Input data of Pacific bluefin tuna fisheries

for stock assessment model, Stock Synthesis 3;

Update for 2022 assessment

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Summary

Update stock assessment for Pacific bluefin tuna (PBF) is scheduled in March 2022. For the assessment, the input data file, which contains quarterly catch, size frequency, and catch per unit of effort (CPUE) based abundance indices have been revised and updated up to fishing year 2020 (up to June in 2021 calendar year). Fleet definition was slightly modified to treat the size frequency suitably (e.g. recent Japanese longline fleet). Abundance indices from Japanese longlines and Taiwanese longlines were updated where the CPUE standardization methods for Japanese recruitment monitoring survey was revised.

1. Introduction

ISC PBFWG is tasked to conduct the model-based assessment in March 2022. This assessment has been scheduled as "update assessment" of the previous (2020) benchmark assessment model. Catch, size composition and abundance index are updated based on the same method with the previous assessment. Potentially due to the COVID-19 pandemic, operation change and/or other reasons such as an opportunistic fishery unloading due to the management, some data collections were in a difficult situation. It caused the changing the data source or data reduction since this stock assessment. These situations are provided in each section.

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 2020 fishing year corresponds to 1st July 2020 to 30th June 2021. The time period modeled in the assessment of PBF is 1952-2020 (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".

4. Fishery definition

Provisionally, a total of 25 Fleets were defined for fishery removals in the model based on stratification of country, gear type, season, area, and size of fish caught (Table 2) after PBFWG data preparatory meeting (ISC, 2021b). 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 21: Unaccounted mortality fisheries (in weight) in WPO

Fleet 22: Unaccounted mortality fisheries (in number) in WPO

Fleet 23: Japanese longline fisheries (JPLL) for season 2-4 and all seasons after 2016

Fleet 24: Eastern Pacific Ocean sports fishery (EPOSP) for early period (-2013)

Fleet 25: Unaccounted mortality fisheries (in number) in EPO

Fisheries with small amount of PBF catch were also considered in the stock assessment. As the previous

assessments (e.g. ISC 2018, ISC 2020), 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). 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.

5. Catch and unaccounted mortality 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 14,000 t (in 2011-2020 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, 22, 24 and 25, whose catches were expressed in thousands of fish (Fig. 1-(b)). For the 2022 assessment, the quarterly catch data was updated up to Season 4 of fishing year 2020 (2021 calendar year Quarter 2). Some modifications were observed in the terminal year of the previous assessment (2018 FY) (Table 5). Fishery data in the terminal year of the assessment are often used from the provisional statistics, so those modifications would be occurred when the data source was finalized as the official statistics.

5.2 Unaccounted mortality data

The PBFWG has considered "unaccounted mortality" (ISC 2019) from released bycaught PBF for the assessment. Japan (Nakatsuka and Fukuda 2019), Korea (Lee et al., 2020) and United States (Piner et al., 2020) provided discard information in response to the WG recommendation. Fleet 21 represents for estimated unaccounted mortality by weight, Fleet 22 and fleet 25 represent 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 was taken same estimation method with estimation of Japanese discard amount.

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).

For all unaccounted mortality fleets, same methods to estimate each member's unaccounted mortality were used for this assessment.

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 (Tsukahara et al., 2022, Chang et al., 2021) or from the survey by the members (Fujioka et al., 2021) 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 S5), and a Japanese troll index (S4) as the recruitment index for the base case model (ISC 2020). 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. Since this assessment, Japanese recruitment monitoring survey index (S12) was included in the model as a candidate of the latest recruitment index. This index was standardized by the spatio-temporal model (Fujioka et al., 2021). S1 (Japanese coastal longline CPUE: 1993-2019) was updated for an additional year data although the most recent year data (2020 FY) was not used due to the possible change in the catchability due to the newly introduced management measure (Tsukahara et al., 2022). S5 (Taiwanese longline CPUE in Southern area: 2002-2020) was updated with additional 2 years data for 2022 assessment (Chang et al., 2021).

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 2020). The same approach will be used in 2022 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 was revised by changing standardization methods using spatio-temporal model (S1: 1993-2018 fishing year). For the standardization. Tsukahara et al., (2020) compared the CPUE between "conventional GLMM model" and "new spatio-temporal model", and confirmed those had overall similar trends. Because of the introduction of Individual Quota (IQ) system for this fishery since FY 2020, the fishery operation would be changed, and consequently, this fleet could not exhaust their allocations in total for FY 2020 although they could exhaust their allocations in the previous several years. This would be a signal of the change in catchability of fishery, and Tsukahara et al. (2021) recommended not to include FY 2020 data for the next stock assessment. The WG agreed to this suggestion. Also, it was reported that the fish size caught by this fleet became smaller since 2017 than the previous years and possible reason for this change might be an influx of the new (young) abundant cohort for this fleet (change in the availability) or change in the fishery operation such as the area or season (change in the selectivity) or mixed effect of those. Although it was not clear whether there is the selectivity change or availability change, to maintain the size selectivity of the index constant over time, an additional data filtering was introduced (Tsukahara et al., 2022).

