Input data of Pacific bluefin tuna fisheries

for stock assessment model, Stock Synthesis 3;

Update for 2020 assessment

Kirara Nishikawa, Hiromu Fukuda and Shuya Nakatsuka

National Research Institute of Far Seas Fisheries,
Japan Fisheries Research and Education Agency
5-7-1, Orido, Shimizu-ku, Shizuoka 424-8633, JAPAN

March 2020

Summary

Benchmark stock assessment for Pacific bluefin tuna (PBF) will be conducted in March 2020. Input file, quarterly catch, size frequency, and abundance indices (CPUE) have been revised and updated up to fishing year 2018 (up to June in 2019 calendar year). This document is based on the tentative model circulated to PBFWG on 28th February 2020. Fleet definition was modified to treat the size frequency suitably (e.g. creation of new fleet for Japanese small pelagic fish purse seine fishery in the East China Sea for farming, separating Japanese longline by seasons).   Some size frequency data were revised and updated using improved estimation method (Japanese tuna purse seine fishery off the Pacific coast of Japan and Korean offshore large purse seine fishery). Abundance indices (CPUE) from Japanese longline, Japanese troll, and Taiwanese longlines were updated up to the 2018 fishing year where the CPUE standardization methods for Japanese and Taiwanese longlines were revised.

1.   Introduction

  WCPFC requested ISC to conduct assessment of Pacific bluefin tuna (PBF) in 2018 and 2020 (WCPFC 2017a, 2017b). In addition, they also requested projections for various harvest scenarios under the interim harvest strategy   as follows (WCPFC HS 2017-02);

  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").

  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%.

Where "initial rebuilding target" is $SSB_{MED;}$ median point estimate of SSB for 1952-2014 (WCPFC 2016), and "second rebuilding target" is 20% $SSB_{F=0}$ which was recommended to be reached by 2034 or 10 years after reaching the initial rebuilding target, whichever is earlier (WCPFC 2017a). ISC is required to provide relevant information on potential catch limit increases, reduction, and/or transfer (WCPFC 2017a, 2017b). In 2019, IATTC-WCPFC Northern Committee Joint Meeting requested harvest scenarios for future projections (WCPFC 2019).

     In response to the above situation, ISC PBFWG conducts the model-based assessment in March 2020. This assessment has been scheduled as "benchmark assessment", which reviews every aspect of the previous stock assessment. This document summarizes input data as the data catalog for the stock assessment using the Stock Synthesis 3 model (SS3). This document can be corresponding to the draft of "Stock assessment input data" section in the stock assessment report.

2. Definition of fishing year and temporal stratification of the input data

In the stock assessment for PBF, a "fishing year" is from July 1st of one calendar year through June 30th of the following calendar year. Thus, the 2018 fishing year corresponds to 1st July 2018 to 30th June 2019. The time period modeled in the assessment of PBF is 1952-2018 (fishing year), 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.

Recruitment is assumed to occur at the beginning of "Season 1" of fishing year (starting from July; see section 4) in the assessment model. Relationships between calendar year, fishing year, and year class are shown in Table 1.

3. Spatial stratification of the input data

PBF are distributed across the North Pacific Ocean and considered to be a single stock (Nakatsuka, 2019). Juvenile PBF move between the western Pacific Ocean (WPO) and eastern Pacific Ocean (EPO) (Itoh et al. 2003, Boustany et al. 2010), but it is difficult to use spatial explicit model due to a lack of information of movement rates. Thus, the previous assessments have been assumed an instantaneously mixed population and incorporated regional selection patterns as "areas-as-fleets approach (Waterhouse et al. 2014)". A simulation study on how to deal with movement in PBF stock assessment suggested that although the use of alternative model processes is not as effective as the spatially explicit model with estimation of movement rates, some management quantities are less biased in the model using fishery selection to account for availability (spatial patterns) as well as contact gear selectivity (Lee et al. 2017). Accordingly, PBFWG decided to continue to apply "areas-as-fleets approach", while spatially explicit model could be a future option.

4. Fishery definition

Provisionally, a total of 24 Fleets were defined for the stock assessment of PBF based on stratification of country, gear type, season, area, and size of fish caught (Table 2) after PBFWG data preparatory meeting (ISC, 2019). Representative fisheries for each Fleet are as follows;

Fleet 1: Japanese longline fisheries (JPLL),

Fleet 2: Japanese small pelagic fish purse seine fishery in the East China Sea (JPSPPS) for seasons 1, 3, and 4,

Fleet 3: Korean offshore large purse seine fishery (KROLPS),

Fleet 4: Japanese tuna purse seine fishery in the Sea of Japan (JP TPSJS),

Fleet 5: Japanese tuna purse seine fishery off the Pacific coast of Japan (JP TPSPO),

Fleet 6: Japanese troll fishery (JP Troll) for seasons 2-4,

Fleet 7: Japanese pole and line fishery (JP PL),

Fleet 8-10: Japanese set-net fisheries (JP SetNet),

Fleet 11: Japanese other fisheries (JP Others), mainly small-scale fisheries in the Tsugaru Strait,

Fleet 12: Taiwanese longline fishery (TWLL) in southern fishing ground,

Fleet 13: Eastern Pacific Ocean commercial purse seine fishery of USA (USCOMM),

Fleet 14: Eastern Pacific Ocean commercial purse seine fishery of Mexico (MXCOMM),

Fleet 15: Eastern Pacific Ocean sports fishery (EPOSP) for recent period (2014-),

Fleet 16: Japanese troll fishery for farming (JP Troll for Pen),

Fleet 17: Taiwanese longline fishery (TWLL) in northern fishing ground,

Fleet 18: Japanese small pelagic fish purse seine fishery in the East China Sea (JPSPPS) for seasons 2,

Fleet 19: Japanese troll fishery (JP Troll) for season 1,

Fleet 20: Japanese small pelagic fish purse seine fishery in the East China Sea (JPSPPS) for farming,

Fleet 26: Unaccounted mortality in weight

Fleet 27: Unaccounted mortality in number.

Fleet 28: Japanese longline fisheries (JPLL) for season 2-4,

Fleet 29: Eastern Pacific Ocean sports fishery (EPOSP) for early period (-2013)

Fisheries with small amount of PBF catch were also considered in the stock assessment. As the previous assessments (e.g. ISC 2016, ISC 2018), their catch amounts were included in the fleet with similar catch-at-size, fishing grounds, and seasons. For example, reported small catch by Korea (by trawl, set-net, and troll fisheries) is included in Fleet 3 (KROLPS) since this assessment. Taiwanese purse seine catch was included in Fleet 4, the driftnet catch of both Japan and Taiwan were included in Season 1 of Fleet 7, and the other Taiwanese catches were included in Season 4 of Fleet 7. Japanese miscellaneous catches for Season 1-3 and Season 4 were included in Japanese set-net fleets, Fleet 8 and 9, respectively. The other Japanese catch (by trawl and other small longline other than those from the Tsugaru Strait) were included in Fleet 11. Non ISC members' catch after FY2014 (i.e. by New Zealand, Australia, etc.) is included in Fleet 12 since this assessment.

5. Catch and discard data

5.1 Catch data

Although fisheries catching PBF have been operated since at least the beginning of the 20th century in the EPO (Bayliff 1991) and for several centuries in the WPO (Itoh 1961), the detailed fishery statistics prior to 1952—especially from the WPO—were not available. Therefore, the fishing year 1952 has been used as the starting year of the stock assessments because catch-and-effort data from Japanese longline and catch data from EPO commercial purse seine fleets were available from that year onward.

Throughout the assessment period, total annual catch fluctuated widely, which shows that the historical maximum and minimum total catches of calendar year are 40,383 t in 1956 and 8,653 t in 1990, respectively (Table 3, Fig 1). During the last 10 years, the average of annual catch is about 15,000 t (in 2009-2018 calendar

years). The majority is caught by purse seine fisheries: Japanese tuna purse seine fishery operating off the Pacific coast of Japan (Fleet 5) and US purse seine fishery operating EPO (Fleet 13) accounted for large portion of the catch until the 1990s, then catches of Japanese small pelagic fish purse seine fishery operating in the East China Sea (Fleet 2 and Fleet 18), Japanese tuna purse seine fishery in the Sea of Japan (Fleet 4), and Mexican purses seine fisheries (Fleet 14) have become relatively larger (Fig 1-(a)).

For the assessment model, quarterly catch data has been developed on a fleet basis (Table 4). For some of fisheries, the quarterly catches for the early period were estimated using recent quarterly catch proportions applied to annual catch data; e.g. Fleet 8 and 9 before fishing year 1994 (Kai 2007), Fleet 5 before fishing year 1971 (Takeuchi 2007), etc.. For other fleets, recent quarterly catches were directly derived from logbook or landing statistics. Fleet 11 includes small-scaled Japanese fisheries (e.g. trawl, small longline, etc.), and their annual total catch was placed in Season 2 of fishing year. The catches by Fleet 10 were placed in Season 2 of fishing year aggregating their quarterly catch data. Catch data for stock assessment were expressed in tones for all fleets except for Fleet 15, 16, 20 and 28 , whose catches were expressed in thousands of fish (Fig. 1-(b)). For the 2020 assessment, the quarterly catch data was updated up to Season 4 of fishing year 2018 (2019 calendar year Quarter 2). Catch amount for Fleet 2 is decreased than previous stock assessment by it being recorded in fleet 20 as number data.

5.2 Discard data

The PBFWG agreed that the base-case of this assessment should include "unaccounted mortality" (ISC 2019) from released bycaught PBF. Japan (Nakatsuka and Fukuda 2020), Korea (Lee et al., 2020a) and United States (Piner et al., 2020) provided discard information in response to WG recommendation. Fleet 26 represents for estimated unaccounted mortality by weight, and Fleet 27 represents for estimated unaccounted mortality in number.

For estimation for Japanese discard amount, it was proposed to apply unaccounted mortality of 5% of reported catch for all Japanese fisheries for FY 2017 and 2018 when release of PBF considered to have become significant (Nakatsuka and Fukuda 2020). And Japanese discard number and Korean discard amount were taken same estimation method with estimation of Japanese discard amount (Lee et al., 2020a).

For the US recreational fishery, catches, releases (discard) and predation events of hooked fish are recorded in California Commercial Passenger Fishing Vessels logbooks. An estimate of release mortality and subsequent discard mortality numbers were developed for this fleet. A random-effect inverse variance meta-analysis estimated the mortality rate (6%). The number of unseen kills were small (<500 fish). These estimates are appropriate for use in the assessment (Piner et al., 2020).

6. Abundance Indices

7-1. Overview

CPUE-based abundance indices which have been discussed in ISC PBFWG are listed in Table 5. These series were derived from fishery-specific catch and effort data which were standardized with appropriate statistical methods (Fig. 2 and Table 6). In previous assessment, the WG used four longline CPUE series as the adult abundance indices (S1, S2, S3, and S9), and a Japanese troll index (S5) as the recruitment index for the base case model (ISC 2018). Among them, the temporal coverage of S2 and S3 indices (Japanese offshore and distant water longline CPUE) are early period (1952-1973) and middle period (1974-1992), respectively. Therefore, S1 (Japanese coastal longline CPUE: 1993-current), S5 (Japanese troll CPUE: 1980-current), and S9 (Taiwanese longline CPUE in Southern area: 2002-current) were updated for 2020 assessment (Tsukahara et al., 2020, Nishikawa et al., 2020, Chang et al., 2020). S1 (Japanese coastal longline CPUE: 1993-current) and S9 (Taiwanese longline CPUE in Southern area: 2000-current) were revised by changing standardization methods using spatio-temporal model.

In previous assessment, the input coefficients of variation (CV) of abundance indices was set 0.2 as a minimum value for the assessment model, if the original CV which was estimated by the statistical model for the standardization (Table 7) was less than 0.2 (ISC 2018b). The same approach will be used in 2020 assessment.

7-2. Japanese Longline CPUE (S1, S2, & S3)

Japanese longline CPUE is based on the logbook data. The logbook system for the coastal longline fishery is only available from fishing year 1993. Before fishing year 1993, the logbook-based CPUE only for offshore and distant-water longline is available. Because of the change of operational pattern and available dataset (i.e. hooks-per-basket), the offshore and distant-water longline CPUE has to be split up into two time-series; fishing year 1952-1973 (S2; Fujioka et al. 2012a) and 1974-1992 (S3; Yokawa 2008).

For the 2020 assessment, Japanese coastal longline CPUE is revised by changing standardization methods using spatio-temporal model (S1: 1993-2018 fishing year). For the standardization. Tsukahara et al., (2020) compared the CPUE from the "previous model" and "spatio-temporal model" showed exactly similar trends.

7-4. Japanese Troll CPUE (S4)

Catch-and-effort data for coastal troll fisheries targeting age-0 PBF in Nagasaki prefectures has been collected from five fishing ports. The troll fishery in Nagasaki prefecture has dominant share in Japanese troll catch, and they can fish age-0 PBF from both two spawning grounds (around Ryuku Islands and the Sea of Japan) because of the geographical location of their fishing ground (Ichinokawa et al. 2012). The units of effort in the catch-and-effort data are the cumulative daily number of unloading troll vessels, which is nearly equivalent to the total number of trolling trips because most troll vessels make one-day trips. The effort data doesn't include the unloading without PBF catch: no zero-catch data was available. Therefore, a log normal model was applied for the standardization of the CPUE (S5).

For the 2020 assessment, the troll CPUE (S4) was updated (Nishikawa et al., 2019). Japanese troll

fisheries were separated into 2 Fleets by season (Fleet 6 and 19) in the assessment model. The catch and effort data for S4 CPUE standardization was revised to use seasons 2-4 by fleets structure for Japanese troll fisheries (Nishikawa et al., 2019). Fleet 6 was used as the correspondence Fleet for the selectivity setting of S4 CPUE (ISC 2016c). PBFWG agreed to exclude data in FY2017 for S4 due to lack of data coverage compared with previous years (Nishikawa et al., 2020).

7-5. Taiwanese Longline CPUE for southern area (S5)

Previous Taiwanese longline CPUE was developed by following process; (1) Estimating PBF catch in number from landing weight for 2001-2003 based on an MCMC simulation, (2) Deriving fishing days for 2007-2009 from data of vessel monitoring system (VMS) and voyage data recorder (VDR), (3) Deriving fishing days for 2001-2006 from vessels trip information based on linear relationships between fishing days and at-sea days for a trip, by vessel size and fishing port, during 2007-current, and (4) Estimating and standardizing the CPUE (catch number per fishing days) for fishing year 2001-current (Chang and Liu 2018, Chang et al. 2020).

The fishing ground of Taiwanese longline fleet can be separated into southern and northern area. The southern area has been considered as the main fishing ground for the Taiwanese longline fishery. Spatio-temporal model was tried to apply for Taiwanese longline CPUEs standardization. These CPUEs (S6-7) are submitted, but these will not be included to in the likelihood function used to fit the data (ISC 2019). Thus the CPUE which was based on the operations in the southern area and standardized by traditional way is used as the input data for the stock assessment (Chang et al. 2020) (S5: 2002-2018).

7.   Size composition data

8-1. Overview

Quarterly size composition data (length or weight) for PBF from 1952 to 2018 (fishing year) will be used for the stock assessment. All length data in the model is "fork length (FL)" which is measured to the nearest cm. In the assessment model, the length composition bins of 2, 4, and 6 cm width were used for 16-58, 58-110, and 110-290 cm FL fish, respectively. Weight composition bins were of variable width, ranging from 1 kg to 30kg (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 273kg), which set two bins for each age between 0 to 15 to minimize the misinterpretation of the data (Fujioka et al. 2012b). The lower boundary of each bin was used to define the bin.

For the 2020 assessment, the size composition data for Fleets 7, 13, and 15 were not updated as on the previous assessment (ISC 2018). Length composition data were updated and estimated for Fleets 1-4, 6, 8, 9, 12, 14, 15, 17-20 and 28, while weight composition data were updated for Fleets 10 and 11. Of these, the size compositions for Fleets 10-11 were combined to simplify the assessment model (Table 8). Fleet 16 was assumed to catch age 0 fish using age selectivity setting, thus their size composition was not required. Fig. 3 -21 shows the quarterly size compositions of each fleet for the last seven years.

The souse of input sample sizes for the size composition data was summarized in Table 8. Depending on the corresponding fisheries, the information of sample size was based on four different criteria; "Number

of fish measured", "Number of landing well measured", "Number of total month of well sampled port", and "Number of haul well measured".

8-2. Japanese Longline (Fleet 1 and 28)

Length-composition data for PBF from the Japanese longline fishery (Fleet 1) are available for the periods of fishing year 1952-1968 and 1994-2018 (Fig. 3). Until 1960s, the data were collected mainly from Tsukiji market. Since 1990s, sampling and market data have been collected at the major PBF unloading ports, e.g. Okinawa, Miyazaki, and Wakayama prefectures. Length measurements were relatively sparse from 1969 to 1993 and has not been included in the assessment.

Length compositions for fishing year 1952-1968 were estimated based on the aggregated catch and length measurement data by year, month, and area (5x5 degree cells). Using this stratification, length composition was raised by catch number (Mizuno et al. 2012). Since fishing year 1993, the length compositions were estimated based on the quarterly landing amount and length measurement in each prefecture. Using quarter and prefecture strata, length composition was raised by landing weight (Sakai et al. 2018).

Size composition data for season 3 is available since this stock assessment. Size composition are different between season 3 and season 4. Size composition for season 3 are composed by smaller fish than season 3. Thus PBFWG agreed to split the Fleet for the period of fishing year 1993-2018 by season 3 and season 4 (ISC 2019).

