Updates of Japanese quarterly catch data up to 2014 fishing year

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Summary

In the next full stock assessment on Pacific bluefin tuna, input data such as quarterly catch, size composition and CPUE will be updated up to June 2015 (2014 fishing year). This paper presents updated quarterly catch of fleets related to the Japanese fisheries up to 2014 fishing year. Prior to the updates, errors in the input data for the previous stock assessment were corrected and those influences were tested through a sensitivity run. In addition, annual catches for the Japanese coastal longline and other fisheries from 2007 to 2013 were revised.

Introduction

Previous stock assessment of Pacific bluefin tuna were completed in February 2014 through simple updates of input data (quarterly catch, size frequencies and CPUE) up to June 2013 (2012 fishing year). The next full stock assessment will be conducted in February-March 2016 with input data updated up to June 2015 (2014 fishing year). Quarterly catch data submitted from the ISC-PBFWG members is essential input data for the SS3 model for stock assessment.

Prior to updates of the data, the quarterly catch data used for the 2014 stock assessment were revised with correcting errors pointed out by Oshima et al. (2014). In addition, annual catches of 2007-2013 for the Japanese coastal longline and other fisheries were revised. Both changes were reflected in the latest ISC catch table (ISC 2015). Description of this revision is documented in this paper. Finally, this paper presents the updated quarterly catch of fleets related to the Japanese fisheries based on the same configuration of fleets of the 2014 stock assessment. In addition, because a new fleet for the Japanese troll for farming will be set in the next stock assessment, the quarterly catch for this fleet is provided in this paper.

Data sources

Following six data source were used for the updates of the quarterly catch data;

1. The Annual Report of Catch Statistics on Fishery and Aquaculture published by the Statistics Department, Ministry of Agriculture, Forestry and Fisheries, the Government of Japan (SD report, previously referred to as “SID report”). The latest available SD report available is for 2010. In the latest SD report, all PBF were categorized into “Bluefin tuna” regardless of fish size, whereas small PBF had been sorted into “Other tunas” in the SD report published before 2007.
2. Catch data obtained from collection of sales slip at the unloading sites. This type of data collection has been carried out as a part of the Research Project on Japanese bluefin tuna (RJB),

which started in 1994.

3. Monthly catch data by landing ports, derived from the Survey on Catch of Bluefin Tuna in Japan's Coastal Areas implemented by Japan Fishery Agency, Ministry of Agriculture, Forestry and Fisheries, the government of Japan, called as "JFA data" and used for PBF catch estimation of troll and set net fisheries since the 2nd quarter of 2008.
4. Three types of logbook of larger scale fisheries data are available. The first is logbook data from tuna and small pelagic purse seine fisheries submitted from fishing vessels larger than 40 GRT. The second is logbook data from the distant water and offshore longline fisheries operated by fishing vessel of 20 GRT and over, which are raised to the entire fleet by coverage rate, are available since 1971 and include catch in weight (kg) aggregated by year, by month, by 5°x5° grid in latitude and longitude, by fishery category (distant water or offshore longline) and by tonnage classes of vessels. The third is logbook data submitted from fishermen engaging coastal longline with fishing vessel of 10 – 20 GRT.
5. Logbook data from small-scale coastal fisheries operated by a powered fishing boats such as troll and pole-and-line, collected by Japan Fishery Agency, Ministry of Agriculture, Forestry and Fisheries, the government of Japan, available since April 2011.
6. Complete survey of monthly catch for coastal fisheries throughout Japan conducted by Japan Fishery Agency, Ministry of Agriculture, Forestry and Fisheries, the government of Japan, available for troll vessels and set nets since 2014.
7. Report from fish farmers, information on number of age-0 PBF caught by troll fishery and released for sea pens submitted by all fish farmers of PBF, available since 2011.

Fishing year

In the stock assessment model, fishing year is applied. The fishing year starts from July and ends in June.