7-4. Japanese Troll CPUE (S4, S12)

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).

In the PBFWG meeting on April 2021, the members discussed that this index might be negatively biased after 2016 due to the operational changes of fishery (increase of the live release and fishing season) responding to strict management measures introduce in 2017, and thus the data point after FY2016 should not be included in the future assessments (ISC 2021a).

As a possible alternative index to inform recruitment trend, the real-time recruitment monitoring survey index, which includes live-release information, was submitted to the WG (Fujioka et al., 2021). The WG agreed to include this new index (S12) after FY 2017 in the 2022 assessment model, however, whether this index is

included to the likelihood function or not is the subject to decision by the WG (ISC 2021b).

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

An adult index of relative abundance was developed from Taiwanese fishing operations. The fishing ground of the Taiwanese longline fleet can be separated into southern and northern areas. The southern area has been considered as the main fishing ground for this fleet. The CPUE used in this assessment was based on the operations in the southern area and standardized by GLMM (Chang et al. 2021) (S5: 2002-2020) and was developed using the following process; (1) Estimating PBF catch in number from landing weight for 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 vessel-trip information from the Coast Guard Administration, based on linear relationships between fishing days and at-sea days in a trip, by vessel size and fishing port;and (4) Estimating and standardizing the CPUE (catch number per fishing days) for fishing year 2003-2020 (Liu and Chang, 2019, Chang et al. 2021). Spatio-temporal model was applied for Taiwanese longline CPUEs standardization (Yuan et al., 2019). These CPUEs (S6-7) are submitted, but these will not be included to in the likelihood function (ISC 2019). Thus the CPUE which was based on the operations in the southern area and standardized by traditional GLMM is used as the input data for the stock assessment (Chang et al. 2021) (S5: 2002-2020).

7. Size composition data

8-1. Overview

Quarterly size composition data (length or weight) for PBF from 1952 to 2020 (fishing year) are included in the data file for the 2022 stock assessment if available. 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.

Length composition data were updated and estimated for Fleets 1-6, 12, 14-19, 21 and 23. Fig. 3 -22 shows the quarterly size compositions of each fleet for the last seven years. Size composition data for Fleets 8-10 were not updated due to the decline in the size sampling coverage. In the data preparation for those composition data, we found a spiky catch-at-size distribution for recent several seasons due to the raising a few size observations by large amount of catch. The author thought those would not be representative for the size composition of those fleets.

The source 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 23)

Length-composition data for PBF from the Japanese longline fishery (Fleet 1) are available for the periods of fishing year 1952-1968 and 1994-2020 (Fig. 3 and Fig. 22). 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). Although the size data from the JLL are important to estimate the selectivity of fishery and index, there has been a discrepancy between the entire fishing area and the area used for the index estimation from JLL CPUE. The area used for the index estimation covered basically western and southern part of entire fishing area, and it is expected there are larger fish than the rest of the area (eastern area). Also, the recent size composition data from JLL in season 4 showed many observations of small sized fish (Tsukahara et al., 2020). Although it is unclear whether this was a sign of the selectivity change (i.e. operating in more eastern area to get small sized fish) or availability change (i.e. influx of the newly available abundant young cohort to the fishery), Tsukahara et al. (2021) removed catch record of fish body weight smaller than 60 kg in GG from the CPUE estimation for JLL. To maintain consistency between the CPUE standardization model and Stock Assessment model, size observations smaller than 152 cm (converted length from weight in GG) were removed from the JLL size composition data for 1993-2016.

Size composition data for season 3 is available since the previous stock assessment (Tsukahara et al., 2018). Size compositions are different between season 3 and season 4 due to the spatial and temporal difference in the main fishing ground. Size composition for season 3 are composed by smaller fish than season 4. Thus PBFWG agreed to split the Fleet for the period of fishing year 1993-2020 by season 3 and season 4 (ISC 2019). From this assessment, recent (2017-2020) size composition data as well as the corresponding catch data in season 4 are moved to Fleet 23 because of the increase of the small sized fish in the composition data. Thus, Fleet 23 is now the Japanese longline in season 3 for 1994-2016 and in all seasons after 2016.

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 2002-2020, whereas that for Fleet 18 (Season 2) was fishing year 2003-2012, 2014, and 2016-2020. Since 2020 assessment, Fleet 20 was 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), and updated up to 2020.

8-4. Korean purse seine (Fleet 3)

Length-composition data from the Korean purse seine fishery has been also available since 2010 fishing year (Kim et al. 2015). Until the 2016 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. In 2013 fishing year, larger sized fish (> around 70 cm) was observed in the composition of KPS fleet, and those large fish were occurred occasionally in the following years. In the 2020 assessment, the WG agreed to separate size composition for Japanese and Korean purse seine (ISC 2019). The most recent Size composition of Fleet 3 was provided in Lim et al., 2021.