8-3. Japanese purse seines in the East China Sea (Fleet 2 and 18, 20)

Length-composition data for PBF from the Japanese purse seine fishery in the East China Sea has been developed from length measurements taken at Fukuoka and Matsuura, which are the major landing ports for this fishery. The data is separated into two Fleets by season (Fleet 2 and 18). The available period for Fleet 2 (Seasons 1, 3, 4) was fishing year 2002-2018, whereas that for Fleet 18 (Season 2) was fishing year 2003-2012, 2014, and 2016. In previous assessment, the data in Seasons 3-4 of 2014 for Fleet 2 was not used in the assessment model, because there seems to be bias in the measurement data during this period due to the lack of size measurement of smaller fish mainly for farming (ISC 2015b). Since 2020 assessment, Fleet 20 will be established as Japanese purse seines in the East China Sea for farming. The size composition data for this new fleet were obtained using stereo-scopic camera (Fukuda and Nakatsuka 2019).

8-4. Korean purse seine (Fleet 3)

Length-composition data from the Korean purse seine fishery has been also available since 2010 fishing year (Lee et al. 2020b). In previous assessment, the size composition by both Fleet 2 and 3 was combined and shared for 2010-2014 (ISC 2016b), because their size composition was similar during that period. Since 2013 fishing year, larger sized fish (> around 70 cm) has been also observed in season 3. The WG agreed to separate size composition for Japanese and Korean purse seine (ISC 2019). Size composition of Fleet 3 was provided.

8-4. Japanese purse seines in the Sea of Japan (Fleet 4)

Length-composition data for PBF from the Japanese purse seine fleet in the Sea of Japan (Fleet 4) has been collected by port samplers in Sakai-minato and available since 1987, except for 1990 when there was no catch (Fig. 6). Size measurements have been high coverage and most of the landings were sampled. This fleet catches mainly PBF older than age 3 (Fukuda et al. 2012).

8-5. Japanese purse seines off the Pacific coast of Japan (Fleet 5)

Size composition data for PBF from Japanese purse seiners operating off the Pacific coast of Japan were collected at Tukiji market and several unloading ports in the Tohoku region between the 1950s and 1993. Since 1994, length and weight composition data have been collected at Shiogama and Ishinomaki ports (Abe et al. 2012).

Although the length measurements for this fishery had been made since 1980s, an appropriate method to create catch-at-size data has not yet been established for the entire period. Therefore, the data periods of length composition for this fleet has been limited to 1995-2006 fishing year in recent assessment model (Fig. 7). The size composition data for this fishery is highly variable (from 50 cm to very large), and it was recognized the need for further research especially focusing on the smaller fish. Size composition was calculated during FY 2016-2018 by starting port sampling program since 2015. The size selectivity of JTPS-PO fleet could be changed to the only large size (> 30 kg in body weight) PBF fishery due to the domestic quota allocation, where they had caught wider size of PBF from age 1 and older. Estimated size composition for this fishery indicated distinct selectivity change before and after the introduction of the new management (Fukuda 2019).

8-6. Japanese Troll and Pole-and-Line (Fleet 6, 7, and 19)

Length-composition data for Japanese troll fishery (Fleet 6 and 19) was estimated as following: 1) Fish length was measured at the main unloading port, 2) The measurement data was pooled by "Area" and "month" as the minimum spatial and temporal strata, and 3) The pooled measurement data was raised by catch number in corresponding strata (Fukuda et al. 2015). In this procedure, unless more than 80% of catch had corresponding size data, the estimated quarterly length-composition data was not used to fit in the assessment model. According to this criterion, the length composition data for season 1, 3 and 4 of 2017 fishing year and season 4 of 2018 fishing year were not included in updated data for 2020 assessment.

The fisheries of Fleet 6 and Fleet 7 tend to operate in the same area and catch similar-sized fish (primarily age-0 fish). Thus, the size selectivity information of Fleet 6 has been mirrored to Fleet 7 in the assessment model because of the relatively poor size sampling of Fleet 7 (Fig. 8 and 9).

8-7. Japanese set-net fishery except for Hokkaido and Aomori prefectures (Fleet 8 and 9)

Size measurement data for PBF from Japanese set-net fisheries have been collected since 1993. The catch-at-size data were estimated based on the multi-stratified raising using the catch weight. Excessive estimation was avoided by the introduction of broad size category stratum (i.e. Small/Medium/Large) and limitation of

over-strata calculation (Hiraoka et al. 2018). Due to the complexity of the dataset, the set-net fishery was divided into 3 fleets: Fleet 8 is the Season 1, 2, and 3 of the fisheries in all prefectures except for Hokkaido and Aomori, Fleet 9 is Season 4 from the same areas, and Fleet 10 is all season of set-net fishery in Hokkaido and Aomori (ISCWG 2015). For Fleet 8 and 9, length-composition data is available. The data showed that the catch-at-size of set-net were highly variable from year to year, and quarter and quarter, probably because of the influence of the environmental conditions and migration (Kai 2007). Japanese Set-net fisheries (Fleet 8-10) and the other fishery (Fleet 11) are operated around Japan. Thus, the age selectivity has been shared in Fleet 8-11. And size selectivity has been estimated by each fleet.

8-8. Japanese set-net fishery for Hokkaido and Aomori (Fleet 10) and Other Fisheries (Fleet 11)

Size composition for PBF from the set-net fishery in Hokkaido and Aomori prefectures (Fleet 10) is based on the weight measurement data (Sakai et al. 2015). Fleet 11 also has weight-composition data, which includes Japanese hand line and small-scaled longline fisheries in the Tsugaru Strait and its adjacent waters (Nishikawa et al. 2015). Both Fleet 10 and 11 probably target similar fish in similar area, thus their size-composition data was combined to estimate (ISC 2015c; Fig. 12 and 13).

8-9. Taiwanese longline (Fleet 12 and 17)

Length-composition data for PBF from the Taiwanese longline fishery (Fleet 12 and 17) were based on the market landing information and port sampling. Since 2010, additional information has been also available from the catch documentation scheme (CDS) program, which can provide much more size samples with higher quality (Chang et al. 2015). The Taiwanese longline fishery was separated into two fleets by fishing area; Fleet 12 for southern area and Fleet 17 for northern area. For the 2020 assessment, the length composition data for both fleets were updated. The southern area has been the main fishing ground for Taiwanese longliners, and their data period was longer than that of the northern area (Fleet 12: 1992-2018 fishing year, Fleet 17: 2009-2018 fishing year).

8-10. EPO commercial purse seine fisheries of US dominant period & transition period (Fleet 13) and Mexico dominant period (Fleet 14)

Length-composition data for PBF from EPO purse seine fishery are collected by port samplers from IATTC and national/municipal sampling programs (Bayliff 1993, Aires-da-Silva and Dreyfus 2012). Fleet 13 is US dominant & transition period of EPO purse seine fishery until 2001. For this fleet, length composition data for US dominant period from 1952 to 1982 is used to estimate the selectivity pattern for the stock assessment (ISC 2015c). Fleet 14 is Mexico dominant period of EPO purse seine fishery (2002 onwards). The length composition data for Fleet 14 had been obtained by IATTC at-sea observers and port sampling programs. Since 2013, size composition data has measured by stereoscopic cameras from the largest farming company (Dreyfus and Aires-da-Silva 2015). For 2020 assessment, the length composition data for 2017-2018 fishing year was updated (Dreyfus 2020)).

8-11. US recreational fishery (Fleet 15 and 29)

Size composition data for PBF from the US recreational fishery had been collected by IATTC staff since

1993 (Hoyle 2006) , however the size sampling program by IATTC ended in 2012. From 2014, NOAA took over the sampling program (Heberer and Lee 2019). In the 2020 assessment, the US recreational fishery was separated into two fleets for the early period (Fleet 29; before 2013) when the IATTC conducted the size sampling survey for this fishery and recent period (Fleet 15; after 2014) when the NOAA conducted the size sampling for this fishery.

8-12. Japanese troll fishery for farming (Fleet 16)

In Japan, lengths of PBF caught by troll for farming has been similar with those of fish caught by conventional troll in season 1 (Fleet 16). For the stock assessment, the WG has been treated that the troll fishery for farming is targeting age-0 fish specifically (ISC 2015a). There are no size composition data (dummy data is recorded in input file of SS3).

References

Aires-da-Silva, A. M. N. Maunder, and M. Dreyfus. 2012. Updated standardized catch rates for Pacific bluefin tuna caught by United States and Mexican-flag purse seine fisheries in the Eastern Pacific Ocean (1960-2011). ISC/12/PBFWG-1/18

Aires-da-Silva, A. and M. Dreyfus. 2012. A critical review on the PBF length-composition data for the EPO purse seine fishery with new data collected at Mexican PBF pen rearing operations. ISC/12/PBFWG-3/02

Abe, M., M. Kanaiwa, K. Oshima, and Y. Takeuchi. 2012. Estimation of catch at size of PBF, *Thunnus orientalis*, caught by Japanese tuna purse seine operated in Pacific ocean. ISC/12/PBFWG-1/03

Bayliff, W. H. 1991. Status of northern bluefin tuna in the Pacific Ocean. Pp. 29-88. In: R. B. Deriso and W. H. Bayliff (eds.). World meeting on stock assessment of bluefin tunas: strengths and weakness. Special Rep. 7, Inter-Amer. Trop. Tuna Comm., La Jolla, CA.

Bayliff, W. H. 1993. Growth and age composition of Northern bluefin tuna, Thunnus thynnus, caught in the eastern Pacific Ocean, as estimated from length-frequency data, with comments on trans-Pacific migrations. Inter-American Tropical Tuna Commission Bulletin 20, 503-540.

Boustany, A. M., R. Matteson, M. Castleton, C. Farwell, and B. A. Block. 2010. Movement of pacific bluefin tuna (*Thunnus orientalis*) in the Eastern North Pacific revealed with archival tags. Progress in Oceanography 86, 94-104.

Chang, S. K., Y. W. Fu, and H. I. Liu. 2015. Brief review on size distribution of Taiwanese PBF catch. ISC/15/PBFWG-2/16.

Chang, S. K., and H. I. Liu. 2016. Update of standardized PBF CPUE series for Taiwanese longline fishery. ISC/16/PBFWG-1/02 (revised)

Chang, S. K., H. I. Liu, H. Fukuda, and M. N. Maunder. 2017. Data reconstruction can improve abundance index estimation: An example using Taiwanese longline data for Pacific bluefin tuna. PLoS ONE 12(10): e0185784.

Chang, S. K. and H. I Liu. 2018. Standardized PBF CPUE Series and size frequency for Taiwanese longline fishery up to 2017 calendar year. ISC/18/PBFWG-1/02

Chang, S. K., T.-L. Yuan, H. I Liu., and H. Xu 2020. Abundance index of Taiwanese PBF fisheries based on traditional and spatiotemporal delta-generalized linear mixed models. ISC/20/PBFWG-1/XX

Dreyfus, M. and A. Aires-da-Silva. 2015. PBF catch-composition of the Mexican purse seine fishery from data collected at pen rearing operations: and update for 2013-2014. ISC/15/PBFWG-2/05.

Dreyfus, M. 2020. BF catch size-composition of the Mexican purse seine fishery from data collected at pen rearing operations during 2018-2019. ISC/20/PBFWG-1/XX

Fujioka, K., M. Ichinokawa, K. Oshima, and Y. Takeuchi. 2012a. Re-estimation of standardized CPUE of Pacific bluefin tuna caught by Japanese offshore longline fisheries operated during 1952-1974. ISC/12/PBFWG-1/10.

Fujioka, K., H. Fukuda, K. Oshima, M. Abe, S. Iwata, M. Kai, and Y. Takeuchi. 2012b. Modification

introduced to the input fishery data for Stock Synthesis III model used in the 2010 Pacific bluefin tuna stock assessment.   ISC/12/PBFWG-2/3.

Fukuda, H., M. Kanaiwa, I. Tsuruoka, and Y. Takauchi.   2012.   A review of the fishery and size data for the purse seine fleet operating in the Japan Sea (Fleet 3). ISC/12/PBFWG-3/03.

Fukuda, H., H. Uyama, and K. Oshima.   2015.   A minor change in the estimation of length composition data of Japanese troll fisheries.   ISC/15/PBFWG-2/03.

Fukuda, H. 2019. Estimation of the PBF length-composition for the Japanese purse seine operating in the Pacific side. ISC/19/PBFWG-2/05

Fukuda, H. and S. Nakatsuka. 2019. Estimation of the PBF length-composition for the Japanese purse seine with new data collected at young PBF farming operation using stereoscopic camera. ISC/19/PBFWG-2/02

Fukuda, Y., Y. Tsukahara and O. Sakai. 2018. Updated standardized CPUE for 0 age Pacific Bluefin Tuna caught by Japanese troll fisheries: Updated up to 2016 fishing year. ISC/18/PBFWG-1/XX

Heberer, L. and H.-H. Lee. 2019. Updated size composition data from the San Diego Commercial Passenger Fishing Vessel (CPFV) recreational fishery for Fleet 15: Eastern Pacific Ocean Sport Fisheries, 2014-2019. ISC/19/PBFWG-2/06

Hiraoka, Y., M. Kanaiwa, H. Fukuda, K. Oshima, and M. Kai.   2018.   Size distribution of Pacific bluefin tuna caught with Japanese set nets estimated via stratigied stepwise weighting method.   Nippon Suisan Gakkaishi 84(1), p2-13.

Hoyle, S. 2006. Sampling the catch of bluefin tuna (*Thunnus thynnus*) for length composition. ISC/16/PBFWG/16

Ichinokawa, M., K. Oshima, and Y. Takeuchi.   2012.   Abundance indices of young Pacific bluefin tuna, derived from catch-and-effort data of troll fisheries in various regions of Japan.   ISC/12/PBFWG-1/11.

ISC.   2014.   Stock assessment of Bluefin tuna in the Pacific Ocean in 2014. Report of the Pacific Bluefin tuna working group.   121p.

ISC.   2015a.   Report of the Pacific Bluefin tuna working group intersessional workshop. 20-24 April, 2015.   24p.

ISC.   2015b.   Report of the fifteenth meeting of the international scientific committee for tuna and tuna-like species in the North Pacific Ocean, plenary session. 15-20 July 2015.   76p.

ISC.   2015c.   Report of the Pacific Bluefin tuna working group intersessional workshop. 18-25 November, 2015.

ISC   2016a.   Report of the sixteenth meeting of the international science committee for tuna and tuna-like species in the North Pacific Ocean: Plenary session. 13-18 July, 2016. 83p.

ISC.   2016b.   2016 Pacific Bluefin Tuna Stock Assessment. Report of the Pacific Bluefin tuna working group.   140p.

ISC.   2016c.   Report of the Pacific Bluefin Tuna Working Group Workshop, 29 February-11 March 2016.

ISC.   2017.   Report of the Pacific Bluefin tuna working group intersessional workshop. 15-20 February,

2017.   23p.

ISC.   2019.   Report of the Pacific Bluefin tuna working group intersessional workshop. 18-23 November, 2019.

Itoh, S.   1961.   Fishery biology of the sardine, Sardinops melanosticta (T. & S.), in the waters around Japan. Bull. Jap. Sea Reg. Fish. Res. Lab. 9, 1-227 [in Japanese]

Itoh, T., S. Tsuji, and A. Nitta.   2003.   Migration of young bluefin tuna Thunnus orientalis in the Pacific Ocean observed with archival tags.   Fisheries Bulletin 101, 514-544.

Kai, M.   2007.   Estimation of quarterly catches by Japanese set net.   ISC/07/PBFWG-1/06.

Kanaiwa, M., T. Shimura, R. Uji, Y. Ishihara, and Y. Takeuchi.   2012.   CPUE analysis for Japanese purse seine in Sea of Japan.   ISC/12/PBFWG-1/09

Kanaiwa, M., A. Yamamoto, Y. Ishihara, I. Tsuruoka, K. Oshima, H. Fukuda, and Y. Takeuchi.   2015.   Estimation of annual stock indices for Pacific bluefin tuna using landing data at Sakai-minato Port. ISC/15/PBFWG-1/05

Kim, D. N., Y. Kwon, S. I. Lee, D-h An, H. Cho, and A. Shin.   2015.   Preliminary analysis of catch and size data for Pacific bluefin tuna, Thunnus orientalis caught by Korean offshore large purse seine. ISC/15/PBFWG-2/15.

Lee, H-H., K. R. Piner, M. N. Maunder, I. G. Taylor, and R. D. Methot, Jr.   2017.   Evaluation of alternative modelling approaches to account for spatial effects due to age-based movement. Canadian Journal of Fisheries and Aquatic Sciences. 74(11): 1832-1844

Lee, M. K., D. N. Kim, S. I. Lee and D. H. An. 2020a. Status and future plans for information on discard mortality rates of Korean fisheries for Pacific bluefin tuna, *Thunnus orientalis*. ISC/20/PBFWG-1/13

Lee, S. K., D. N. Kim, M. K. Lee and H. J. Jo. 2020b. Size distribution of Pacific bluefin tuna, *Thunnus orientalis* caught by Korean offshore large purse seine fishery. ISC/20/PBFWG-1/06

Mizuno, A. N., M. Ichinokawa, K. Oshima, and Y. Takeuchi.   2012.   Estimation of length compositions on Pacific bluefin tuna caught by Japanese longline fishery.   ISC/12/PBFWG-1/01.

Nakatsuka, S. 2019, Stock Structure of Pacific Bluefin Tuna (Thunnus orientalis) for Management Purposes—A Review of Available Information, Reviews in Fisheries Science & Aquaculture, DOI: 10.1080/23308249.2019.1686455

Nakatsuka, S. and H. Fukuda. 2020. Estimation of Unaccounted Mortality in the Japanese Fisheries. ISC/20/PBFWG-1/XX

Nishikawa, K., H. Fukuda, and K. Oshima.   2015.   Estimation of weight composition fore Japanese small scale fisheries in Tsugaru Strait: Fleet 14 (Other fisheries).   ISC/15PBFWG-2/07

Piner, K., H.H. Lee, E. Hellmers and S. Stohs. 2020. Estimates of Recreational release Mortality for the US Commercial Passenger Vessel Fleet (2000-2019). ISC/20/PBFWG-1/XX

Sakai, O., Y. Hiraoka, H. Fukuda, and K. Oshima.   2015.   Estimation of catch at size of Pacific bluefin tuna caught by Japanese set net fisheries: Updated up to 2014 fishing year.   ISC/15/PBFWG-2/04.