Definition of fleets

The existing base case model for the PBF stock assessment has 14 fleets, of which eleven are associated with Japanese fisheries (Table 1). Fleet 1 (FL1) was set for the Japanese longline fishery including the distant water and offshore longline and the coastal longline. The Japanese and Korean small pelagic fish purse seiners shared Fleet 2 (FL2). The Japanese tuna purse seine fishery in the Sea of Japan was allocated to Fleet 3 (FL3), which included minor amount of the Taiwanese purse seiners. Fleet 4 (FL4) was set for the Japanese tuna purse seine off the Pacific coast of Japan. Fleet 5 (FL5) was the Japanese troll fishery. Fleet 6 (FL6) was set for the Japanese pole-and-line fishery and included the Japanese drift net, the Taiwanese drift net and the Taiwanese other fishery. Fleets 7 to 10 (FL7-10) were set for the Japanese set net fishery. Four kinds of the set net fisheries were

separated in consideration of spatio-temporal differences in size selectivity (Kai and Takeuchi 2012). The Taiwanese longline was representative fishery of Fleet 11 (FL11), which included catches from out of the ISC members. Fleet 12 (FL12) is composed of commercial fisheries operated in the Eastern Pacific Ocean and is dominated by the Mexican purse seine fishery since 2000s. Fleet 13 (FL13) corresponded to the US sports fishing. Fleet 14 (FL14) was set for the Japanese other fisheries including angling, trawl and other longline fisheries.

Revision of quarterly catch data for previous years

There were some errors in the input data for the 2014 stock assessment data (Oshima et al. 2014). The errors were non-use of catch data for minor fisheries and inconsistencies between the catch data used in the assessment and annual catch data reported in the ISC catch tables. The ISC-PBFWG decided that corrections of errors in the input data were not applied in the 2014 stock assessment and should be done through investigation of effects of the changes on the stock assessment results in future assessment (PBFWG 2014). The input data used for the 2014 stock assessment were revised based on Oshima et al. (2014). Additionally, a sensitivity run was performed with the base case run of the 2014 stock assessment so as to assess the effects of the data revisions on the stock assessment results.

Revision of annual catch for coastal longline and others

The Japanese coastal longline is defined as a longline fishery operated by fishing boats smaller than 20 gross registered tonnage (GRT). In a main fishing season of April to June, adult PBF are caught by this fishery in the waters spreading from Nansei Islands to Kyusyu Island and catch amount during this season accounts for more than 70% of catch of the year. The annual catch of this fishery is reported in 'coastal longline' gear in the ISC catch table. After 2006, it was derived from a nationwide-annul total of catch for a category of 'Engan-Maguro-Haenawa' in the SD report.

In the SD report, there are three fishery categories related to longline catching tunas. The first and second categories are called as 'Enyo-Maguro-Haenawa' and 'Kinkai-Maguro-Haenawa', respectively, equivalent to their fishing licenses. Catch from the longline vessels of 20 GRT and over are classified as either the first category or the second one. Additionally, the catch from the longline vessels smaller than 20 GRT and with the license of 'Kinkai-Maguro-Haenawa' are included in the 'Kinkai-Maguro-Haenawa' category. The catch of all the longline boats smaller than 20 GRT and without the 'Kinkai-Maguro-Haenawa' license are incorporated into the third category of 'Engan-Maguro-Haenawa'.

On the other hand, the small-scale coastal longline using a total of 100-500 hooks is operated by small-scaled fishing boats (< 10 GRT) in Tsugaru Strait located between the north end of Aomori and the south end of Hokkaido. Its main fishing season is during the second half of year, different from the coastal longline described above. In addition to this longline, hand line targeting PBF are

also conducted in Tsugaru Strait with the small-scaled fishing boats. Annual catch of this longline is calculated with the RJB data. In the conventional ISC catch table by 2014, the annual catch for this longline was separated from that for the coastal longline mentioned above and reported as a part of 'others' (other gears).

The annual total catches of 'Engan-Maguro-Haenawa' by prefecture have been available in the SD report since 2007. Those in Aomori and Hokkaido are apparently also included in the annual-nationwide total of catch of 'Engan-Maguro-Haenawa' in the SD report. Hence, PBF catch by the small-scale longline in Tsugaru Strait for 2007-2013 must be doubly reported in the ISC catch tables by 2014. That is, the annual catches of the small-scale longline fishery in Tsugaru Strait derived from the SD report were included in 'coastal longline' gear in the ISC catch table, meanwhile those calculated with the RJB data were included in other gears of that table.

In July 2015, the annual catches for coastal longline and others from 2007 to 2013 were revised prior to updates of the ISC catch table. There are some possibilities that the catch of longline in Aomori and Hokkaido based on the SD report include those from hand line, because the small-scale fishing boats in Tsugaru Strait can operate multiple gears. In contrast, the RJB data, which are obtained from the sales slip collected at unloading ports, are more reliable in identification of gear than the SD report. Hence, the RJB data were used as a data source of the annual catch of the longline fishery in Tsugaru Strait. The following procedures were used to revise 'coastal longline' and 'others' from 2007 to 2013 in the ISC catch table.