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 port 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.

Recent size composition was calculated for FY 2014-2020 by strengthened port sampling program since FY 2014 (Fukuda et al., 2019). The size selectivity of JTPS-PO fleet would be changed to the only large size (> 30 kg in body weight) PBF due to the domestic quota allocation since 2014 FY. Estimated size composition for this fishery indicated distinct selectivity change before and after the introduction of the new management.

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 to 3 of 2019 FY and season 1 and 4 of 2020 FY were updated.

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 (ISC 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.

Likely due to the COVID-19 pandemic and other reasons such as an opportunistic fishery unloading due to the management, the data sampling in FY 2019-2020 for those coastal fisheries might have been sparser than the past period. Thus, the authors suggest to the WG not to use those data in the upcoming assessment meeting.

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 2015; Fig. 12 and 13). Because of the same reason with Japanese set-net fishery, these fisheries might have been sparser than after. Thus, the authors suggest to the WG not to use those data in the upcoming assessment meeting.

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 2022 assessment, the length composition data for both fleets were updated. The southern area has been the main fishing ground for Taiwanese longliner, and their data period was longer than that of the northern area (Fleet 12: 1992-2020

fishing year, Fleet 17: 2009-2020 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 2015). 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 2022 assessment, the length composition data for 2019-2020 fishing year were updated (Dreyfus 2021)).

8-11. US recreational fishery (Fleet 15 and 24)

Size composition data for PBF from the US recreational fishery had been collected by the IATTC staff since 1993 (Hoyle 2006), however the size sampling program by the 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 24; before 2013) when the IATTC conducted the size sampling survey for this fishery and following period (Fleet 15; after 2013) when the NOAA conducted the size sampling for this fishery. Due to COVID-19 pandemic, the Port sampling program by the SWFSC NOAA discontinued (Lee et al., 2021). As an alternative, another on-board sampling program by the Sportfishing Association of California (SAC data) measured the length of fish, although it was a lower coverage than the port sampling by NOAA, was suggested for the size data during 2019-2020. This showed that despite the variability in the both of SAC data and NOAA data, either each data provides more appropriate information on the catch-at-age(/size) than borrowed information from the EPO commercial fleet and borrowed the information from the most recent data in the same fleet. For 2022 stock assessment, the WG agreed to use the data on-board sampling program by SAC in 2019 and 2020 FY to inform the size of removals by the U.S. recreational fishery (ISC 2021b).

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).

8-13 Unobserved mortality fleets (Fleets 21, 22, and 25)

Unobserved mortality related to the possible post-release mortality of discards were included as removals. The unobserved mortality was separated into three separate fleets. This is new information and included in

the assessment because recent management measures coupled with the beginning of increasing abundance are thought to increase potential discarding. Because there is no available data to represent the size distribution of unobserved fish, the size selectivity for these fleets was assumed to be similar to the associated fisheries.

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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	2018				2019				2020				2021	
Season	Season 1	Season 2	Season 3	Season 4	Season 1	Season 2	Season 3	Season 4	Season 1	Season 2	Season 3	Season 4	Season 1	Season 2
SSB				SSB in 2018				SSB in 2019				SSB in 2020		
Day of birth in SS	Birthday of 2018 yr class				Birthday of 2019 yr class				Birthday of 2020 yr class				Birthday of 2021 yr class	
Recruitment	Recruitment in 2018				Recruitment in 2019				Recruitment in 2020				Recruitment in 2021	
Year class	2018 yr class				2019 yr class				2020 yr class				2021 yr class	
Calender year	2018				2019				2020				2021	
Month	7 8 9 10 11 12				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, S12
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
Fleet 20	JSPPS Pen	Weight	JSPPS for Farming				
Fleet 21	Unaccounted mortality	Weight	Discard amount for JPN and KOR fisheries				
Fleet 22	Unaccounted mortality	Number	Discard amount for USA and JPN				
Fleet 23	JPLL (Seas1-3)	Weight	JP Longline(1993-2018, Season 1-3)	JP Longline(2019-2020)			
Fleet 24	EPOSP_early	Number	US Recreational Fisheries (-2013)				
Fleet 25	EPO sports unaccounted mortality	Number	Discard amount for USA and JPN				