Sakai, O. and K. Oshima.   2015.   Japanese troll CPUE targeting age-0 Pacific bluefin tuna: Updated up ti 2014 fishing year.   ISC/15/PBFWG-2/08.

Sakai, O. and Y. Tsukahara. 2018. Japanese coastal longline CPUE and catch-at-length for Pacific bluefin tuna: Update up to 2016 fishing year. ISC/18/PBFWG-1/01.

Takeuchi, Y. 2007. Estimation of quarterly catch of Japanese tune purse seine operating in the north western Pacific and Sea of Japan catching medium to large bluefin tuna. ISC/07/PBFWG-1/10.

Waterhouse, L., D. B. Sampson, M. Maunder, and B. X. Semmens. 2014. Using areas-as-fleets selectivity to model spatial fishing: Asymptotic curves are unlikely under equilibrium conditions. Fisheries Research 158: 15-25.

WCPFC. 2016. Conservation and Management Measure to establish a multi-annual rebuilding plan for Pacific bluefin tuna. Conservation and Management Measure 2016-04. Commission 13th regular session. 4p.

WCPFC. 2017a. Summary report of Commission for the conservation and management of highly migratory fish stocks in the Western and Central Pacific Ocean. Northern Committee 13th regular session. 56p.

WCPFC. 2017b. Provisional outcomes document of Commission for the conservation and management of highly migratory fish stocks in the Western and Central Pacific Ocean. Commission 14th regular session. 15p.

WCPFC 2017. Harvest Strategy for Pacific bluefin tuna fisheries. Commission 14th regular session. WCPFC HS 2017-02.

Yokawa, K. 2008. Correction of the standardized CPUE of Pacific bluefin tuna caught by Japanese offshore and distant-water longliners. ISC/08/PBFWG-1/05 .

Table 1. Relationships between fishing year and calendar year for the stock assessment of Pacific bluefin tuna (*Thunnus orientalis*).
Spawning stock biomass (SSB) is defined as the estimated values at the beginning of Season 4 (April-June).
Recruitment occurs at the beginning of Season 1.

Fishing year	2016				2017				2018				2019	
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 2016				SSB in 2017				SSB in 2018		
Day of birth in SS	Birthday of 2016 yr class				Birthday of 2017 yr class				Birthday of 2018 yr class				Birthday of 2019 yr class	
Recruitment	Recruitment in 2016				Recruitment in 2017				Recruitment in 2018				Recruitment in 2019	
Year class	2016 yr class				2017 yr class				2018 yr class				2019 yr class	
Calender year	2016			2017				2018				2019		
Month	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				1 2 3 4 5 6 7 8 9 10 11 12		

Table 2. Definition of fleets for the stock assessment of Pacific bluefin tuna (*Thunnus orientalis*).

Fleet #	Fleet name	Unit of Catch	Gears included				Abundance index
			Representative component	Component 2	Component 3	Component 4	
Fleet 1	JPLL	Weight	JP Longline (1952-1992)	JP Longline (1993-2018, Season 4)			S1, S2, S3
Fleet 2	JSPPS (Seas1, 3, 4)	Weight	JP SPPS (Season 1, 3, 4)				
Fleet 3	KROLPS	Weight	KR OLPS	KR Trawl[*1]	KR Setnet[*1]	KR Troll[*1]	S9
Fleet 4	JPTPSJS	Weight	JP TPSJS	TW PS[*2]			
Fleet 5	JPTPSPO	Weight	JP TPSPO				
Fleet 6	JPTroll (Seas2-4)	Weight	JP Troll (Season 2-4)				S4, S10
Fleet 7	JPPL	Weight	JP Pole-and-Line	JP Driftnet[*3]	TW Driftnet[*3]	TW Others[*4]	
Fleet 8	JPSetNet (Seas1-3)	Weight	JP Setnet (Season 1-3)	JP Miscellaneous (Season 1-3)			
Fleet 9	JPSetNet (Seas4)	Weight	JP Setnet (Season 4)	JP Miscellaneous (Season 4)			
Fleet 10	JPSetNet_HK_AM	Weight	JP Setnet in Hokkaido and Aomori				
Fleet 11	JPOthers	Weight	JP Handline & Tsugaru Longline	JP Trawl	JP OtherLL		
Fleet 12	TWLL (South)	Weight	TW Longline (South area)	Out of ISC members (NZ, AU, etc.)[*5]			S5, S6
Fleet 13	USCOMM (-2001)	Weight	US Commercial Fisheries (PS, Others)	Mex Commercial Fisheries (PS, Others)			
Fleet 14	MEXCOMM (2002-)	Weight	Mex Commercial Fisheries (PS, Others)	US Commercial Fisheries (PS, Others)			
Fleet 15	EPOSP	Number	US Recreational Fisheries (2014-)				
Fleet 16	JPTroll4Pen	Number	JP Troll for Farming				
Fleet 17	TWLL (North)	Weight	TW Longline (North area)				S7, S8
Fleet 18	JPSPPS (Seas2)	Weight	JP SPPS (Season 2)				
Fleet 19	JPTroll (Seas1)	Weight	JP Troll (Season 1)				S11
Fleet20	JSPPS Pen	Weight	JSPPS for Farming				
Fleet 26	Unaccounted mortality	Weight	Discard amount for JPN and KOR fisheries				
Fleet 27	Unaccounted mortality	Number	Discard amount for USA and JPN				
Fleet 28	JPLL (Seas3)	Weight	JP Longline(1993-)				
Fleet 29	EPOSP_early	Number	US Recreational Fisheries (-2013)				

*1 Catch for KRean Trawl, KRean Setnet and KRean Troll are **included** in the input data until the 2020 stock assessment.

*2 Annual catches for Taiwanese PS are put into the Season 1 in the input data.

*3 Annual catches for Japanese and Taiwanese Driftnets are put into the Season 1 in the input data.

*4 Annual catches for Japanese and Taiwanese Others are put into the Season 4 in the input data.

*5 Annual catches of out of ISC PBFWG members are put into Season 1 in the input data.

Note: Seasons follow the fishing year.

Table 3. Pacific bluefin tuna (*Thunnus orientalis*) catches (in metric tons) by fisheries, for calendar year 1952-2018. "0"; fishing effort was reported but no catch, "+ "; bellow 499kg catch, "-"; unreported or not available.

| Calendar Year | Japan (JP)[1] | | | | | | | | | Sub Total |
| | Purse Seine | | Dist. & Off. Longline | | Coastal Longline | Troll[2] | Pole and Line | Set Net | Others | |
	Tuna PS	Small PS	NP	SP						
1952	7,680		2,694	9		667	2,198	2,145	1,700	17,094
1953	5,570		3,040	8		1,472	3,052	2,335	160	15,636
1954	5,366		3,088	28		1,656	3,044	5,579	266	19,027
1955	14,016		2,951	17		1,507	2,841	3,256	1,151	25,739
1956	20,979		2,672	238		1,763	4,060	4,170	385	34,268
1957	18,147		1,685	48		2,392	1,795	2,822	414	27,302
1958	8,586		818	25		1,497	2,337	1,187	215	14,666
1959	9,996		3,136	565		736	586	1,575	167	16,760
1960	10,541		5,910	193		1,885	600	2,032	369	21,531
1961	9,124		6,364	427		3,193	662	2,710	599	23,078
1962	10,657		5,769	413		1,683	747	2,545	293	22,107
1963	9,786		6,077	449		2,542	1,256	2,797	294	23,201
1964	8,973		3,140	114		2,784	1,037	1,475	1,884	19,406
1965	11,496		2,569	194		1,963	831	2,121	1,106	20,280
1966	10,082		1,370	174		1,614	613	1,261	129	15,243
1967	6,462		878	44		3,273	1,210	2,603	302	14,772
1968	9,268		500	7		1,568	983	3,058	217	15,601
1969	3,236		313	20	565	2,219	721	2,187	195	9,456
1970	2,907		181	11	426	1,198	723	1,779	224	7,448
1971	3,721		280	51	417	1,492	938	1,555	317	8,772
1972	4,212		107	27	405	842	944	1,107	197	7,840
1973	2,266		110	63	728	2,108	526	2,351	636	8,788
1974	4,106		108	43	1,069	1,656	1,192	6,019	754	14,948
1975	4,491		215	41	846	1,031	1,401	2,433	808	11,266
1976	2,148		87	83	233	830	1,082	2,996	1,237	8,697
1977	5,110		155	23	183	2,166	2,256	2,257	1,052	13,202
1978	10,427		444	7	204	4,517	1,154	2,546	2,276	21,577
1979	13,881		220	35	509	2,655	1,250	4,558	2,429	25,537
1980	11,327		140	40	671	1,531	1,392	2,521	1,953	19,574
1981	25,422		313	29	277	1,777	754	2,129	2,653	33,353
1982	19,234		206	20	512	864	1,777	1,667	1,709	25,988
1983	14,774		87	8	130	2,028	356	972	1,117	19,471
1984	4,433		57	22	85	1,874	587	2,234	868	10,161
1985	4,154		38	9	67	1,850	1,817	2,562	1,175	11,673
1986	7,412		30	14	72	1,467	1,086	2,914	719	13,714
1987	8,653		30	33	181	880	1,565	2,198	445	13,985
1988	3,583	22	51	30	106	1,124	907	843	498	7,163
1989	6,077	113	37	32	172	903	754	748	283	9,118
1990	2,834	155	42	27	267	1,250	536	716	455	6,282
1991	4,336	5,472	48	20	170	2,069	286	1,485	650	14,536
1992	4,255	2,907	85	16	428	915	166	1,208	1,081	11,063
1993	5,156	1,444	145	10	667	546	129	848	365	9,310
1994	7,345	786	238	20	968	4,111	162	1,158	398	15,186
1995	5,334	13,575	107	10	571	4,778	270	1,859	586	27,090
1996	5,540	2,104	123	9	778	3,640	94	1,149	570	14,008
1997	6,137	7,015	142	12	1,158	2,740	34	803	811	18,852
1998	2,715	2,676	169	10	1,086	2,876	85	874	700	11,191
1999	11,619	4,554	127	17	1,030	3,440	35	1,097	709	22,628
2000	8,193	8,293	121	7	832	5,217	102	1,125	689	24,577
2001	3,139	4,481	63	6	728	3,466	180	1,366	782	14,212
2002	3,922	4,981	47	5	794	2,607	99	1,100	631	14,186
2003	956	4,812	85	12	1,152	2,060	44	839	446	10,407
2004	4,934	3,323	231	9	1,616	2,445	132	896	514	14,099
2005	4,034	8,783	107	14	1,818	3,633	549	2,182	548	21,668
2006	3,644	5,236	63	11	1,058	1,860	108	1,421	777	14,178
2007	2,965	3,875	83	8	1,679	2,823	236	1,503	657	13,829
2008	3,029	7,192	19	8	1,371	2,377	64	2,358	770	17,189
2009	2,127	5,950	8	7	1,072	2,003	50	2,236	575	14,029
2010	1,122	2,620	5	6	885	1,583	83	1,603	495	8,401
2011	2,227	6,113	9	11	828	1,820	63	1,651	283	13,004
2012	1,043	1,419	6	8	667	570	113	1,932	343	6,101
2013	2,008	763	7	7	777	904	8	1,415	529	6,418
2014	2,250	3,206	11	4	672	1,023	5	1,907	499	9,577
2015	2,759	886	12	4	607	413	8	1,242	432	6,361
2016	3,267	1,828	13	4	644	778	44	1,227	508	8,314
2017	3,341	1,199	21	0	880	603	86	2,255	665	9,049
2018[3]	3,225	825	19	0	679	372	8	645	431	6,204

Table 3. Cont.
"0"; fishing effort was reported but no catch, "+"; bellow 499kg catch, "-"; unreported or not available.

Calendar Year	Korea (KR)[4]					Taiwan (TW)				
	Purse Seine	Setnet	Troll	Trawl	Sub Total	Longline	Purse Seine	Distant Driftnet	Others	Sub Total
1952										
1953										
1954										
1955										
1956										
1957										
1958										
1959										
1960										
1961										
1962										
1963										
1964										
1965						54				54
1966										0
1967						53				53
1968						33				33
1969						23				23
1970										0
1971						1				1
1972						14				14
1973						33				33
1974						47			15	62
1975						61			5	66
1976						17			2	19
1977						131			2	133
1978						66			2	68
1979						58				58
1980						114			5	119
1981						179				179
1982	31				31	207		2		209
1983	13				13	175	9	2		186
1984	4				4	477	5		8	490
1985	1				1	210	80	11		301
1986	344				344	70	16	13		99
1987	89				89	365	21	14		400
1988	32				32	108	197	37	25	367
1989	71				71	205	259	51	3	518
1990	132				132	189	149	299	16	653
1991	265				265	342		107	12	461
1992	288				288	464	73	3	5	545
1993	40				40	471	1		3	475
1994	50				50	559				559
1995	821				821	335			2	337
1996	102				102	956				956
1997	1,054				1,054	1,814				1,814
1998	188				188	1,910				1,910
1999	256				256	3,089				3,089
2000	2,401			0	2,401	2,780			2	2,782
2001	1,176			10	1,186	1,839			4	1,843
2002	932			1	933	1,523			4	1,527
2003	2,601			0	2,601	1,863			21	1,884
2004	773			0	773	1,714			3	1,717
2005	1,318			9	1,327	1,368			2	1,370
2006	1,012			3	1,015	1,149			1	1,150
2007	1,281			4	1,285	1,401			10	1,411
2008	1,866			10	1,876	979			2	981
2009	936			4	940	877			11	888
2010	1,196			16	1,212	373			29	402
2011	670		0	14	684	292			16	308
2012	1,421		1	2	1,424	210			2	212
2013	604	1	0	0	605	331			2	333
2014	1,305	6	0	0	1,311	483			38	521
2015	676	1	0	0	677	552			25	577
2016	1,024	3	0	2	1,029	454			0	454
2017	734	3	0	6	743	415			0	415
2018	523	7	0	5	535	381			0	381

4 Catch statistics of Korea derived from Japanese Import statistics for 1982-1999.

Table 3. Cont.
"0"; fishing effort was reported but no catch, "+"; bellow 499kg catch, "-"; unreported or not available.

Calendar Year	United States (US)[5]				Mexico (MX)			Sub total	Out of ISC members		Grand Total
	Purse Seine	Others	Sport	Sub Total	Purse Seine	Others	Sub Total		New Zealand (NZ)[6]	Australia (AU)[7]	
1952	2,076		2	2,078				2,078			19,172
1953	4,433		48	4,481				4,481			20,117
1954	9,537		11	9,548				9,548			28,575
1955	6,173		93	6,266				6,266			32,005
1956	5,727		388	6,115				6,115			40,383
1957	9,215		73	9,288				9,288			36,590
1958	13,934		10	13,944				13,944			28,610
1959	3,506	56	13	3,575	171	32	203	3,779			20,539
1960	4,547	0	1	4,548				4,548			26,079
1961	7,989	16	23	8,028	130		130	8,158			31,236
1962	10,769	0	25	10,794	294		294	11,088			33,195
1963	11,832	28	7	11,867	412		412	12,280			35,481
1964	9,047	39	7	9,093	131		131	9,224			28,631
1965	6,523	77	1	6,601	289		289	6,890			27,224
1966	15,450	12	20	15,482	435		435	15,918			31,161
1967	5,517	0	32	5,549	371		371	5,920			20,745
1968	5,773	8	12	5,794	195		195	5,989			21,623
1969	6,657	9	15	6,681	260		260	6,940			16,419
1970	3,873	0	19	3,892	92		92	3,983			11,432
1971	7,804	0	8	7,812	555		555	8,367			17,140
1972	11,656	45	15	11,716	1,646		1,646	13,362			21,216
1973	9,639	21	54	9,714	1,084		1,084	10,798			19,619
1974	5,243	30	58	5,331	344		344	5,675			20,685
1975	7,353	84	34	7,471	2,145		2,145	9,616			20,948
1976	8,652	25	21	8,698	1,968		1,968	10,666			19,381
1977	3,259	13	19	3,291	2,186		2,186	5,477			18,811
1978	4,663	6	5	4,674	545		545	5,218			26,863
1979	5,889	6	11	5,906	213		213	6,119			31,715
1980	2,327	24	7	2,358	582		582	2,940			22,634
1981	867	14	9	891	218		218	1,109			34,641
1982	2,639	2	11	2,652	506		506	3,159			29,387
1983	629	11	33	673	214		214	887			20,557
1984	673	29	49	751	166		166	917			11,573
1985	3,320	28	89	3,437	676		676	4,113			16,089
1986	4,851	57	12	4,920	189		189	5,109			19,266
1987	861	20	34	915	119		119	1,033			15,507
1988	923	50	6	979	447	1	448	1,427			8,989
1989	1,046	21	112	1,180	57		57	1,236			10,943
1990	1,380	92	65	1,537	50		50	1,587			8,653
1991	410	6	92	508	9		9	517	2		15,781
1992	1,928	61	110	2,099	0		0	2,099	0		13,995
1993	580	103	283	966				966	6	0	10,797
1994	906	59	56	1,021	63	2	65	1,086	2	1	16,884
1995	657	49	245	951	11		11	962	2	1	29,213
1996	4,639	70	40	4,749	3,700		3,700	8,449	4		23,519
1997	2,240	133	131	2,504	367		367	2,872	14	1	24,607
1998	1,771	281	422	2,474	1	0	1	2,475	20	3	15,787
1999	184	184	408	776	2,369	35	2,404	3,180	21	5	29,178
2000	693	61	319	1,073	3,019	99	3,118	4,192	21	8	33,980
2001	292	48	344	684	863		863	1,548	50	7	18,846
2002	50	12	613	675	1,708	2	1,710	2,385	55	6	19,093
2003	22	18	355	395	3,211	43	3,254	3,649	41	12	18,593
2004		11	50	61	8,880	14	8,894	8,955	67	10	25,621
2005	201	7	73	281	4,542		4,542	4,823	20	13	29,222
2006		2	94	96	9,927		9,927	10,023	21	5	26,392
2007	42	2	12	56	4,147		4,147	4,203	13	4	20,745
2008		1	63	64	4,392	15	4,407	4,471	14	3	24,533
2009	410	6	156	572	3,019		3,019	3,591	16	3	19,467
2010		1	88	89	7,746		7,746	7,835	10	0	17,860
2011		118	225	343	2,730	1	2,731	3,074	28	1	17,099
2012		43	400	443	6,668	1	6,669	7,112	13	1	14,863
2013		11	809	820	3,154		3,154	3,974	24	0	11,354
2014	401	7	420	828	4,862		4,862	5,690	12	0	17,112
2015	86	12	399	498	3,082		3,082	3,580	16	0	11,211
2016	316	41	368	724	2,709		2,709	3,433	18	0	13,248
2017	466	21	450	937	3,643		3,643	4,580	14	0	14,802
2018	12	50	484	546	2,482		2,482	3,028	20	0	10,168

5 US in 1952-1958 contains catch from other countries - primarily Mexico. Other includes catches from gillnet, troll, pole-and-line, and longline.
6 Catches by New Zealand from 1991 to 2006 are derived from the Ministry of Fisheries, Science Group (Compilers) 2006: Report from the Fishery Assessment Plenary,
7 Catches by Australia are provided by SPC.