1. The annual catches for 'Engan-Maguro-Haenawa' in Aomori and Hokkaido listed in the SD report were removed from the annual catch for 'coastal longline' gear in the ISC catch table.
2. The annual catch for the coastal longline in Tsugaru Strait calculated with the RJB data was removed from those for 'others' in the ISC catch table and added to those for 'coastal longline' gear.

Consequently, the annual catches of the longline fishery in Tsugaru Strait since 2007 were incorporated into not 'others' but 'coastal longline' in the ISC catch table.

Results and discussion

Revision of quarterly catch data for previous years

The errors were found in Fleets 1, 6-10, 11 and 14 and causes of those were identified (Table 2). In particular, it was found that overall historical catch data for the Japanese miscellaneous fishery (unclassified fishery) were not included. The annual catches of this fishery in recent year were less than 100 mt, whereas those in 1950s or 1960s exceeded 1,000 mt. The ISC-PBFWG (2008) agreed that the quarterly catch data for the Japanese miscellaneous fishery were incorporated into the Japanese set net fleet, which constitutes a single fleet in the stock assessments prior to 2012. In the current fleet configuration, the quarterly catch for set net are allocated to four fleets of Fleets 7-10. Because

Fleets 7 and 8 include the catch data from limited regions or limited seasons, the catches in the 1st to 3rd quarters of fishing year for the miscellaneous fishery were incorporated into Fleet 9, meanwhile those in the 4th quarter were included in Fleet 10. As a whole, the revision of catch data resulted in increase of the annual catches, although about 800 mt decrease was made in Fleet 10 by the revision (Fig. 1).

The revision of catch data hardly affected estimates on recruitment of age-0 fish (Fig. 2). In contrast, the revision of catch data effected increases of SSB, ranging from 1,018 mt to 6,524 mt on an average of 3,046 mt. In particular, obvious increases of SSB were found after 2004.

Updates of catch data

Previous and updated annual catch for 'coastal longline' and 'others' in the ISC catch table are listed in Table 3. The revised annual catches for 'coastal longline gear' were 88% of the previous ones on average. The revised annual catches for 'others' were decreased to 43% to 63% of the previous ones.

Figure 3 shows time series of the annual catch derived from quarterly catch for Fleets 1-10 and 14 from 1952 fishing year to 2014 fishing year. The catch data for the longline in Tsugaru Strait were included in Fleet 14 in a consistent manner to the previous stock assessment, because seasonality and size selectivity of this longline deemed to be different from those of Fleet 1 (JLL) (Abe et al. 2012; Nishikawa et al. 2015).

Quarterly catch for the Japanese troll fishery for farming

Both catch in weight and number are available for the troll fishery for farming (Table 4). Because main fishing season of this fishery is from July to September, it is reasonable that the annual catches are incorporated only into the 1st quarter in fishing year (3rd quarter in calendar year).

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Table 1 Definition of fleets in the SS3 model as a base case of the 2014 stock assessment. Each fleet is composed of single or multiple fisheries. Component 1 corresponds to a representative fishery of each fleet.

Fleet	Abbr.	Component 1 (Representative fishery)	Component 2	Component 3	Component 4	Component 5
1	JLL	Jpn longline				
2	SPelPS	Jpn small pelagic fish purse seine Kor small pelagic fish purse seine	Kor trawl			
3	TunaPSJS	Jpn tuna purse seine in the Sea of Japan				
4	TunaPSPO	Jpn tuna purse seine off the Pacific coast of Japan				
5	JpnTroll	Jpn Troll				
6	JpnPL	Jpn Pole-and-line	Jpn drift net	Twn drift net	Twn others	
7	JpnSetNet NOJWeight	Set net of northern part of Japan[1]				
8	JpnSetNet NOJLength	Set net of Hokuriku region of Japan[2] for quarters 3 and 4				
9	JpnSetNetOA LengthQt1-3	Set net of other area in Japan for quarters of 1 to 3	Jpn miscellaneous fishery for quarters of 1 to 3			
10	JpnSetNetOA LengthQt4	Set net of other area in Japan for 4th quarter	Jpn miscellaneous fishery for 4th quarter			
11	TWLL	Twn longline	Out of ISC members			
12	EPOPS	US purse seine	US others	Mex purse seine	Mex others	EPO others
13	EPOSP	US sports				
14	Others	Jpn angling (Hand line)	Jpn trawl	Jpn other longline		

[1]Northrn part of Japan consisted of Hokkaido and Aomori (Kai and Takeuchi 2012).
[2]Hokuriku region consisted of prefectures on the Sea of Japan sides (Kai and Takeuchi 2012).