*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	Longline	Troll[2]	Pole and Line	Set Net	Others	
1952	7,680	2,694	667	2,198	2,145	1,700	17,084
1953	5,570	3,040	1,472	3,052	2,335	160	15,629
1954	5,366	3,088	1,656	3,044	5,579	266	18,999
1955	14,016	2,951	1,507	2,841	3,256	1,151	25,722
1956	20,979	2,672	1,763	4,060	4,170	385	34,029
1957	18,147	1,685	2,392	1,795	2,822	414	27,255
1958	8,586	818	1,497	2,337	1,187	215	14,640
1959	9,996	3,136	736	586	1,575	167	16,196
1960	10,541	5,910	1,885	600	2,032	369	21,337
1961	9,124	6,364	3,193	662	2,710	599	22,652
1962	10,657	5,769	1,683	747	2,545	293	21,694
1963	9,786	6,077	2,542	1,256	2,797	294	22,752
1964	8,973	3,140	2,784	1,037	1,475	1,884	19,293
1965	11,496	2,569	1,963	831	2,121	1,106	20,086
1966	10,082	1,370	1,614	613	1,261	129	15,069
1967	6,462	878	3,273	1,210	2,603	302	14,728
1968	9,268	500	1,568	983	3,058	217	15,594
1969	3,236	878	2,219	721	2,187	195	9,436
1970	2,907	607	1,198	723	1,779	224	7,438
1971	3,721	697	1,492	938	1,555	317	8,720
1972	4,212	512	842	944	1,107	197	7,814
1973	2,266	838	2,108	526	2,351	636	8,725
1974	4,106	1,177	1,656	1,192	6,019	754	14,904
1975	4,491	1,061	1,031	1,401	2,433	808	11,225
1976	2,148	320	830	1,082	2,996	1,237	8,613
1977	5,110	338	2,166	2,256	2,257	1,052	13,179
1978	10,427	648	4,517	1,154	2,546	2,276	21,568
1979	13,881	729	2,655	1,250	4,558	2,429	25,502
1980	11,327	811	1,531	1,392	2,521	1,953	19,535
1981	25,422	590	1,777	754	2,129	2,653	33,325
1982	19,234	718	864	1,777	1,667	1,709	25,969
1983	14,774	217	2,028	356	972	1,117	19,464
1984	4,433	142	1,874	587	2,234	868	10,138
1985	4,154	105	1,850	1,817	2,562	1,175	11,663
1986	7,412	102	1,467	1,086	2,914	719	13,700
1987	8,653	211	880	1,565	2,198	445	13,952
1988	3,605	157	1,124	907	843	498	7,134
1989	6,190	209	903	754	748	283	9,087
1990	2,989	267	1,250	536	716	455	6,213
1991	9,808	218	2,069	286	1,485	650	14,516
1992	7,162	513	915	166	1,208	1,081	11,045
1993	6,600	812	546	129	848	365	9,300
1994	8,131	1,206	4,111	162	1,158	398	15,166
1995	18,909	678	4,778	270	1,859	586	27,080
1996	7,644	901	3,640	94	1,149	570	13,998
1997	13,152	1,300	2,740	34	803	811	18,840
1998	5,391	1,255	2,876	85	874	700	11,181
1999	16,173	1,157	3,440	35	1,097	709	22,611
2000	16,486	953	5,217	102	1,125	689	24,572
2001	7,620	791	3,466	180	1,366	782	14,205
2002	8,903	841	2,607	99	1,100	631	14,181
2003	5,768	1,237	2,060	44	839	446	10,394
2004	8,257	1,847	2,445	132	896	514	14,091
2005	12,817	1,925	3,633	549	2,182	548	21,654
2006	8,880	1,121	1,860	108	1,421	777	14,167
2007	6,840	1,762	2,823	236	1,503	657	13,821
2008	10,221	1,390	2,377	64	2,358	770	17,180
2009	8,077	1,080	2,003	50	2,236	575	14,021
2010	3,742	890	1,583	83	1,603	495	8,396
2011	8,340	837	1,820	63	1,651	283	12,993
2012	2,462	673	570	113	1,932	343	6,093
2013	2,771	784	904	8	1,415	529	6,411
2014	5,456	683	1,023	5	1,907	499	9,573
2015	3,645	648	413	8	1,242	431	6,386
2016	5,095	691	778	54	1,228	508	8,354
2017	4,540	913	605	49	2,221	665	8,993
2018	4,050	700	371	9	645	431	6,206
2019	4,464	1,002	720 +		941	372	7,499
2020 [3]	3,960	1,416	760	1	1,234	502	7,873