Table 4. Quarterly catch of Pacific bluefin tuna (*Thunnus orientalis*) by fleet for fishing year 1952-2018.

Fishing year	Season	Weight (mt)																		Number (1000 fish)			
		Fleet1 and Fleet 28	Fleet2	Fleet3	Fleet4	Fleet5	Fleet6	Fleet7	Fleet8	Fleet9	Fleet10	Fleet11	Fleet12	Fleet13	Fleet14	Fleet17	Fleet18	Fleet19	Fleet 26	Fleet15 and 29	Fleet16	Fleet20	Fleet27
1952	1	1073	0	0	0	4936	0	713	736	0	236	0	0	1951	0	0	0	23	0	0	0	0	0
1952	2	132	0	0	0	0	498	505	537	0	170	172	0	24	0	0	0	0	0	0	0	0	0
1952	3	145	0	0	0	0	282	796	503	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	4	1898	0	0	0	1990	39	907	0	568	17	0	0	0	0	0	0	0	0	0	0	0	0
1953	1	764	0	0	0	3580	0	650	371	0	255	0	0	3843	0	0	0	51	0	3	0	0	0
1953	2	241	0	0	0	0	1098	706	458	0	186	131	0	590	0	0	0	0	0	1	0	0	0
1953	3	263	0	0	0	0	318	609	430	0	2	0	0	0	0	0	0	0	0	0	0	0	0
1953	4	1578	0	0	0	1917	44	815	0	1427	107	0	0	2289	0	0	0	0	0	0	0	0	0
1954	1	1096	0	0	0	3448	0	744	1109	0	861	0	0	6845	0	0	0	58	0	1	0	0	0
1954	2	178	0	0	0	0	1236	923	1032	0	613	219	0	403	0	0	0	0	0	0	0	0	0
1954	3	177	0	0	0	0	289	569	612	0	1	0	0	483	0	0	0	0	0	0	0	0	0
1954	4	1310	0	0	0	5008	40	761	0	1334	43	0	0	3131	0	0	0	0	0	1	0	0	0
1955	1	1172	0	0	0	9008	0	665	788	0	364	0	0	2467	0	0	0	53	0	4	0	0	0
1955	2	311	0	0	0	0	1125	862	889	0	260	101	0	93	0	0	0	0	0	0	0	0	0
1955	3	124	0	0	0	0	338	813	903	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1955	4	1104	0	0	0	7496	47	1087	0	1180	38	0	0	0	0	0	0	0	0	0	0	0	0
1956	1	1521	0	0	0	13483	0	953	636	0	262	0	0	4753	0	0	0	62	0	30	0	0	0
1956	2	161	0	0	0	0	1316	1232	1134	0	185	192	0	974	0	0	0	0	0	2	0	0	0
1956	3	163	0	0	0	0	459	359	506	0	3	0	0	0	0	0	0	0	0	0	0	0	0
1956	4	905	0	0	0	6036	64	481	0	935	98	0	0	141	0	0	0	0	0	0	0	0	0
1957	1	566	0	0	0	12111	0	425	558	0	74	0	0	8779	0	0	0	84	0	6	0	0	0
1957	2	98	0	0	0	0	1785	545	830	0	25	194	0	296	0	0	0	0	0	0	0	0	0
1957	3	135	0	0	0	0	287	468	286	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	4	384	0	0	0	3937	40	626	0	394	14	0	0	2635	0	0	0	0	0	0	0	0	0
1958	1	113	0	0	0	4650	0	541	189	0	10	0	0	11188	0	0	0	52	0	1	0	0	0
1958	2	211	0	0	0	0	1117	709	316	0	4	183	0	112	0	0	0	0	0	0	0	0	0
1958	3	371	0	0	0	0	141	117	365	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1958	4	1573	0	0	0	4431	20	157	0	509	39	0	0	1278	0	0	0	0	0	0	0	0	0
1959	1	841	0	0	0	5565	0	135	227	0	29	0	0	2487	0	0	0	26	0	1	0	0	0
1959	2	916	0	0	0	0	550	178	408	0	10	153	0	0	0	0	0	0	0	0	0	0	0
1959	3	642	0	0	0	0	362	120	457	0	0	0	0	103	0	0	0	0	0	0	0	0	0
1959	4	4029	0	0	0	3475	50	161	0	562	15	0	0	1492	0	0	0	0	0	0	0	0	0
1960	1	706	0	0	0	7066	0	204	302	0	113	0	0	2912	0	0	0	66	0	0	0	0	0
1960	2	729	0	0	0	0	1407	182	504	0	80	302	0	40	0	0	0	0	0	0	0	0	0
1960	3	781	0	0	0	0	613	133	683	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	4	3940	0	0	0	3356	85	177	0	863	16	0	0	1164	0	0	0	0	0	0	0	0	0
1961	1	1472	0	0	0	5768	0	170	430	0	12	0	0	6755	0	0	0	112	0	2	0	0	0
1961	2	597	0	0	0	0	2383	201	701	0	4	580	0	217	0	0	0	0	0	0	0	0	0
1961	3	800	0	0	0	0	323	149	566	0	1	0	0	108	0	0	0	0	0	0	0	0	0
1961	4	4331	0	0	0	3981	45	200	0	561	32	0	0	2376	0	0	0	0	0	0	0	0	0
1962	1	593	0	0	0	6677	0	176	744	0	71	0	0	8578	0	0	0	59	0	2	0	0	0
1962	2	459	0	0	0	0	1256	227	527	0	43	288	0	1	0	0	0	0	0	0	0	0	0
1962	3	541	0	0	0	0	488	251	528	0	2	0	0	72	0	0	0	0	0	0	0	0	0
1962	4	5130	0	0	0	3485	68	336	0	702	73	0	0	2428	0	0	0	0	0	0	0	0	0
1963	1	600	0	0	0	6301	0	305	406	0	240	0	0	9718	0	0	0	89	0	0	0	0	0
1963	2	255	0	0	0	0	1897	381	689	0	158	276	0	53	0	0	0	0	0	0	0	0	0
1963	3	313	0	0	0	0	534	208	598	0	1	0	0	17	0	0	0	0	0	0	0	0	0
1963	4	2321	0	0	0	3175	74	278	0	992	30	0	0	1768	0	0	0	0	0	0	0	0	0
1964	1	360	0	0	0	5798	0	246	562	0	49	0	0	7420	0	0	0	97	0	1	0	0	0
1964	2	260	0	0	0	0	2078	315	726	0	27	366	0	13	0	0	0	0	0	0	0	0	0
1964	3	322	0	0	0	0	377	229	518	0	1	0	0	26	0	0	0	0	0	0	0	0	0
1964	4	1945	0	0	0	4024	52	242	0	857	32	0	54	545	0	0	0	0	0	0	0	0	0
1965	1	160	0	0	0	7471	0	213	711	0	37	0	0	5400	0	0	0	69	0	0	0	0	0
1965	2	336	0	0	0	0	1465	200	690	0	18	313	0	918	0	0	0	0	0	0	0	0	0
1965	3	122	0	0	0	0	310	145	299	0	1	0	0	1	0	0	0	0	0	0	0	0	0
1965	4	862	0	0	0	3058	43	189	0	382	46	0	0	4873	0	0	0	0	0	0	0	0	0
1966	1	285	0	0	0	7025	0	188	161	0	57	0	0	11021	0	0	0	56	0	2	0	0	0
1966	2	275	0	0	0	0	1204	133	291	0	29	81	0	2	0	0	0	0	0	0	0	0	0
1966	3	218	0	0	0	0	628	285	847	0	2	0	0	16	0	0	0	0	0	0	0	0	0
1966	4	387	0	0	0	2376	87	373	0	570	61	0	53	3064	0	0	0	0	0	0	0	0	0
1967	1	246	0	0	0	4085	0	330	273	0	84	0	0	2768	0	0	0	114	0	3	0	0	0
1967	2	73	0	0	0	0	2443	261	728	0	44	259	0	40	0	0	0	0	0	0	0	0	0
1967	3	179	0	0	0	0	301	221	631	0	3	0	0	50	0	0	0	0	0	0	0	0	0
1967	4	140	0	0	0	3741	42	307	0	819	130	0	33	789	0	0	0	0	0	0	0	0	0
1968	1	135	0	0	0	5527	0	255	456	0	177	0	0	4812	0	0	0	55	0	1	0	0	0
1968	2	54	0	0	0	0	1171	206	755	0	93	206	0	325	0	0	0	0	0	0	0	0	0
1968	3	75	0	0	0	0	426	160	375	0	3	0	0	11	0	0	0	0	0	0	0	0	0
1968	4	661	0	0	0	1176	59	197	0	433	141	0	23	1608	0	0	0	0	0	0	0	0	0

Table 4. Cont.

Fishing year	Season	Weight (mt)																		Number (1000 fish)			
		Fleet1 and Fleet 28	Fleet2	Fleet3	Fleet4	Fleet5	Fleet6	Fleet7	Fleet8	Fleet9	Fleet10	Fleet11	Fleet12	Fleet13	Fleet14	Fleet17	Fleet18	Fleet19	Fleet 26	Fleet15 and 29	Fleet16	Fleet20	Fleet27
1969	1	109	0	0	0	2061	0	184	294	0	319	0	0	5258	0	0	0	78	0	1	0	0	0
1969	2	54	0	0	0	0	1656	213	426	0	196	160	0	49	0	0	0	0	0	0	0	0	0
1969	3	37	0	0	0	0	230	178	232	0	3	0	0	14	0	0	0	0	0	0	0	0	0
1969	4	524	0	0	0	1274	32	204	0	433	140	0	0	1416	0	0	0	0	0	0	0	0	0
1970	1	23	0	0	0	1633	0	210	282	0	190	0	0	2534	0	0	0	42	0	1	0	0	0
1970	2	35	0	0	0	0	894	194	398	0	99	161	0	2	0	0	0	0	0	1	0	0	0
1970	3	181	0	0	0	0	286	234	163	0	4	0	0	31	0	0	0	0	0	0	0	0	0
1970	4	505	0	0	0	2835	40	269	0	284	171	0	1	4039	0	0	0	0	0	0	0	0	0
1971	1	19	0	0	0	887	0	230	200	0	340	0	0	3349	0	0	0	52	0	1	0	0	0
1971	2	43	0	0	0	0	1114	240	261	0	202	212	0	939	0	0	0	0	0	0	0	0	0
1971	3	47	0	0	0	0	162	297	199	0	3	0	0	3	0	0	0	0	0	0	0	0	0
1971	4	446	0	0	0	2049	23	78	0	215	111	0	14	2879	0	0	0	0	0	0	0	0	0
1972	1	15	0	0	0	2163	0	449	127	0	164	0	0	8861	0	0	0	29	0	1	0	0	0
1972	2	31	0	0	0	0	629	159	233	0	89	124	0	1603	0	0	0	0	0	0	0	0	0
1972	3	57	0	0	0	0	405	73	485	0	2	0	0	11	0	0	0	0	0	0	0	0	0
1972	4	799	0	0	0	464	56	160	0	501	70	0	33	2043	0	0	0	0	0	2	0	0	0
1973	1	21	0	0	0	1803	0	419	359	0	277	0	0	8690	0	0	0	74	0	4	0	0	0
1973	2	25	0	0	0	0	1573	183	514	0	186	286	0	0	0	0	0	0	0	0	0	0	0
1973	3	30	0	0	0	0	318	450	1313	0	4	0	0	0	0	0	0	0	0	0	0	0	0
1973	4	1037	0	0	0	416	44	246	0	1403	155	0	47	1227	0	0	0	0	0	0	0	0	0
1974	1	105	0	0	0	3690	0	483	865	0	546	0	0	4238	0	0	0	58	0	6	0	0	0
1974	2	48	0	0	0	0	1236	363	1424	0	362	368	0	151	0	0	0	0	0	0	0	0	0
1974	3	29	0	0	0	0	198	806	287	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1974	4	891	0	0	0	3415	28	132	0	349	73	0	61	3065	0	0	0	0	0	0	0	0	0
1975	1	121	0	0	0	1077	0	1096	309	0	605	0	0	5748	0	0	0	36	0	3	0	0	0
1975	2	61	0	0	0	0	769	50	378	0	431	132	0	769	0	0	0	0	0	0	0	0	0
1975	3	37	0	0	0	0	159	80	231	0	5	0	0	616	0	0	0	0	0	0	0	0	0
1975	4	298	0	0	0	1122	22	271	0	430	240	0	17	2283	0	0	0	0	0	0	0	0	0
1976	1	54	0	0	0	1026	0	1300	301	0	818	0	0	7250	0	0	0	29	0	2	0	0	0
1976	2	15	0	0	0	0	619	518	431	0	540	152	0	497	0	0	0	0	0	0	0	0	0
1976	3	69	0	0	0	0	416	169	320	0	2	0	0	2	0	0	0	0	0	0	0	0	0
1976	4	244	0	0	0	4063	58	1338	0	411	108	0	131	2015	0	0	0	0	0	0	0	0	0
1977	1	37	0	0	0	1047	0	1258	222	0	485	0	0	3094	0	0	0	76	0	2	0	0	0
1977	2	12	0	0	0	0	1617	377	378	0	331	168	0	348	0	0	0	0	0	0	0	0	0
1977	3	58	0	0	0	867	51	377	0	2	0	0	86	0	0	0	0	0	0	0	0	0
1977	4	243	0	0	0	10346	121	426	0	527	107	0	66	704	0	0	0	0	0	0	0	0	0
1978	1	340	0	0	3	78	0	2329	282	0	441	0	0	4403	0	0	0	158	0	0	0	0	0
1978	2	16	0	0	0	0	3372	380	512	0	298	246	0	21	0	0	0	0	0	0	0	0	0
1978	3	55	0	0	0	0	510	454	733	0	2	0	0	11	0	0	0	0	0	0	0	0	0
1978	4	580	0	0	0	11145	71	211	0	1011	115	0	58	2331	0	0	0	0	0	0	0	0	0
1979	1	104	0	0	0	2736	0	1720	527	0	768	0	0	3539	0	0	0	93	0	1	0	0	0
1979	2	24	0	0	0	0	1982	406	861	0	541	888	0	227	0	0	0	0	0	0	0	0	0
1979	3	43	0	0	0	0	294	572	363	0	3	0	0	0	0	0	0	0	0	0	0	0	0
1979	4	749	0	0	0	6168	41	195	0	379	140	0	114	1435	0	0	0	0	0	0	0	0	0
1980	1	20	0	0	0	5159	0	1641	322	0	574	0	0	1439	0	0	0	54	0	1	0	0	0
1980	2	41	0	0	0	0	1143	468	353	0	387	474	0	59	0	0	0	0	0	0	0	0	0
1980	3	185	0	0	0	0	283	85	406	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1980	4	336	0	0	0	6344	0	115	0	404	54	0	179	356	0	0	0	0	0	0	0	0	0
1981	1	56	0	0	1297	17781	0	2382	271	0	352	0	0	742	0	0	0	68	0	0	0	0	0
1981	2	41	0	0	0	0	1426	302	393	0	248	523	0	1	0	0	0	0	0	0	0	0	0
1981	3	63	0	8	0	0	435	336	277	0	2	0	0	0	0	0	0	0	0	0	0	0	0
1981	4	583	0	12	0	5410	53	671	0	341	69	0	207	60	0	0	0	0	0	0	0	0	0
1982	1	73	0	6	1615	12209	0	1905	198	0	300	0	0	2682	0	0	0	5	0	1	0	0	0
1982	2	20	0	5	0	0	370	444	277	0	204	132	0	406	0	0	0	0	0	0	0	0	0
1982	3	38	0	3	0	0	81	31	189	0	1	0	0	91	0	0	0	0	0	0	0	0	0
1982	4	161	0	5	0	11951	0	107	0	207	35	0	175	8	0	0	0	0	0	0	0	0	0
1983	1	8	0	3	570	2262	0	897	143	0	113	0	0	631	0	0	0	21	0	1	0	0	0
1983	2	15	0	2	0	0	1925	131	210	0	74	310	0	125	0	0	0	0	0	1	0	0	0
1983	3	41	0	1	0	0	287	33	380	0	3	0	0	72	0	0	0	0	0	0	0	0	0
1983	4	94	0	2	0	2448	0	116	0	431	138	0	477	144	0	0	0	0	0	0	0	0	0
1984	1	20	0	1	807	1184	0	588	311	0	343	0	0	563	0	0	0	28	0	3	0	0	0
1984	2	9	0	1	0	0	1558	391	413	0	215	336	0	90	0	0	0	0	0	1	0	0	0
1984	3	24	0	0	0	0	538	1011	265	0	3	0	0	62	0	0	0	0	0	0	0	0	0
1984	4	74	0	0	0	2897	135	464	0	358	153	0	210	1572	0	0	0	0	0	0	0	0	0
1985	1	8	0	0	448	889	0	961	229	0	714	0	0	1264	0	0	0	12	0	5	0	0	0
1985	2	8	0	0	0	0	1165	120	352	0	488	447	0	1126	0	0	0	0	0	0	0	0	0
1985	3	19	0	84	0	0	224	74	369	0	3	0	0	109	0	0	0	0	0	0	0	0	0
1985	4	84	0	130	0	6340	0	460	0	547	118	0	70	428	0	0	0	0	0	0	0	0	0

Table 4. Cont.