Table 2 List of error in input data used in the 2014 stock assessment. There are two type of error; the first is non-use of catch data for particular fisheries and inconsistencies between quarterly catch data used in the 2014 stock assessment and annual catch data reported in the ISC catch table.

Fleet	Type of error	Description of errors in the input data
1	Non-use	In the 1974 calendar year, catch from the Japanese distant water and offshore longliners were not included.
1	Inconsistency	Annual total of quarterly catch for the 2002-2010 calendar years differed from the annual catches reported in the ISC catch table.
6	Non-use	Catches for the Taiwanese other fisheries were not included after the 2004 fishing year.
7-10	Non-use	Catches from the Japanese miscellaneous fishery did not include before 2010 fishing year.
7-10	Inconsistency	Annual total of quarterly catch for 2010 calendar year differed from the annual catch reported in the ISC catch table.
11	Inconsistency	Annual total of quarterly catch for 2002 to 2010 calendar years differed from the annual catches reported in the ISC catch table.
11	Non-use	Catches from out of the ISC members were not included after 2002 fishing year.
14	Inconsistency	Quarterly catches for 2009 and 2010 fishing years switched places.

Table 3 Previous and revised annual catches for ‘coastal longline’ gear and ‘others’ in the ISC catch table.

Year	Previous		Revised	
	Coastal longline	Others	Coastal longline	Others
2007	2,004	1,209	1,679	657
2008	1,476	1,192	1,371	770
2009	1,304	913	1,072	575
2010	903	918	885	495
2011	933	654	828	283
2012	792	779	667	343
2013	878	1,012	777	529

Table 4 Annual catch in number and weight for the Japanese troll fishery for farming.

Fishing year	Catch in number (1000 fish)	Catch in weight (mt)
1998	47	11.7
1999	214	53.6
2000	382	95.4
2001	549	137.3
2002	716	179.1
2003	884	220.9
2004	1,051	262.8
2005	908	226.9
2006	1,265	316.3
2007	1,753	438.2
2008	1,214	303.5
2009	512	127.9
2010	1,127	281.7
2011	808	202.0
2012	346	86.4
2013	519	129.7
2014	148	37.1

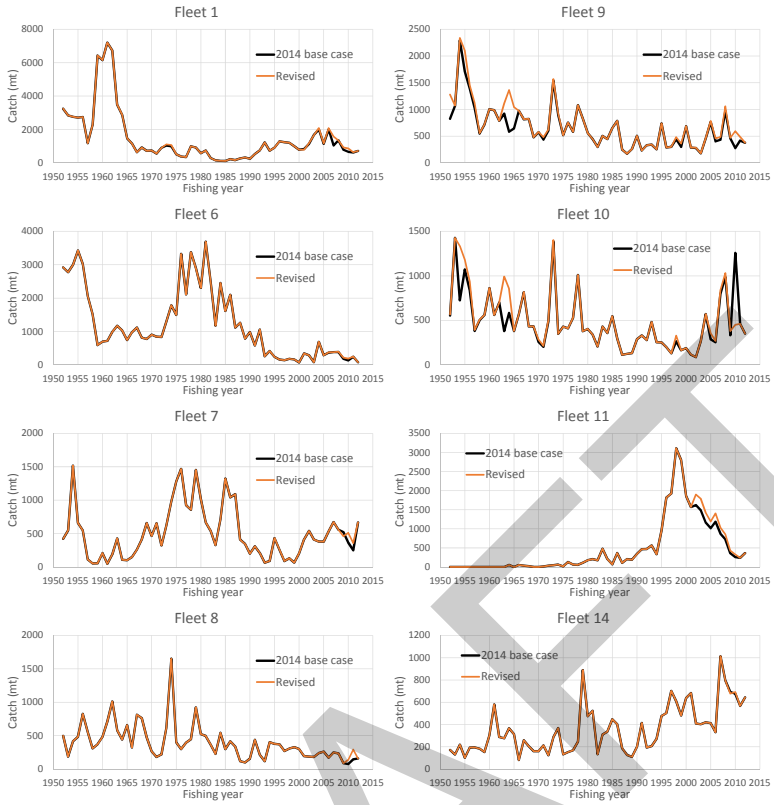

Fig. 1 Time series of annual catch derived from quarterly catch for Fleets 1, 6-11 and 14 from 1952 fishing year to 2012 fishing year. Thick black and thin orange lines indicate the catch data used for the base case of the 2014 stock assessment and revised catch data, respectively.