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)							Sub total
	Purse Seine	Longline	Setnet	Troll	Trawl	Sub Total	Longline	Set-net	Purse Seine	Gill-net (not specified)	Distant Driftnet	Others	Sub Total	
1952														17,084
1953														15,629
1954														18,999
1955														25,722
1956														34,029
1957														27,255
1958														14,640
1959														16,196
1960														21,337
1961														22,652
1962														21,694
1963														22,752
1964														19,293
1965							54						54	20,140
1966													0	15,069
1967							53						53	14,781
1968							33						33	15,627
1969							23						23	9,459
1970													0	7,438
1971		0					1						1	8,721
1972		0					14						14	7,828
1973		0					33						33	8,758
1974		0					47					15	62	14,966
1975		3					61					5	66	11,291
1976		5					17					2	19	8,632
1977		0					131					2	133	13,312
1978		3					66					2	68	21,636
1979		0					58				-		58	25,560
1980		0					114					5	119	19,654
1981		0					179						179	33,504
1982	31	0				31	207				2	-	209	26,209
1983	13	0				13	175		9		2	-	186	19,663
1984	4	1				5	477		5	-		8	490	10,633
1985	1	0				1	210		80	11	-		301	11,965
1986	344	0				344	70		16	13	-		99	14,143
1987	89	13				102	365		21	14	-		400	14,454
1988	32	0				32	108		197	37		25	367	7,533
1989	71	0				71	205		259	51		3	518	9,676
1990	132	0				132	189		149	299		16	653	6,998
1991	265	0				265	342	-		107		12	461	15,242
1992	288	0				288	464		73	3		5	545	11,878
1993	40	0				40	471		1			3	475	9,815
1994	50	0				50	559				-		559	15,775
1995	821	0				821	335					2	337	28,238
1996	102	0				102	956 -		-	-		-	956	15,056
1997	1,054	0				1,054	1,814 -		-	-		-	1,814	21,708
1998	188	0				188	1,910 -		-	-		-	1,910	13,279
1999	256	0				256	3,089 -		-	-		-	3,089	25,956
2000	2,401	0			0	2,401	2,780 -		-	1		1	2,782	29,755
2001	1,176	0			10	1,186	1,839 -		-	2		2	1,843	17,234
2002	932	0			1	933	1,523 -		-	3		1	1,527	16,641
2003	2,601	0			0	2,601	1,863 -		-	10		11	1,884	14,879
2004	773	0			0	773	1,714 -		-	1		2	1,717	16,581
2005	1,318	0			9	1,327	1,368	1	-	-		1	1,370	24,351
2006	1,012	0			3	1,015	1,149	1	-	-		-	1,150	16,332
2007	1,281	0			4	1,285	1,401	2	-	8		-	1,411	16,517
2008	1,866	0			10	1,876	979	1	-	1		-	981	20,037
2009	936	0			4	940	877	1	-	10		-	888	15,849
2010	1,196	0			16	1,212	373	29	-	7			409	10,017
2011	670	0		+	14	684	292	16	-	7		1	316	13,993
2012	1,421	0			2	1,423	210	2	-			2	214	7,730
2013	604 -		1	+	0	605	331	2	-	1		-	334	7,350
2014	1,305		6	0 -		1,311	483	38	-	4		-	525	11,409
2015	676		1	0		677	552	25	-	1		-	578	7,641
2016	1,024		3	0	2	1,030	454 -		-	+		-	454	9,838
2017	734		3		6	743	415 -		-			+	415	10,151
2018	523		7		5	535	381 +		-	3		+	384	7,125
2019	542		36		3	581	486	2	-	2		2	492	8,572
2020	567		35		3	605	1,148	1	-	+		3	1,152	9,630

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

Calendar Year	United States (US)[5]								
	Drift gill-net	Longline	Pole and line	Troll	Hook and Line	Others	Purse seine	Sport	Sub Total
1952							2,076	2	2,078
1953							4,433	48	4,481
1954							9,537	11	9,548
1955							6,173	93	6,266
1956							5,727	388	6,115
1957							9,215	73	9,288
1958							13,934	10	13,944
1959			56				3,506	13	3,575
1960			+				4,547	1	4,548
1961			16				7,989	23	8,028
1962			+				10,769	25	10,794
1963			28				11,832	7	11,867
1964			39				9,047	7	9,093
1965			11		+	66	6,523	1	6,601
1966			12				15,450	20	15,482
1967			+				5,517	32	5,549
1968			8				5,773	12	5,793
1969			9				6,657	15	6,681
1970			+				3,873	19	3,892
1971			+				7,804	8	7,812
1972			3			42	11,656	15	11,716
1973			5		+	20	9,639	54	9,718
1974			+		+	30	5,243	58	5,331
1975			83			1	7,353	34	7,471
1976			22		+	3	8,652	21	8,698
1977			10			3	3,259	19	3,291
1978			4			2	4,663	5	4,674
1979			5			1	5,889	11	5,906
1980			+			24	2,327	7	2,358
1981	4		+	10		+	867	9	890
1982	9		1			+	2,639	11	2,660
1983	31		59			2	629	33	754
1984	6	1	5			18	673	49	752
1985	8					20	3,320	89	3,437
1986	16					41	4,851	12	4,920
1987	2					18	861	34	915
1988	4					46	923	6	979
1989	3					18	1,046	112	1,179
1990	11					81	1,380	65	1,537
1991	4	2				+	410	92	508
1992	9	38				14	1,928	110	2,099
1993	32	42				29	580	283	966
1994	28	30				1	906	86	1,051
1995	20	29				+	657	245	951
1996	43	25		2		+	4,639	40	4,749
1997	58	26		1		48	2,240	131	2,504
1998	40	54		128		59	1,771	422	2,474
1999	22	54		20		88	184	408	776
2000	30	19		1		11	693	319	1,073
2001	35	6		6		1	292	344	684
2002	7	2		1		2	50	613	675
2003	14	1				3	22	355	395
2004	10	1				+		50	61
2005	5	1				1	201	73	281
2006	1	1				+		94	96
2007	2	+				+	42	12	56
2008	1	+				+		63	64
2009	3	1		0		2	410	156	572
2010	1	0				0		88	89
2011	18	0		0		100		225	343
2012	4	0		0		38		400	442
2013	7	1		0		3		809	820
2014	5	0		+	2	-	401	420	828
2015	4	0			7	-	86	400	499
2016	9	1		0	31	-	316	372	728
2017	1	1		0	18	-	466	451	938
2018	18	1		-	31	4	12	513	579
2019	10	2		1	36	1	226	462	737
2020	28	2		-	87	1	116	651	884