Fishing year	Season	Weight (mt)																		Number (1000 fish)			
		Fleet1 and Fleet 28	Fleet2	Fleet3	Fleet4	Fleet5	Fleet6	Fleet7	Fleet8	Fleet9	Fleet10	Fleet11	Fleet12	Fleet13	Fleet14	Fleet17	Fleet18	Fleet19	Fleet 26	Fleet15 and 29	Fleet16	Fleet20	Fleet27
1986	1	8	0	70	16	1072	0	668	375	0	564	0	0	3759	0	0	0	5	0	1	0	0	0
1986	2	5	0	60	0	0	1238	212	553	0	387	403	0	801	0	0	0	0	0	0	0	0	0
1986	3	20	0	22	0	0	354	1089	274	0	2	0	0	93	0	0	0	0	0	0	0	0	0
1986	4	195	0	34	0	4874	15	132	0	299	89	0	365	31	0	0	0	0	0	0	0	0	0
1987	1	20	0	18	250	3550	0	519	193	0	612	0	0	813	0	0	0	6	0	1	0	0	0
1987	2	9	0	15	0	0	505	98	297	0	432	187	0	63	0	0	0	0	0	1	0	0	0
1987	3	19	0	8	0	0	89	146	94	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1987	4	123	16	12	0	1027	0	357	0	113	45	0	108	221	0	0	0	0	0	0	0	0	0
1988	1	35	0	7	742	2010	0	796	87	0	228	0	0	974	0	0	0	15	0	0	0	0	0
1988	2	10	0	6	0	0	1020	42	118	0	157	127	0	227	0	0	6	0	0	0	0	0	0
1988	3	27	3	17	0	0	259	68	86	0	0	0	0	7	0	0	0	0	0	0	0	0	0
1988	4	190	3	27	0	2134	27	356	0	125	24	0	205	0	0	0	0	0	0	0	0	0	0
1989	1	20	88	15	580	3623	0	411	81	0	186	0	0	988	0	0	0	88	0	5	0	0	0
1989	2	4	0	12	0	0	529	146	114	0	132	110	0	130	0	0	20	0	0	1	0	0	0
1989	3	21	0	32	0	0	166	17	165	0	1	0	0	16	0	0	0	0	0	0	0	0	0
1989	4	280	5	50	0	360	92	213	0	133	26	0	189	1	0	0	0	0	0	0	0	0	0
1990	1	24	32	27	149	2474	0	830	64	0	90	0	0	1311	0	0	0	3	0	4	0	0	0
1990	2	10	0	23	0	0	990	47	179	0	60	199	0	194	0	0	118	0	0	0	0	0	0
1990	3	16	99	65	0	0	636	30	421	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1990	4	193	26	100	0	646	161	79	0	288	49	0	342	86	0	0	0	0	0	0	0	0	0
1991	1	14	182	54	224	3466	0	429	123	0	146	0	2	334	0	0	0	82	0	5	0	0	0
1991	2	14	0	46	0	0	1191	103	363	0	95	414	0	5	0	0	5165	0	0	0	0	0	0
1991	3	36	394	71	0	0	274	18	183	0	2	0	0	0	0	0	0	0	0	0	0	0	0
1991	4	462	2061	109	0	1677	0	35	0	332	68	0	464	11	0	0	0	0	0	0	0	0	0
1992	1	10	255	59	469	2183	0	944	173	0	116	0	0	1650	0	0	0	0	0	8	0	0	0
1992	2	20	0	50	0	0	642	65	269	0	66	193	0	328	0	0	198	0	0	0	0	0	0
1992	3	15	582	10	0	0	145	12	102	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1992	4	708	751	15	0	1243	34	38	0	280	27	0	471	45	0	0	0	0	0	0	0	0	0
1993	1	62	99	8	83	3831	0	204	161	0	32	0	6	525	0	0	0	48	0	10	0	0	0
1993	2	37	0	7	0	0	320	36	230	0	16	207	0	113	0	0	12	0	0	0	0	0	0
1993	3	42	25	12	0	0	67	0	70	0	1	0	0	2	0	0	0	0	0	0	0	0	0
1993	4	1085	562	19	0	2677	15	17	0	481	16	0	559	4	0	0	0	0	0	0	0	0	0
1994	1	77	14	10	694	3973	0	206	168	0	36	0	3	967	0	0	0	458	0	2	0	0	0
1994	2	22	0	9	0	0	3570	65	356	0	31	272	0	58	0	0	185	0	0	0	0	0	0
1994	3	11	406	202	0	0	2475	9	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	4	616	254	309	0	2040	733	136	0	256	23	0	335	0	0	0	0	0	0	0	0	0	0
1995	1	35	4055	168	496	2798	0	143	243	0	213	0	2	716	0	0	0	440	0	16	0	0	0
1995	2	25	0	142	0	0	1130	94	788	0	205	476	0	0	0	0	8860	0	0	0	0	0	0
1995	3	31	1355	25	0	0	136	5	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	4	827	140	38	0	3124	57	1	0	253	16	0	956	757	0	0	0	0	0	2	0	0	0
1996	1	25	451	21	450	1967	0	90	129	0	142	0	4	7652	0	0	0	256	0	1	0	0	0
1996	2	26	0	18	0	0	3191	66	416	0	110	503	0	0	0	0	158	0	0	0	0	0	0
1996	3	27	594	259	0	0	846	1	114	0	0	0	0	1	0	0	0	0	0	0	0	0	0
1996	4	1215	1113	397	0	1402	550	4	0	199	6	0	1814	61	0	0	0	0	0	3	0	0	0
1997	1	27	3000	215	708	4027	0	113	165	0	20	0	15	2638	0	0	0	224	0	5	0	0	0
1997	2	44	0	183	0	0	1120	25	246	0	53	702	0	41	0	0	2309	0	0	0	0	0	0
1997	3	18	559	46	0	0	605	2	158	0	1	0	0	4	0	0	0	0	0	0	0	0	0
1997	4	1150	518	71	0	13	515	2	0	131	15	0	1910	8	0	0	0	0	0	1	0	0	0
1998	1	53	549	38	326	2376	0	108	114	0	29	0	23	2017	0	0	0	131	0	21	23	0	23
1998	2	46	0	33	0	0	1613	64	359	0	68	609	0	24	0	0	1049	0	0	1	0	0	0
1998	3	33	686	63	0	0	798	10	317	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1998	4	1076	986	96	0	5592	360	2	0	329	32	0	3089	2280	0	0	0	0	0	1	0	0	0
1999	1	25	2228	52	579	5448	0	65	133	0	16	0	26	442	0	0	0	129	0	35	107	0	107
1999	2	41	0	44	0	0	2101	17	391	0	46	482	0	49	0	0	653	0	0	1	0	0	0
1999	3	39	651	747	0	0	1456	1	168	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	4	893	2380	1597	0	3403	770	83	0	164	5	0	2780	669	0	0	0	0	0	8	0	0	0
2000	1	15	3214	30	747	4042	0	66	154	0	87	0	29	3204	0	0	0	117	0	13	191	0	191
2000	2	12	0	27	0	0	2780	6	475	0	72	638	0	0	0	0	2048	0	0	0	0	0	0
2000	3	8	898	963	0	0	934	0	358	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2000	4	749	2914	179	0	981	464	4	0	189	45	0	1834	382	0	5	0	0	0	1	0	0	0
2001	1	13	409	9	239	1918	0	167	73	0	174	0	57	821	0	0	0	83	0	21	275	0	275
2001	2	26	0	37	0	0	1847	113	293	0	232	683	0	0	0	0	261	0	0	1	0	0	0
2001	3	76	62	160	0	0	988	17	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	4	671	2126	175	0	556	697	51	0	117	6	0	1513	0	275	10	0	0	0	1	0	0	0
2002	1	45	959	509	599	2767	0	224	157	0	235	0	61	0	1497	0	0	37	0	31	358	0	358
2002	2	56	0	88	0	0	706	24	231	0	251	409	0	0	0	0	1835	0	0	2	0	0	0
2002	3	95	99	238	0	0	520	11	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	4	992	1771	394	0	185	824	34	0	87	54	0	1832	0	590	0	0	0	0	1	0	0	0

Table 4. Cont.

Fishing year	Season	Weight (mt)																		Number (1000 fish)			
		Fleet1 and Fleet28	Fleet2	Fleet3	Fleet4	Fleet5	Fleet6	Fleet7	Fleet8	Fleet9	Fleet10	Fleet11	Fleet12	Fleet13	Fleet14	Fleet17	Fleet18	Fleet19	Fleet 26	Fleet15 and 29	Fleet16	Fleet20	Fleet27
2003	1	78	783	88	571	200	0	58	96	0	291	0	84	0	2704	0	0	80	0	21	442	0	442
2003	2	85	0	1881	0	0	416	6	156	0	71	403	0	0	0	0	2159	0	0	1	0	0	0
2003	3	116	38	53	0	0	182	5	109	0	3	0	1	0	0	0	0	0	0	0	0	0	0
2003	4	1380	1144	556	0	609	54	15	0	266	47	0	1698	0	3620	0	0	0	0	1	0	0	0
2004	1	154	10	59	2100	2225	0	114	136	0	81	0	93	0	5285	0	0	78	0	3	526	0	526
2004	2	205	0	105	0	0	1868	94	186	0	68	421	0	0	0	0	2131	0	0	0	0	0	0
2004	3	122	586	720	0	0	1173	164	379	0	15	0	0	0	0	0	0	0	0	0	0	0	0
2004	4	1602	1888	264	0	264	906	321	0	572	217	0	1287	0	1986	43	0	0	0	0	0	0	0
2005	1	106	3280	222	3694	77	0	171	414	0	137	0	71	0	2764	0	0	293	0	5	454	0	454
2005	2	108	0	121	0	0	1034	30	346	0	102	413	0	0	0	0	3029	0	0	0	0	0	0
2005	3	81	59	220	0	0	513	68	284	0	7	0	0	0	640	0	0	0	0	0	0	0	0
2005	4	873	2412	339	0	940	85	23	0	356	135	0	1078	0	4714	49	0	0	0	5	0	0	0
2006	1	115	252	354	2012	692	0	315	148	0	328	0	48	0	4573	0	0	251	0	2	633	0	633
2006	2	62	0	102	0	0	695	17	229	0	69	331	0	0	1	0	2513	0	0	0	0	0	0
2006	3	61	485	376	0	0	228	32	253	0	10	0	0	0	0	0	0	0	0	0	0	0	0
2006	4	1022	1059	13	0	479	70	15	0	270	127	0	1261	0	1424	95	0	0	0	0	0	0	0
2007	1	66	363	121	2123	364	0	238	150	0	381	0	58	0	2723	4	0	101	0	1	876	0	876
2007	2	71	0	776	0	0	1985	105	314	0	52	1013	0	0	44	0	1968	0	0	0	0	0	0
2007	3	99	214	581	0	0	619	12	268	0	2	0	0	0	0	0	0	0	0	0	0	0	0
2007	4	802	1610	1003	0	1	220	30	0	844	239	0	784	0	1794	175	0	0	0	1	0	0	0
2008	1	33	3007	62	3028	0	0	287	389	0	186	0	35	0	2613	2	0	72	0	10	607	0	607
2008	2	40	0	230	0	0	1163	14	455	0	95	797	0	0	1	0	2361	0	0	0	0	0	0
2008	3	39	702	518	0	0	868	1	449	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2008	4	662	2177	213	0	1	241	13	0	1031	276	0	625	0	1209	186	0	0	0	1	0	0	0
2009	1	26	2891	97	1299	828	0	108	180	0	181	0	82	0	2221	3	0	62	0	12	256	0	256
2009	2	23	0	112	0	0	703	43	143	0	106	677	0	0	3	0	181	0	0	0	0	0	0
2009	3	35	718	617	0	0	264	0	342	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2009	4	400	1390	424	0	35	38	36	0	566	264	0	260	0	2447	78	0	0	0	3	0	0	0
2010	1	27	123	26	1052	35	0	179	190	0	79	0	45	0	5300	0	0	20	0	4	563	0	563
2010	2	10	0	145	0	0	979	44	237	0	9	693	0	0	1	0	388	0	0	1	0	0	0
2010	3	25	67	191	0	0	492	29	374	0	4	0	0	0	0	0	0	0	0	0	0	0	0
2010	4	372	3058	429	0	0	298	34	0	380	384	0	197	0	451	76	0	0	0	2	0	0	0
2011	1	49	611	21	1906	320	0	38	158	0	148	0	48	0	2379	0	0	39	0	29	375	0	375
2011	2	32	0	43	0	0	789	22	217	0	36	567	0	0	19	0	2377	0	0	1	0	0	0
2011	3	20	9	163	0	0	242	70	360	0	5	0	0	0	0	0	0	0	0	0	0	0	0
2011	4	189	530	674	0	3	7	45	0	500	151	0	148	0	1286	50	0	0	0	4	0	0	0
2012	1	24	261	559	841	199	0	103	205	0	514	0	26	0	5421	0	0	2	0	35	180	0	180
2012	2	13	0	28	0	0	233	0	176	0	54	644	0	0	3	0	620	0	0	1	0	0	0
2012	3	28	9	76	0	0	256	2	273	0	4	0	0	0	0	0	0	0	0	0	0	0	0
2012	4	237	743	493	0	12	19	6	0	372	170	0	192	0	1368	123	0	0	0	3	0	0	0
2013	1	28	10	1	1729	268	0	81	132	0	204	0	40	0	1788	0	0	22	0	57	264	0	264
2013	2	15	0	35	0	0	477	3	217	0	82	895	0	0	8	0	2	0	0	5	0	0	0
2013	3	9	79	516	0	0	789	0	306	0	2	0	0	0	2	0	0	0	0	0	0	0	0
2013	4	311	2459	783	0	0	60	43	0	818	285	0	257	0	4036	216	0	0	0	1	0	0	0
2014	1	21	654	6	2203	47	0	125	92	0	231	0	21	0	1228	1	0	40	0	25	61	0	61
2014	2	26	0	6	0	0	97	1	107	0	110	679	0	0	2	0	14	0	0	2	0	0	0
2014	3	39	246	607	0	0	60	7	76	0	1	0	0	0	1	0	0	0	0	1	0	0	0
2014	4	191	86	5	0	939	18	12	0	388	261	0	308	0	3133	237	0	0	0	2	0	121	0
2015	1	25	27	0	1864	0	0	11	88	0	210	0	26	0	43	0	0	19	0	25	243	27	243
2015	2	47	0	65	0	0	233	6	77	0	167	808	0	0	3	0	7	0	0	0	0	0	0
2015	3	72	1	981	0	0	153	5	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	4	217	97	33	0	1287	82	5	0	199	283	0	237	0	2716	215	0	0	0	2	0	267	0
2016	1	83	463	6	1772	0	0	8	135	0	183	0	23	0	329	0	0	224	0	8	261	1	261
2016	2	20	0	9	0	0	213	52	254	0	62	769	0	0	16	0	805	0	0	2	0	0	0
2016	3	50	83	738	0	0	178	31	479	0	1	0	0	0	1	0	0	0	0	0	0	0	0
2016	4	358	131	0	0	1620	6	64	0	368	175	0	232	0	3650	172	0	0	0	2	0	219	0
2017	1	37	111	3	1691	0	0	32	259	0	518	0	30	0	479	1	0	82	0	10	164	0	164
2017	2	35	0	2	0	0	299	1	109	0	316	1038	0	0	0	0	375	0	219	5	0	0	0
2017	3	59	11	530	0	0	81	30	148	0	1	0	0	0	418	0	0	0	0	1	0	0	0
2017	4	354	81	0	0	1571	15	25	0	209	36	0	257	0	2429	115	0	0	171	2	0	245	12
2018	1	11	124	0	1536	0	0	5	98	0	37	0	38	0	40	0	0	42	0	6	218	1	218
2018	2	37	0	5	0	0	196	8	110	0	7	529	0	0	18	0	95	0	183	4	0	0	0
2018	3	194	8	542	0	0	296	35	233	0	1	0	0	0	2007	0	0	0	80	0	0	0	0
2018	4	423	152	16	0	1567	51	9	0	233	52	0	247	0	7	169	0	0	0	5	0	232	12

Table 5-(a). Abundance indices (CPUE) used in the stock assessment model for Pacific bluefin tuna (*Thunnus orientalis*).

CPUE #	Abundance index	Available period (fishing year)	Corresponding fisheries	Corresponding fleet for the selectivity setting	Data quality	Document for reference	Update
S1	Japanese coastal longline CPUE for spawning season.	**1993-2018**	JP Longline	Fleet 1 : JPLL	Standardized by spatio-temporal GLMM	ISC/20/PBFWG-1/02	X
S2	Japanese offshore and distant water longliners CPUE	**1952-1973**	JP Longline	Fleet 1 : JPLL	Standardized by lognormal model	ISC/12/PBFWG-1/10	
S3	Japanese offshore and distant water longliners CPUE	**1974-1992**	JP Longline	Fleet 1 : JPLL		ISC/08/PBFWG-1/05	
S4	Japanese troll CPUE in Nagasaki prefecture (Sea of Japan and East China sea)	**1980-2016, 2018**	JP Troll	Fleet 6 : JP Troll (Seas 2-4)	Standardized by lognormal model	ISC/20/PBFWG-1/04	X
S5	Taiwanese longline CPUE (South area)	**2002-2018**	TW Longline	Fleet 12 : TWLL (South)	Standardized by GLMM	ISC/20/PBFWG-1/03	X

Table 5-(b). Abundance indices (CPUE) **NOT** used in previous assessment model for Pacific bluefin tuna (*Thunnus orientalis*).