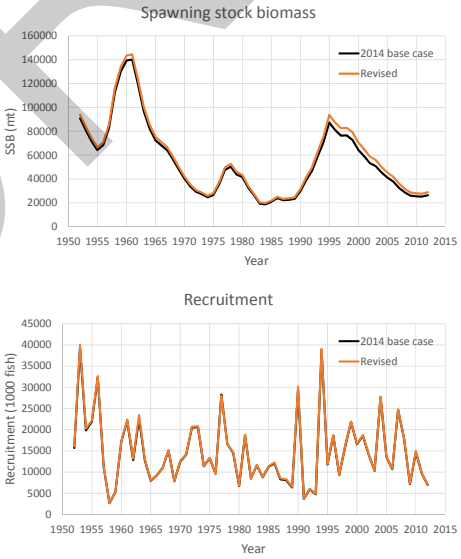

Fig. 2 Historical trends of spawning stock biomass (upper panel) and recruitment of age-0 fish (lower panel) estimated through the base case run of the 2014 stock assessment (black line) and sensitivity run with revised quarterly catch data (orange line).

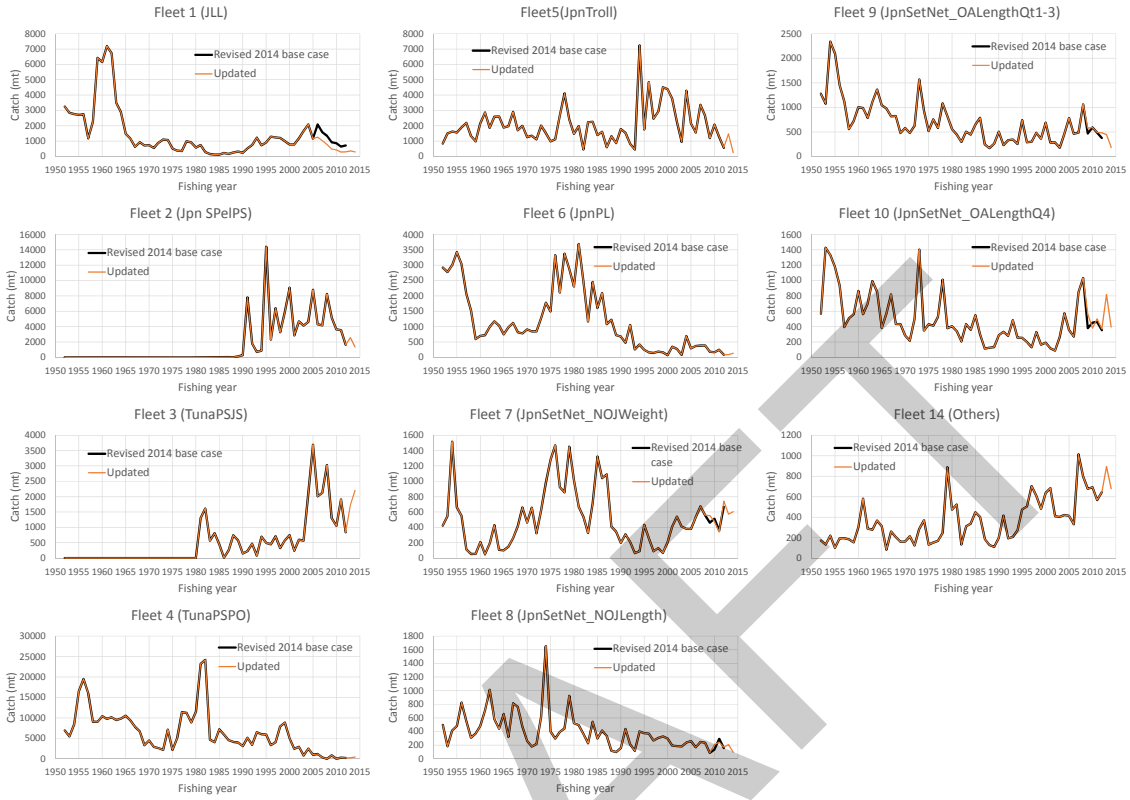

Fig. 3 Time series of the annual catch derived from quarterly catch for Fleets 1-10 and 14 from 1952 fishing year to 2014 fishing year. Thick black and thin orange lines indicate the catch data used for the revised catch data of the 2014 stock assessment (Fig. 2) and updated catch data, respectively.