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

| Mexico (MX) | | | Sub total |
Others	Purse seine	Sub Total	
-	-		2,078
-	-		4,481
-	-		9,548
-	-		6,266
-	-		6,115
-	-		9,288
-	-		13,944
32	171	203	3,778
-	-		4,548
-	130	130	8,158
-	294	294	11,088
-	412	412	12,279
-	131	131	9,224
-	289	289	6,890
-	435	435	15,917
-	371	371	5,920
-	195	195	5,988
-	260	260	6,941
-	92	92	3,984
-	555	555	8,367
-	1,646	1,646	13,362
-	1,084	1,084	10,802
-	344	344	5,675
-	2,145	2,145	9,616
-	1,968	1,968	10,666
-	2,186	2,186	5,477
-	545	545	5,219
-	213	213	6,119
-	582	582	2,940
-	218	218	1,108
-	506	506	3,166
-	214	214	968
-	166	166	918
-	676	676	4,113
-	189	189	5,109
-	119	119	1,034
1	447	448	1,427
-	57	57	1,236
-	50	50	1,587
-	9	9	517
-	0	0	2,099
-	0		966
2	63	65	1,116
-	11	11	962
-	3,700	3,700	8,449
-	367	367	2,871
-	1	1	2,475
35	2,369	2,404	3,180
99	3,019	3,118	4,191
-	863	863	1,547
2	1,708	1,710	2,385
43	3,211	3,254	3,649
14	8,880	8,894	8,955
-	4,542	4,542	4,823
-	9,806	9,806	9,902
-	4,147	4,147	4,203
15	4,407	4,422	4,486
-	3,019	3,019	3,591
-	7,746	7,746	7,835
1	2,731	2,732	3,075
1	6,668	6,669	7,111
	3,154	3,154	3,974
	4,862	4,862	5,690
	3,082	3,082	3,581
	2,709	2,709	3,437
	3,643	3,643	4,581
	2,482	2,482	3,061
	2,249	2,249	2,986
	3,266	3,266	4,150

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)					
		Fleet 1	Fleet 2	Fleet 3	Fleet 4	Fleet 5	Fleet 6	Fleet 7	Fleet 8	Fleet 9	Fleet 10	Fleet 11	Fleet 12	Fleet 13	Fleet 14	Fleet 17	Fleet 18	Fleet 19	Fleet 21	Fleet 23	Fleet 15	Fleet 16	Fleet 20	Fleet 22	Fleet 24	Fleet 25
1952	1	1073	0	0	0	4936	0	713	736	0	236	0	0	1951	0	0	0	23	0	0	0	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	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	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	0	0	0
1953	1	764	0	0	0	3580	0	650	371	0	255	0	0	3843	0	0	0	51	0	0	0	0	0	0	3	0
1953	2	241	0	0	0	0	1098	706	458	0	186	131	0	590	0	0	0	0	0	0	0	0	0	0	1	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	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	0	0	0
1954	1	1096	0	0	0	3448	0	744	1109	0	861	0	0	6845	0	0	0	58	0	0	0	0	0	0	1	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	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	0	0	0
1954	4	1310	0	0	0	5008	40	761	0	1334	43	0	0	3131	0	0	0	0	0	0	0	0	0	0	1	0
1955	1	1172	0	0	0	9008	0	665	788	0	364	0	0	2467	0	0	0	53	0	0	0	0	0	0	4	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	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	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	0	0	0
1956	1	1521	0	0	0	13483	0	953	636	0	262	0	0	4753	0	0	0	62	0	0	0	0	0	0	30	0
1956	2	161	0	0	0	0	1316	1232	1134	0	185	192	0	974	0	0	0	0	0	0	0	0	0	0	2	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	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	0	0	0
1957	1	566	0	0	0	12111	0	425	558	0	74	0	0	8779	0	0	0	84	0	0	0	0	0	0	6	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	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	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	0	0	0
1958	1	113	0	0	0	4650	0	541	189	0	10	0	0	11188	0	0	0	52	0	0	0	0	0	0	1	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	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	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	0	0	0
1959	1	841	0	0	0	5565	0	135	227	0	29	0	0	2487	0	0	0	26	0	0	0	0	0	0	1	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	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	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	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	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	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	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	0	0	0
1961	1	1472	0	0	0	5768	0	170	430	0	12	0	0	6755	0	0	0	112	0	0	0	0	0	0	2	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	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	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	0	0	0
1962	1	593	0	0	0	6677	0	176	744	0	71	0	0	8578	0	0	0	59	0	0	0	0	0	0	2	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	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	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	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	0	1	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	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	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	0	0	0
1964	1	360	0	0	0	5798	0	246	562	0	49	0	0	7420	0	0	0	97	0	0	0	0	0	0	1	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	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	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	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	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	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	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	0	0	0
1966	1	285	0	0	0	7025	0	188	161	0	57	0	0	11021	0	0	0	56	0	0	0	0	0	0	2	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	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	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	0	0	0
1967	1	246	0	0	0	4085	0	330	273	0	84	0	0	2768	0	0	0	114	0	0	0	0	0	0	3	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	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	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	0	0	0
1968	1	135	0	0	0	5527	0	255	456	0	177	0	0	4812	0	0	0	55	0	0	0	0	0	0	1	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	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	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	0	0	0
1969	1	109	0	0	0	2061	0	184	294	0	319	0	0	5258	0	0	0	78	0	0	0	0	0	0	1	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	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	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	0	0	0