CPUE #	Abundance index	Available period (fishing year)	Corresponding fisheries	Corresponding fleet for the selectivity setting	Data quality	Document for reference	Update
S6	Taiwanese longline geo-stat CPUE (South core area)	**2006-2018**	TW Longline	Fleet 12 : TWLL (South)	Standardized by spatio-temporal GLMM	ISC/20/PBFWG-1/03	X
S7	Taiwanese longline geo-stat CPUE (North core area)	**2006-2018**	TW Longline	Fleet 17 : TWLL (North)	Standardized by spatio-temporal GLMM	ISC/20/PBFWG-1/03	X
S8	Taiwanese longline GLMM CPUE (North whole area)	**2003-2018**	TW Longline	Fleet 17 : TWLL (North)	Standardized by GLMM	ISC/20/PBFWG-1/03	X
S9	Korean Offshore Large scale Purse Seine CPUE	**2004-2018**	KR Purse Seine	Fleet 3: KROLPS	Standardized by GLM	ISC/19/PBFWG-2/13	X
S10	Japanese Recruitment monitoring in the East China Sea	**2011-2018**	JP Troll	Fleet 6 : JP Troll (Seas 2-4)	Standardized by GLMM	ISC/19/PBFWG-2/12	X
S11	Japanese Recruitment monitoring in the Pacific Ocean	**2011-2018**	JP Troll	Fleet 19: JP Troll (Seas 1)	Standardized by GLMM	ISC/19/PBFWG-2/12	X

Table 6.   Available annual abundance indices (CPUE) of Pacific bluefin tuna (*Thunnus orientalis*). S1, S2, S3, S5, and S9 will be fitted to the assessment model (numbers in bold). Numbers in grey indicate that data points were removed.

Fishing year	JP LL			JP Troll	TW LL				JP Troll Monitoring	
	S1	S2	S3	S4	S5	S6	S7	S8	S10	S11
1952		0.01								
1953		0.01								
1954		0.01								
1955		0.01								
1956		0.01								
1957		0.01								
1958		0.02								
1959		0.03								
1960		0.02								
1961		0.02								
1962		0.02								
1963		0.01								
1964		0.01								
1965		0.01								
1966		0.01								
1967		0.01								
1968		0.01								
1969		0.01								
1970		0.00								
1971		0.00								
1972		0.00								
1973		0.00								
1974		0.01	0.00							
1975			0.00							
1976			0.00							
1977			0.00							
1978			0.00							
1979			0.00							
1980			0.00	0.68						
1981			0.00	1.20						
1982			0.00	0.63						
1983			0.00	0.93						
1984			0.00	0.95						
1985			0.00	0.89						
1986			0.00	1.00						
1987			0.00	0.73						
1988			0.00	0.84						
1989			0.00	0.66						
1990			0.00	1.30						
1991			0.00	1.35						
1992			0.00	0.59						
1993	2.28		0.01	0.49						
1994	1.69		0.00	2.05						
1995	2.05		0.01	1.12						
1996	2.13		0.01	1.64						
1997	1.94		0.01	0.96						
1998	1.49		0.00	0.84						
1999	1.06		0.00	1.54						
2000	0.77		0.00	1.17						
2001	0.92		0.00	1.17						
2002	1.39			0.76	2.14					
2003	1.41			0.66	2.22					
2004	1.55			1.32	1.56			0.92		
2005	0.90			1.45	1.68			1.18		
2006	0.99			0.75	1.19	127.46	8.73	0.73		
2007	0.61			1.45	1.02	68.34	12.54	1.03		
2008	0.36			1.48	0.94	41.07	14.50	1.11		
2009	0.22			1.17	0.49	29.90	6.10	0.65		
2010	0.20			1.14	0.43	21.67	9.00	0.77		
2011	0.15			0.99	0.37	18.00	6.51	0.63	0.69	1.40
2012	0.31			0.50	0.39	20.73	9.10	0.76	0.68	0.68
2013	0.31			0.91	0.63	28.83	14.92	1.25	1.19	1.12
2014	0.38			0.43	0.73	30.08	18.10	1.14	0.34	0.40
2015	0.42			0.51	0.71	36.61	19.05	1.48	0.61	0.67
2016	0.65			1.11	0.85	37.47	15.28	1.21	1.42	0.99
2017	0.69				0.81	54.78	8.64	0.73	2.06	1.75
2018	1.10			0.64	0.85	53.14	14.95	1.41	1.17	1.45

Table 7. Coefficient of variation (CV) of the abundance indices (CPUE) of Pacific bluefin tuna (*Thunnus orientalis*), estimated by the statistical model for the standardization. The data points which were removed are shown in grey letters.

Fishing year	JP LL			JP Troll	TW LL				JP Troll Monitoring	
	S1	S2	S3	S4	S5	S6	S7	S8	S10	S11
1952		0.03								
1953		0.02								
1954		0.02								
1955		0.02								
1956		0.02								
1957		0.02								
1958		0.03								
1959		0.03								
1960		0.03								
1961		0.03								
1962		0.03								
1963		0.02								
1964		0.02								
1965		0.02								
1966		0.02								
1967		0.02								
1968		0.02								
1969		0.02								
1970		0.02								
1971		0.02								
1972		0.02								
1973		0.02								
1974		0.03	0.01							
1975			0.01							
1976			0.01							
1977			0.01							
1978			0.01							
1979			0.01							
1980			0.01	0.02						
1981			0.01	0.02						
1982			0.01	0.02						
1983			0.01	0.02						
1984			0.01	0.01						
1985			0.01	0.02						
1986			0.01	0.01						
1987			0.01	0.02						
1988			0.01	0.02						
1989			0.01	0.02						
1990			0.01	0.01						
1991			0.01	0.02						
1992			0.01	0.02						
1993	0.08		0.01	0.02						
1994	0.08		0.01	0.01						
1995	0.06		0.01	0.02						
1996	0.06		0.01	0.01						
1997	0.06		0.01	0.02						
1998	0.05		0.01	0.02						
1999	0.06		0.01	0.02						
2000	0.06		0.01	0.02						
2001	0.05		0.01	0.02						
2002	0.05			0.02	0.04					
2003	0.04			0.02	0.03					
2004	0.04			0.01	0.04			0.13		
2005	0.05			0.02	0.03			0.05		
2006	0.05			0.03	0.04	0.07	0.16	0.03		
2007	0.06			0.02	0.05	0.07	0.13	0.03		
2008	0.07			0.02	0.03	0.08	0.13	0.04		
2009	0.09			0.02	0.05	0.09	0.14	0.04		
2010	0.09			0.02	0.04	0.12	0.14	0.05		
2011	0.09			0.02	0.06	0.12	0.16	0.06	0.07	0.06
2012	0.07			0.02	0.07	0.12	0.12	0.04	0.09	0.08
2013	0.08			0.02	0.06	0.12	0.12	0.03	0.05	0.06
2014	0.08			0.04	0.04	0.10	0.11	0.02	0.12	0.12
2015	0.08			0.02	0.03	0.12	0.12	0.03	0.07	0.10
2016	0.07			0.02	0.03	0.11	0.12	0.03	0.06	0.06
2017	0.14				0.05	0.11	0.16	0.06	0.08	0.05
2018	0.11			0.02	0.04	0.12	0.12	0.03	0.05	0.05

*2: CVs of S2 index are based on the output file of the standardization work (Fujioka K. pers. comm.). The others are based on the ref

Table 8. Summary of the size composition data of Pacific bluefin tuna (*Thunnus orientalis*) for the stock assessment.

Fleet #	Fleet name	Catch-at-size data (Size bin definition)	Size data included		Available period (Fishing year)	Source of sample size	Update
			Component 1	Component 2			
Fleet1	JPLL	Length bin	JPLL (Season 4)		1952-1968, 1993-2016	Scaled Number of fish measured	X
Fleet2	JPSPPS (Seas1, 3, 4)	Length bin	JPSPPS (Season 1, 3, 4)		2002-2018	Number of landing well measured	X
Fleet3	KROLPS	Length bin	KROLPS		2003-2018	Number of trip or set well measured /2	X
Fleet4	TPSJS	Length bin	JP TPSJS		1987-1989, 1991-2018	same velue with the last assessment	X
Fleet5	TPSPO	Length bin	JP TPSPO		1995-2006 and 2014-2018	Number of trip or set well measured /2	X
Fleet6	JP Troll (Seas2-4)	Length bin	JP Troll (Season 2-4)		1994-2018	Total month of well sampled port	X
Fleet7[*1]	PL	Length bin	JP Pole-and-Line		1994-1996, 1998-2004, 2006-2010		
Fleet8	SetNet (Seas1-3)	Length bin	JP Setnet (Season 1-3)		1993-2018	Total month of well sampled port	X
Fleet9	SetNet (Seas4)	Length bin	JP Setnet (Season 4)		1993-2018	Total month of well sampled port	X
Fleet10[*2]	SetNet_HK_AM	Weight bin	JP Setnet in Hokkaido and Aomori	JP Handline & Tsugaru Longline	1994-2018	Total month of well sampled port	X
Fleet11[*2]	JP Others	Weight bin	JP Handline & Tsugaru Longline		1994-2018	Total month of well sampled port	X
Fleet12	TWLL (South)	Length bin	TWLL (South area)		1992-2018	Scaled Number of fish measured	X
Fleet13	USCOMM (-2001)	Length bin	US Commercial Fisheries (PS)		1952-1965, 1969-1982	Number of haul well measured	
Fleet14	MXCOMM (2002-)	Length bin	MX Commercial Fisheries (PS)		2005-2006, 2008-2018	Number of haul well measured	X
Fleet15	EPOSP	Length bin	US Recreational Fisheries		2014-2018	Number of trip or set well measured /2	X
Fleet16[*3]	Troll4Pen	Age (age-0 only)			2014		
Fleet17	TWLL (North)	Length bin	TWLL (North area)		2009-2018	Scaled Number of fish measured	X
Fleet18	JPSPPS (Seas2)	Length bin	JPSPPS (Season 2)		2003-2012, 2014, 2016-2018	Number of landing well measured	X
Fleet19	JP Troll (Seas1)	Length bin	JP Troll (Season 1)		1994-2004, 2006-2008, 2011,2012, 2016, 2018	Total month of well sampled port	X
Fleet20	JSSPS for Pen	Length bin	JSSPS for farming		2016-2018	Numer of set well measured /4	X
Fleet28	JPLL (1993- ,S3)	Length bin	JPLL (Season 3)		1993-2018	Scaled Number of fish measured	X
Fleet29	EPOSP_early	Length bin	US Recreational Fisheries		1993-2003, 2005-2006, 2008-2011		

(a)

Catch by Fleet (weight)

(b)

