Fleet name (If you have) S11Jpn_R_moni_1st	#Choose from the list														
	Unit	#Choose from the list														
	DO NOT change. Subject to input				DO NOT change. Those cells will be automatically updated from your									innut		
	FY and FS are automatically culculated from CY and CQ.	oubject to	nput						change. I		will be du	tomaticali	, apaatea	iioiii youi	input.	
	Fishing year Fishing month	Calendar year Calendar quarter	Index_observed	CV_calcula	ated				#_	S11Jpn_F	R_moni_1st	16				
											36	0	0.2	#_	S11Jpn_R_	_moni_1st
											36	0	0.2	#_	S11Jpn_R	_moni_1st
											36	0	0.2	#_	S11Jpn_R_	_moni_1st
											36	0	0.2	#	S11Jpn R	moni 1st