Table 4. Cont.

Fishing year	Season	Weight (mt)																			Number (1000 fish)					
		Fleet 1	Fleet 2	Fleet 3	Fleet 4	Fleet 5	Fleet 6	Fleet 7	Fleet 8	Fleet 9	Fleet 10	Fleet 11	Fleet 12	Fleet 13	Fleet 14	Fleet 17	Fleet 18	Fleet 19	Fleet 21	Fleet 23	Fleet 15	Fleet 16	Fleet 20	Fleet 22	Fleet 24	Fleet 25
1970	1	23	0	0	0	1633	0	210	282	0	190	0	0	2534	0	0	0	42	0	0	0	0	0	0	1	0
1970	2	35	0	0	0	0	894	194	398	0	99	161	0	2	0	0	0	0	0	0	0	0	0	0	1	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	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	0	0	0
1971	1	19	0	0	0	887	0	230	200	0	340	0	0	3349	0	0	0	52	0	0	0	0	0	0	1	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	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	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	0	0	0
1972	1	15	0	0	0	2163	0	449	127	0	164	0	0	8861	0	0	0	29	0	0	0	0	0	0	1	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	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	0	0	0
1972	4	799	0	0	0	464	56	160	0	501	70	0	33	2043	0	0	0	0	0	0	0	0	0	0	2	0
1973	1	21	0	0	0	1803	0	419	359	0	277	0	0	8690	0	0	0	74	0	0	0	0	0	0	4	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	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	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	0	0	0
1974	1	105	0	0	0	3690	0	483	865	0	546	0	0	4238	0	0	0	58	0	0	0	0	0	0	6	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	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	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	0	0	0
1975	1	121	0	0	0	1077	0	1096	309	0	605	0	0	5748	0	0	0	36	0	0	0	0	0	0	3	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	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	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	0	0	0
1976	1	54	0	0	0	1026	0	1300	301	0	818	0	0	7250	0	0	0	29	0	0	0	0	0	0	2	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	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	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	0	0	0
1977	1	37	0	0	0	1047	0	1258	222	0	485	0	0	3094	0	0	0	76	0	0	0	0	0	0	2	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	0	0	0
1977	3	58	0	0	0	0	867	51	377	0	2	0	0	86	0	0	0	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	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	0	1	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	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	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	0	0	0
1979	1	104	0	0	0	2736	0	1720	527	0	768	0	0	3539	0	0	0	93	0	0	0	0	0	0	1	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	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	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	0	0	0
1980	1	20	0	0	0	5159	0	1641	322	0	574	0	0	1439	0	0	0	54	0	0	0	0	0	0	1	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	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	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	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	0	1	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	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	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	0	0	0
1982	1	73	0	6	1615	12209	0	1905	198	0	300	0	0	2682	0	0	0	5	0	0	0	0	0	0	1	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	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	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	0	0	0
1983	1	8	0	3	570	2262	0	897	143	0	113	0	0	631	0	0	0	21	0	0	0	0	0	0	1	0
1983	2	15	0	2	0	0	1925	131	210	0	74	310	0	125	0	0	0	0	0	0	0	0	0	0	1	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	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	0	0	0
1984	1	20	0	1	807	1184	0	588	311	0	343	0	0	563	0	0	0	28	0	0	0	0	0	0	3	0
1984	2	9	0	1	0	0	1558	391	413	0	215	336	0	90	0	0	0	0	0	0	0	0	0	0	1	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	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	0	0	0
1985	1	8	0	0	448	889	0	961	229	0	714	0	0	1264	0	0	0	12	0	0	0	0	0	0	5	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	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	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	0	0	0
1986	1	8	0	70	16	1072	0	668	375	0	564	0	0	3759	0	0	0	5	0	0	0	0	0	0	1	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	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	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	0	0	0
1987	1	20	0	18	250	3550	0	519	193	0	612	0	0	813	0	0	0	6	0	0	0	0	0	0	1	0
1987	2	9	0	15	0	0	505	98	297	0	432	187	0	63	0	0	0	0	0	0	0	0	0	0	1	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	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	0	0	0

Table 4. Cont.