Catch by Fleet (number)
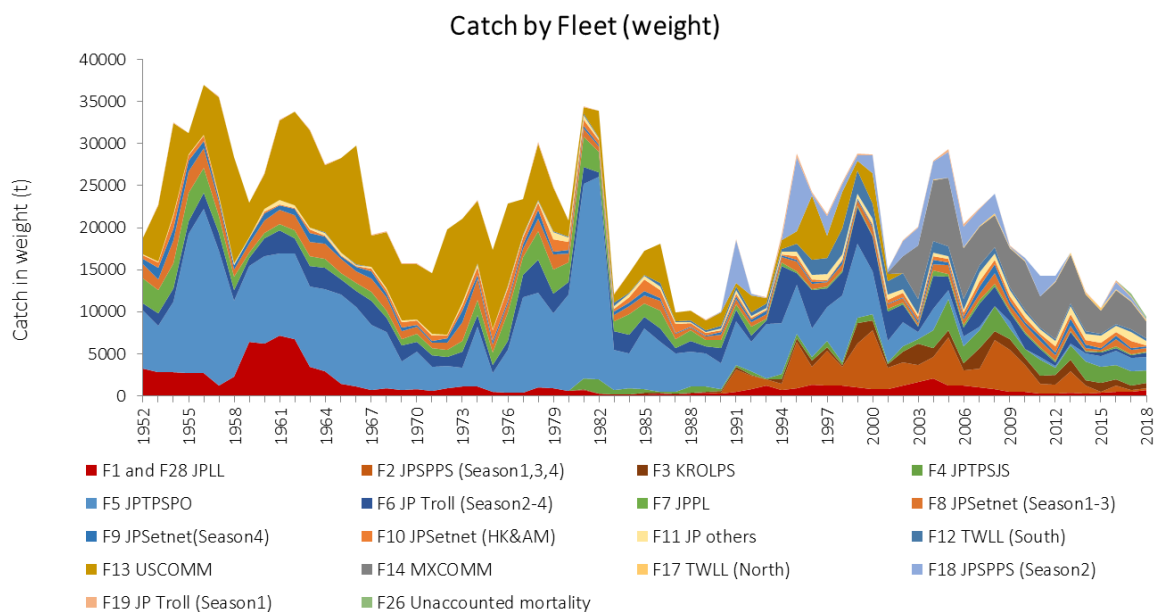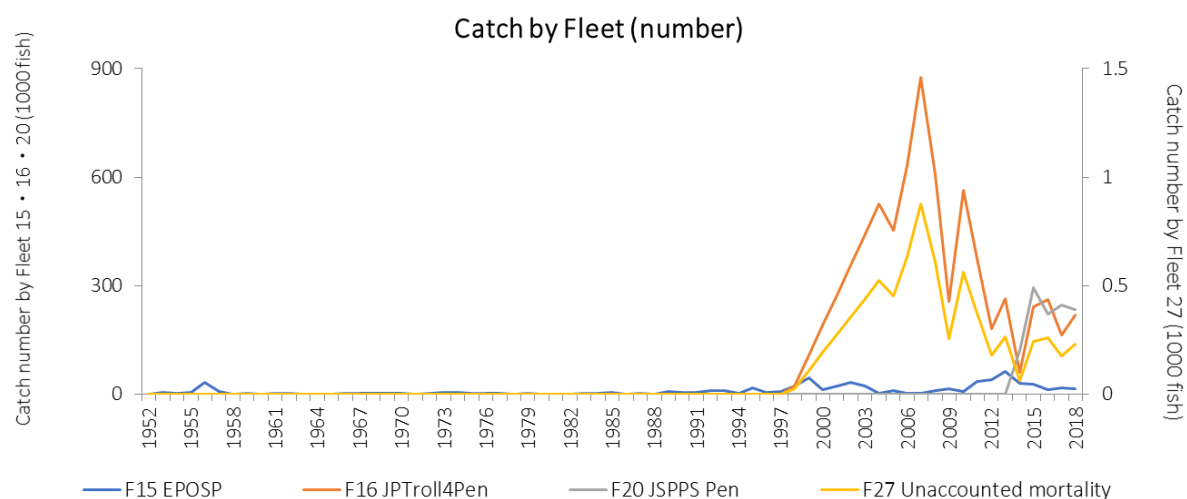
Fig. 1. Historical annual catch of Pacific bluefin tuna (*Thunnus orientalis*) by Fleets 1-14,17-19 (a: upper panel) and by Fleets 15, 16, 20 and 27 (b: lower panel), for fishing year 1952-2018.
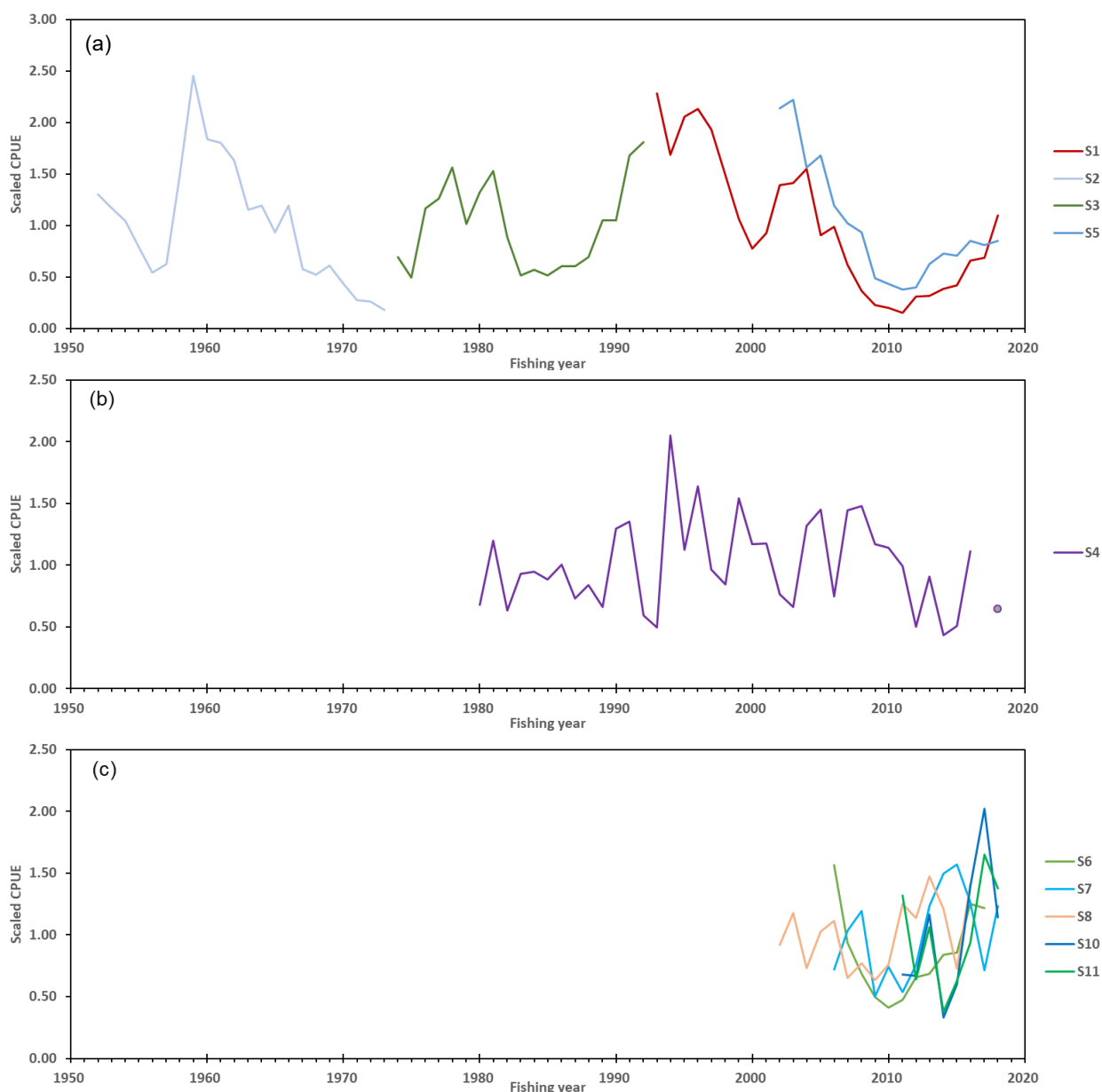
Fig. 2. Abundance indices of Pacific bluefin tuna (*Thunnus orientalis*) submitted to ISC PBFWG. The longline indices of Japanese fisheries (S1, S2, and S3) and Taiwanese fishery in southern area (S5) will be used to represent adult abundance (Fig.-(a)), and the index of Japanese troll fishery (S4) will be used as recruitment index (Fig.-(b)). The other indices will not be fitted to the assessment model (Fig.-(c)); e.g. the indices of Taiwanese longline fishery (S6-8), Korean purse seine (S9) and Japanese troll monitoring (S10, S11).
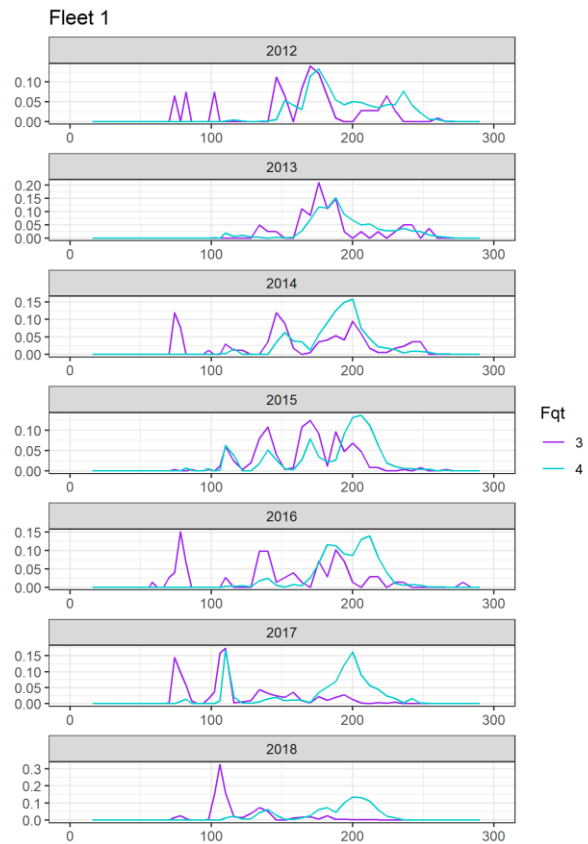
Fig.3. Size composition data of Fleet 1 and 28 (JPLL) for recent 7 years and updated periods. Fork length frequency is available from 1952 to 1968, and from 1993 to 2018 (fishing year).
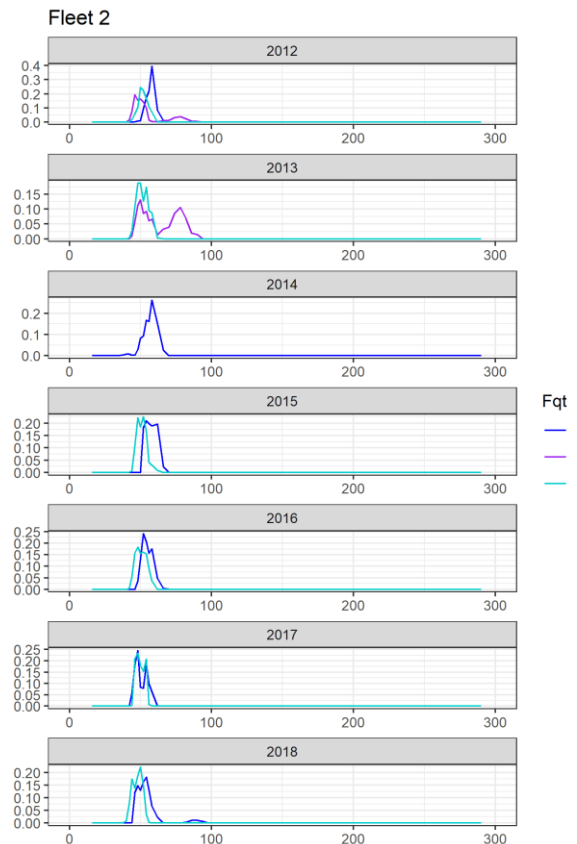
Fig.4. Size composition data of Fleet 2 (JPSPPS) for recent 7 years and updated periods. The data from both fleets were combined, and the selectivity information was sheared. The data are available from 2002 to 2018 (fishing year).
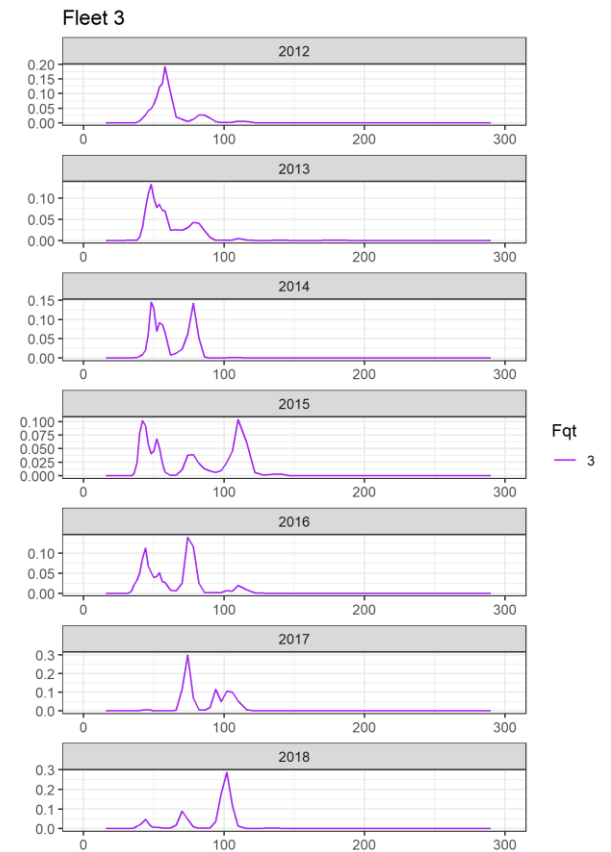
Fig.5. Size composition data of Fleet 3 (KROLPS) for recent 7 years and updated periods. These data were included in the size composition data shown in Fig. 5 (combined size composition).
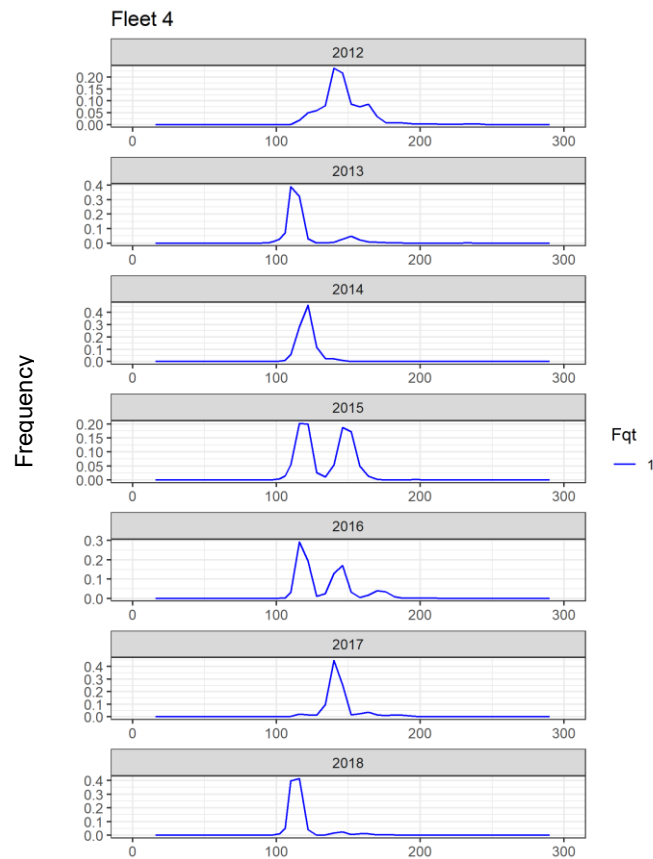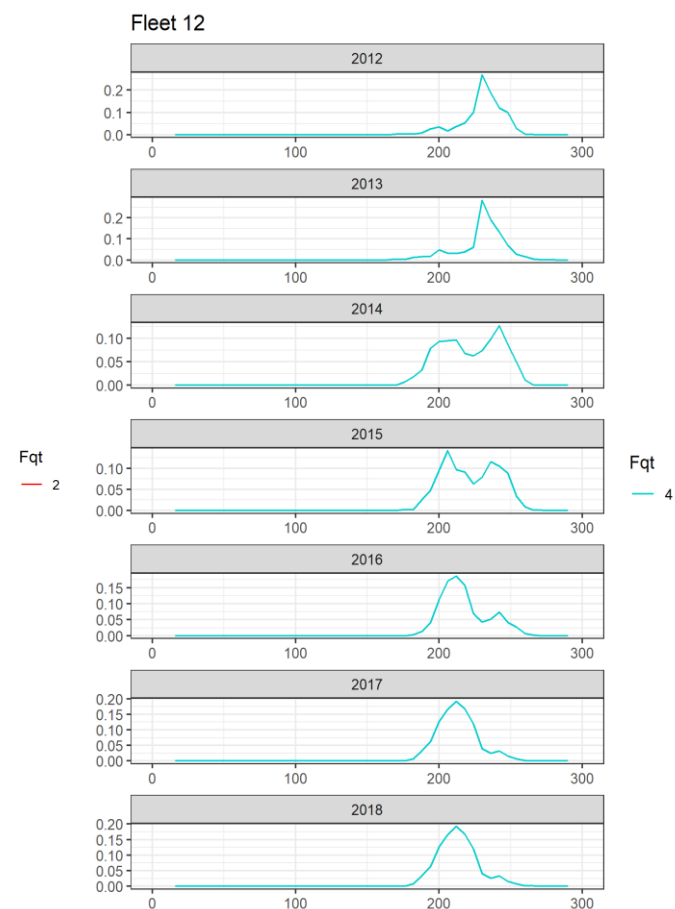
Fig.6. Size composition data of Fleet 4 (TPSJS) for recent 7 years and updated periods. Fork length frequency is available from 1987 to 1989, and from 1991 to 2018 (fishing year).
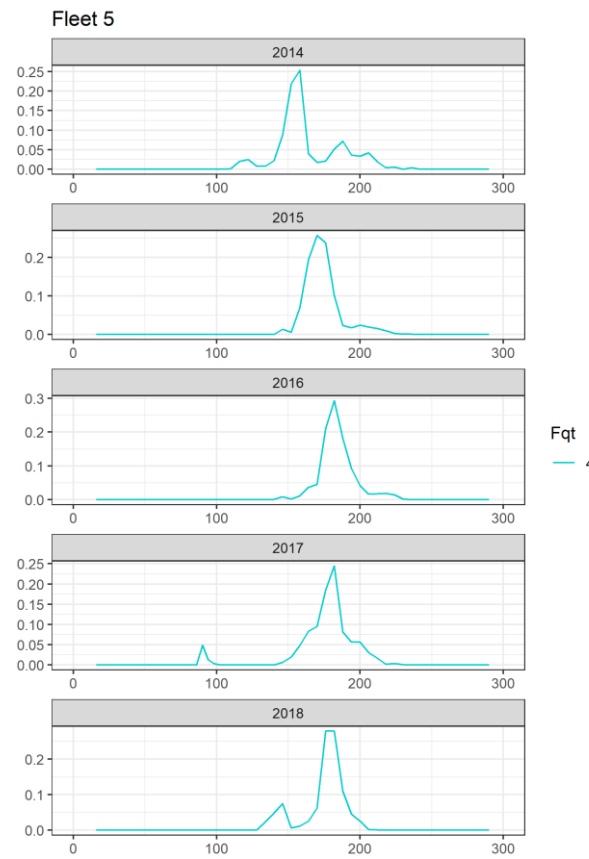
Fig.7. Size composition data of Fleet 5 (TPSPO) for recent 5 years. These data have not been updated. Available period is 1995, 1997-2005 and 2014-2018 (fishing year).
.
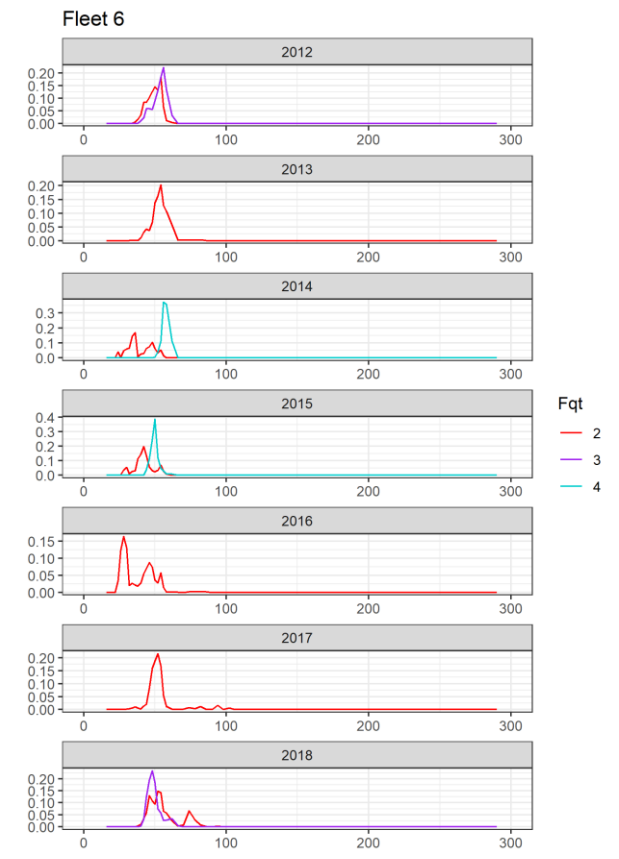
Fig.8. Size composition data of Fleet 6 (Troll Season 2-4) for recent 7 years and updated periods. Selectivity pattern estimated from this fork length frequency is also used for Fleet 7 (PL). The data are available from 1994 to 2018 (fishing year).
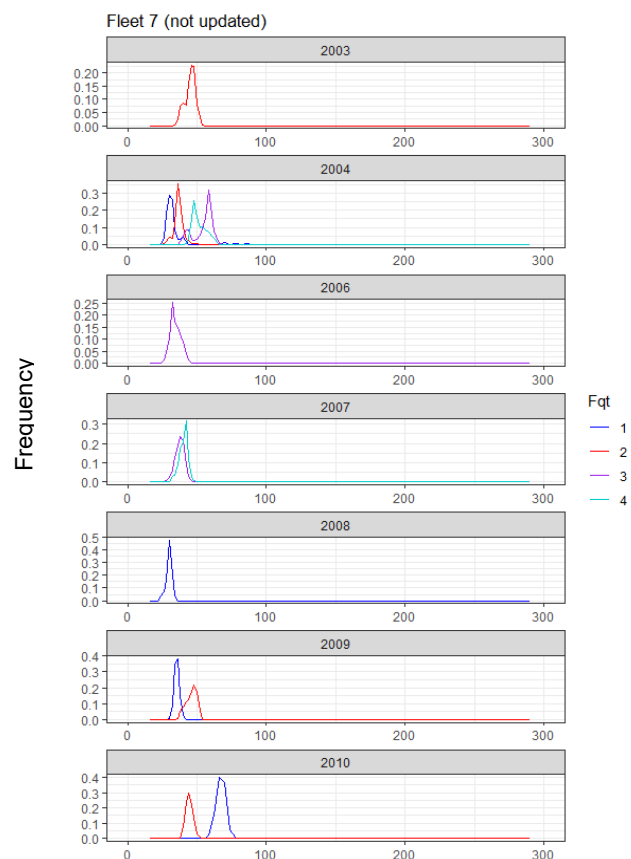
Fig.9. Size composition data of Fleet 7 (PL) for recent 5 years. The data has not been updated, and is available for 1994-1996, 1998-2004, and 2006-2010 (fishing year). These data are not used for the estimation of selectivity for Fleet 7.
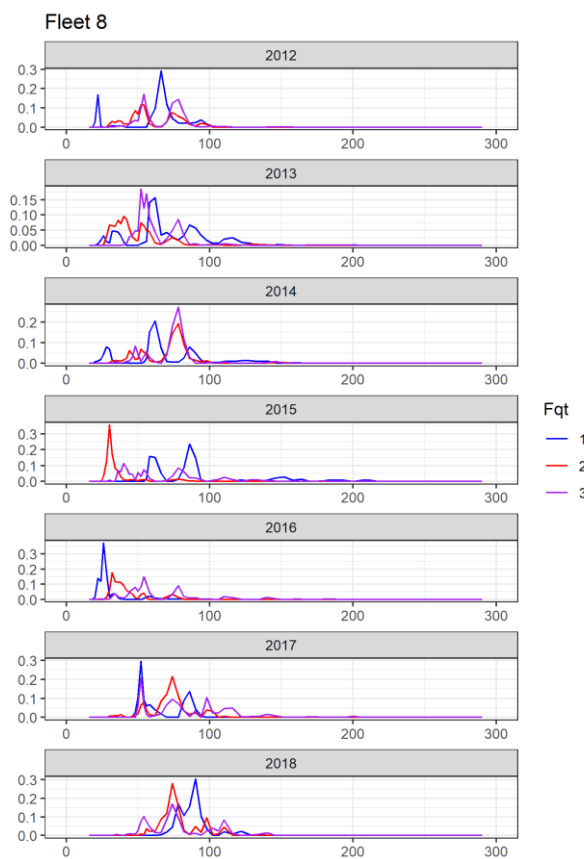
Fig.10. Size composition data of Fleet 8 (Set-net Season 1-3) for recent 7 years and updated periods. Fork length frequency is available from 1993 to 2018 (fishing year).
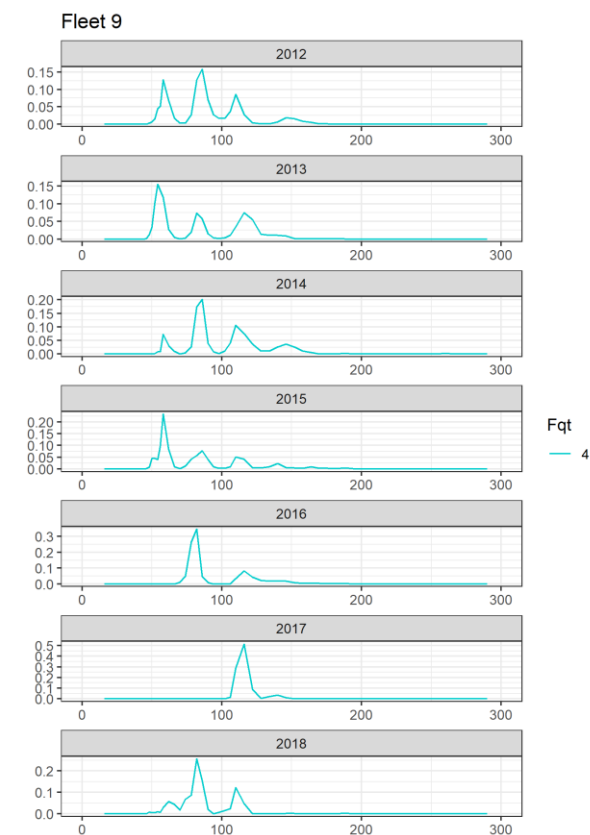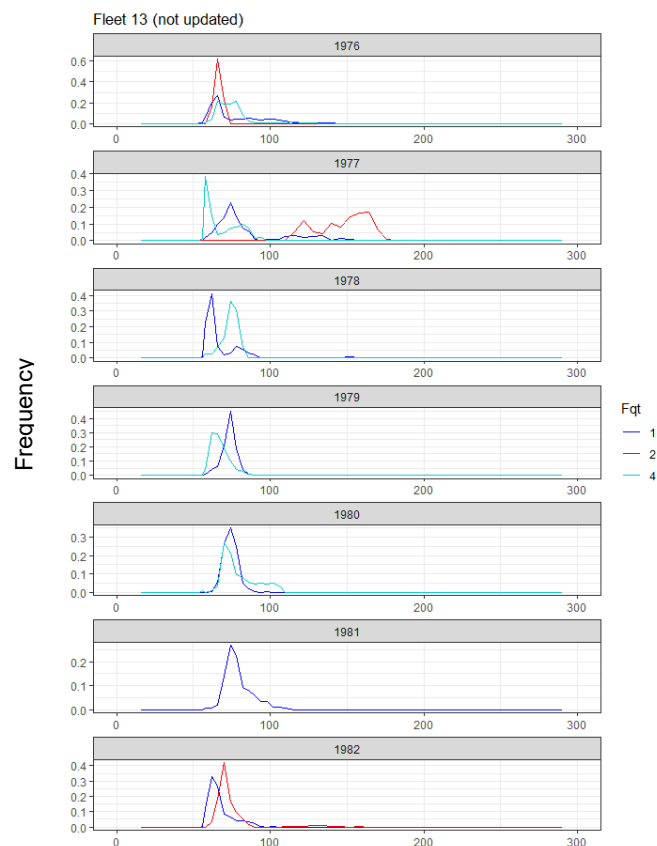
Fig.11. Size composition data of Fleet 9 (Set-net Season 4) for recent 7 years and updated periods. Fork length frequency is available from 1993 to 2018 (fishing year).
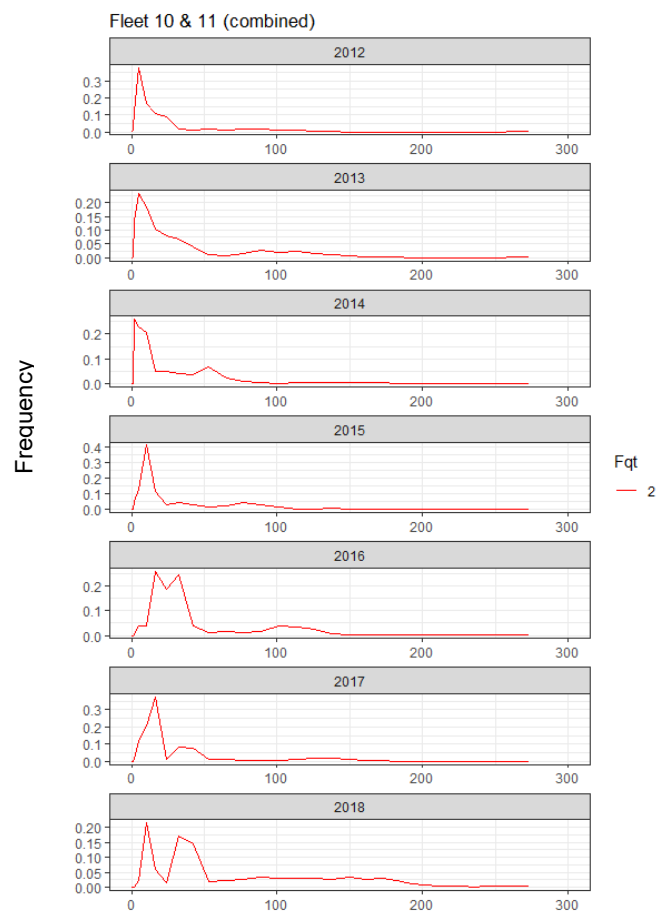
Fig.12. Size composition data of Fleet 10 (Set-net in Hokkaido and Aomori prefectures) and Fleet 11 (JP Others) for recent 7 years and updated periods. Weight frequencies from both fleets are combined. The data are available from 1994 to 2016 (fishing year).
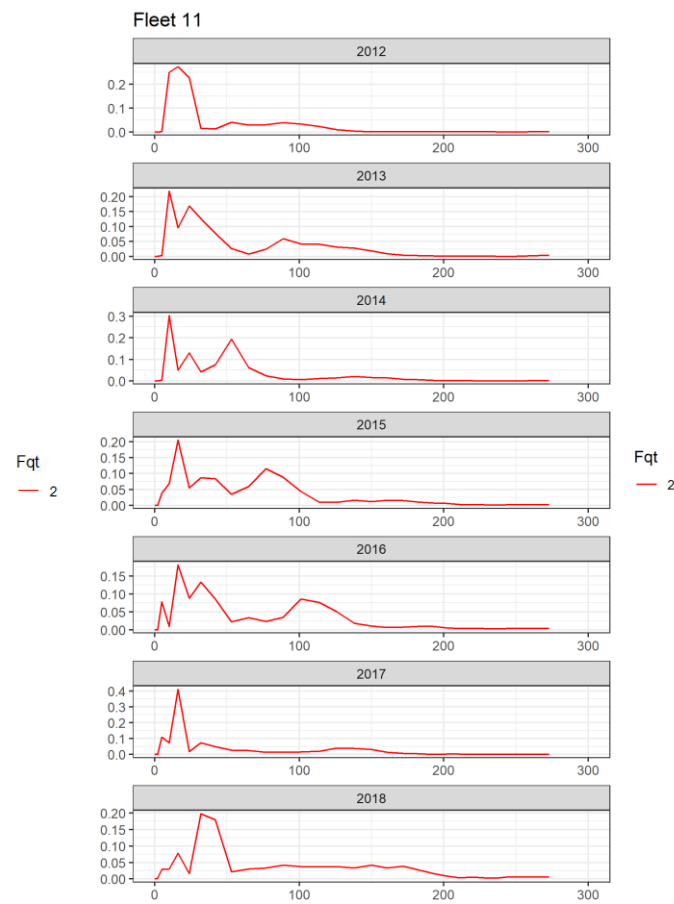
Fig.13. Size composition data of Fleet 11 (JP Others) for recent 7 years and updated periods. These data were included in the weight composition data shown in Fig. 13. (combined size composition).
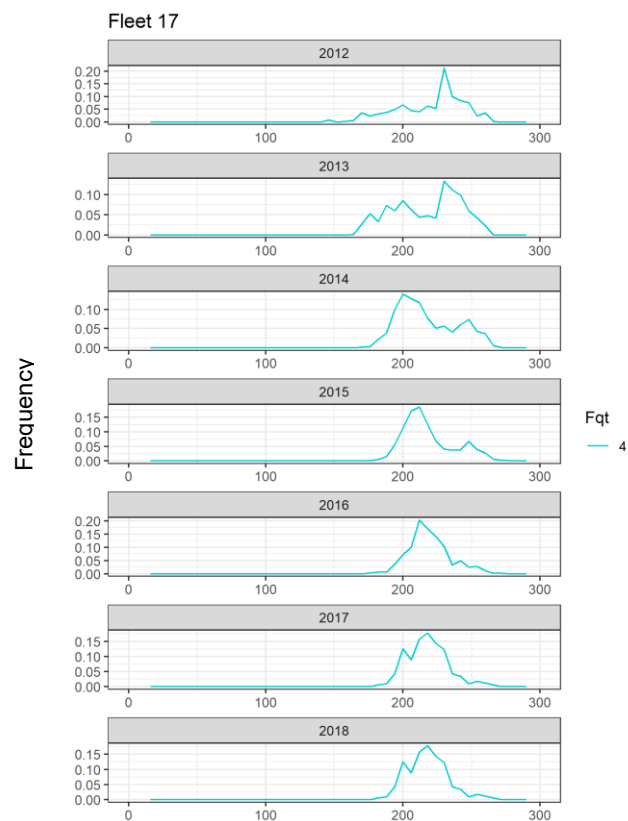
Fig.14. Size composition data of Fleet 12 (TWLL south area) for recent 7 years and updated periods. Fork length frequency is available from 1992 to 2018 (fishing year).

Fig.15. Size composition data of Fleet 13 (USCOMM) for recent 7 years. These data have not been updated. Selectivity pattern estimated from this data is also used for Fleet 15 (EPOSP). Available period is from 1952 to 1965, and from 1969 to 1982 (fishing year).
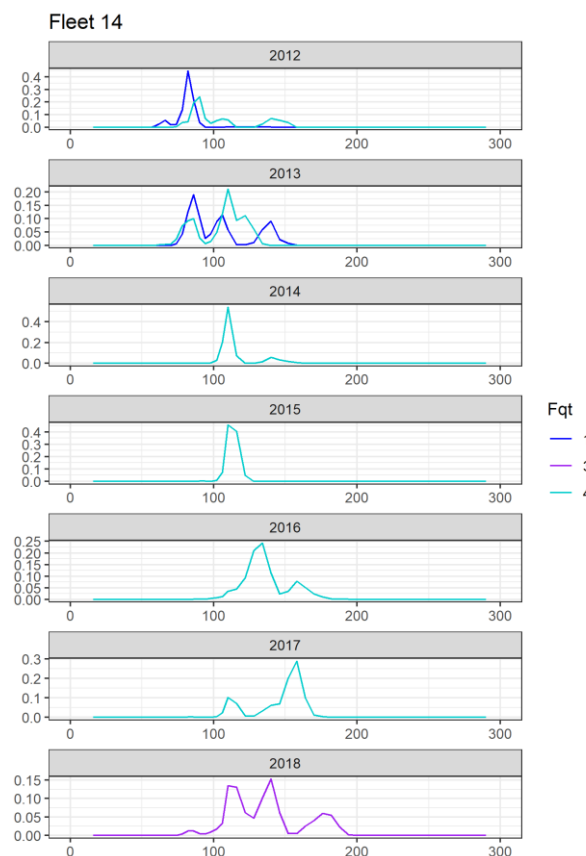
Fig.16. Size composition data of Fleet 14 (MXCOMM) for recent 7 years and updated periods. Fork length frequency is available in 2005-06 and 2008-16 (fishing year).
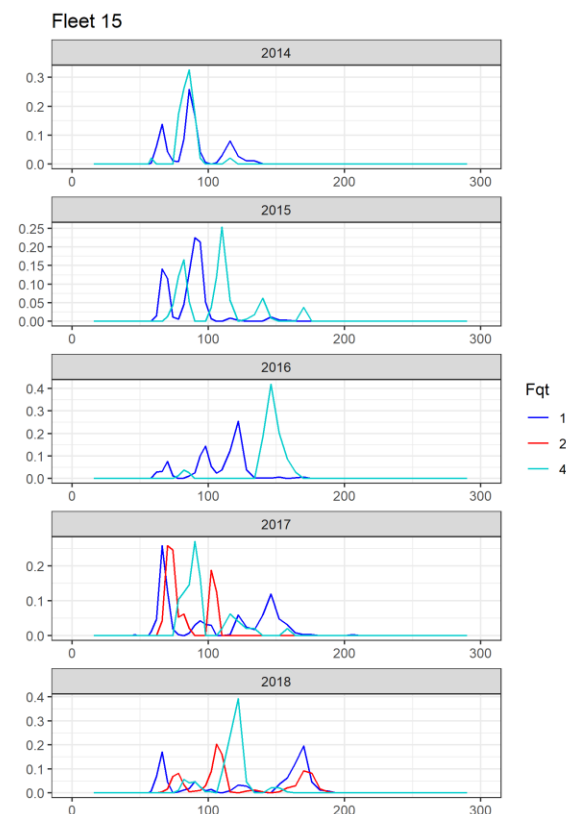
Fig.17. Size composition data of Fleet 15 (EPOSP) for recent 5 years and updated periods. These data are not used for the estimation of selectivity for Fleet 15. Fork length composition data in 1993-2003, 2005-2006, and 2008-2011 (fishing year) were provided for Fleet 15.

Fig.18. Size composition data of Fleet 17 (TWLL north area) for recent 7 years and updated periods. Fork length frequency is available from 2009 to 2016 (fishing year).
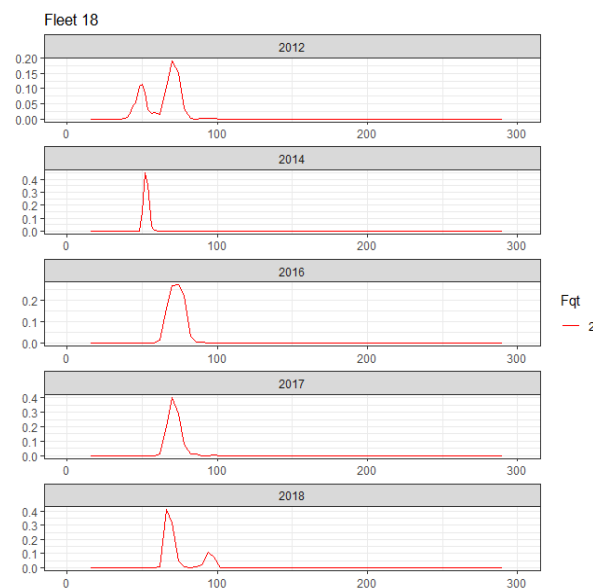
Fig.19. Size composition data of Fleet 18 (JPSPPS season 2) for recent 5 years and updated periods. Fork length frequency is available for 2003-2012, 2014, and 2016 (fishing year).
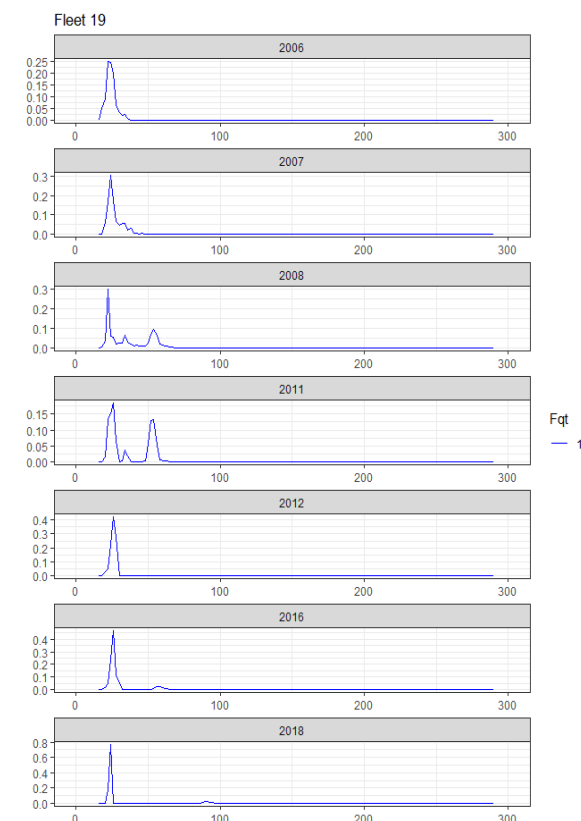
Fig.20. Size composition data of Fleet 19 (Troll season 1) for recent 3 years and updated periods. Fork length frequency is available for 1994-2004, 2006-2008, 2011,2012, 2016, 2018(fishing year).
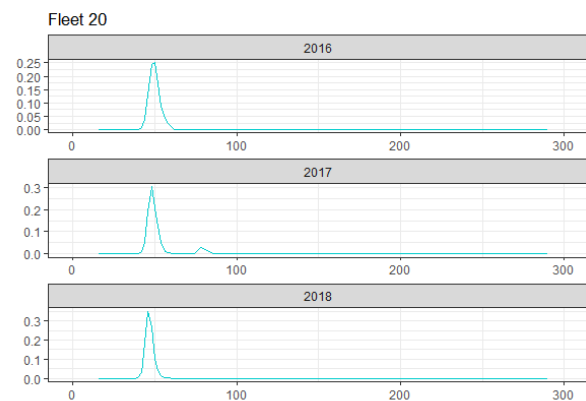
Fig.21. Size composition data of Fleet 20 (JPSPPS for Pen) for recent 3 years and updated periods. Fork length frequency is available for 2016-2018 (fishing year).