Fishing year	Season	Weight (mt)																			Number (1000 fish)					
		Fleet 1	Fleet 2	Fleet 3	Fleet 4	Fleet 5	Fleet 6	Fleet 7	Fleet 8	Fleet 9	Fleet 10	Fleet 11	Fleet 12	Fleet 13	Fleet 14	Fleet 17	Fleet 18	Fleet 19	Fleet 21	Fleet 23	Fleet 15	Fleet 16	Fleet 20	Fleet 22	Fleet 24	Fleet 25
1988	1	35	0	7	742	2010	0	796	87	0	228	0	0	974	0	0	0	15	0	0	0	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	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	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	0	0	0
1989	1	20	88	15	580	3623	0	411	81	0	186	0	0	988	0	0	0	88	0	0	0	0	0	0	5	0
1989	2	4	0	12	0	0	529	146	114	0	132	110	0	130	0	0	20	0	0	0	0	0	0	0	1	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	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	0	0	0
1990	1	24	32	27	149	2474	0	830	64	0	90	0	0	1311	0	0	0	3	0	0	0	0	0	0	4	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	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	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	0	0	0
1991	1	14	182	54	224	3466	0	429	123	0	146	0	2	334	0	0	0	82	0	0	0	0	0	0	5	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	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	0	0	0
1991	4	462	2061	109	0	1677	0	35	0	332	68	0	464	0	0	0	0	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	0	0	0	0	0	8	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	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	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	0	0	0
1993	1	0	99	8	83	3831	0	204	161	0	32	0	6	525	0	0	0	48	0	62	0	0	0	0	10	0
1993	2	0	0	7	0	0	320	36	230	0	16	207	0	113	0	0	12	0	0	37	0	0	0	0	0	0
1993	3	0	25	12	0	0	67	0	70	0	1	0	0	2	0	0	0	0	0	42	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	0	0	0
1994	1	0	14	10	694	3973	0	206	168	0	36	0	3	967	0	0	0	458	0	77	0	0	0	0	2	0
1994	2	0	0	9	0	0	3570	65	356	0	31	272	0	58	0	0	185	0	0	22	0	0	0	0	0	0
1994	3	0	406	202	0	0	2475	9	132	0	0	0	0	0	0	0	0	0	0	11	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	0	0	0
1995	1	0	4055	168	496	2798	0	143	243	0	213	0	2	716	0	0	0	440	0	35	0	0	0	0	16	0
1995	2	0	0	142	0	0	1130	94	788	0	205	476	0	0	0	0	8860	0	0	25	0	0	0	0	0	0
1995	3	0	1355	25	0	0	136	5	84	0	0	0	0	0	0	0	0	0	0	31	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	0	0	0	0	0	2	0
1996	1	0	451	21	450	1967	0	90	129	0	142	0	4	7652	0	0	0	256	0	25	0	0	0	0	1	0
1996	2	0	0	18	0	0	3191	66	416	0	110	503	0	0	0	0	158	0	0	26	0	0	0	0	0	0
1996	3	0	594	259	0	0	846	1	114	0	0	0	0	1	0	0	0	0	0	27	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	0	0	0	0	0	3	0
1997	1	0	3000	215	708	4027	0	113	165	0	20	0	15	2638	0	0	0	224	0	27	0	0	0	0	5	0
1997	2	0	0	183	0	0	1120	25	246	0	53	702	0	41	0	0	2309	0	0	44	0	0	0	0	0	0
1997	3	0	559	46	0	0	605	2	158	0	1	0	0	4	0	0	0	0	0	18	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	0	0	0	0	0	1	0
1998	1	0	549	38	326	2376	0	108	114	0	29	0	23	2017	0	0	0	131	0	53	0	23	0	23	21	0
1998	2	0	0	33	0	0	1613	64	359	0	68	609	0	24	0	0	1049	0	0	46	0	0	0	0	1	0
1998	3	0	686	63	0	0	798	10	317	0	1	0	0	0	0	0	0	0	0	33	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	0	0	0	0	0	0	0
1999	1	0	2228	52	579	5448	0	65	133	0	16	0	26	442	0	0	0	129	0	25	0	107	0	107	35	0
1999	2	0	0	44	0	0	2101	17	391	0	46	482	0	49	0	0	653	0	0	41	0	0	0	0	1	0
1999	3	0	651	747	0	0	1456	1	168	0	0	0	0	0	0	0	0	0	0	39	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	0	0	0	0	0	8	0
2000	1	0	3214	30	747	4042	0	66	154	0	87	0	29	3204	0	0	0	117	0	15	0	191	0	191	13	0
2000	2	0	0	27	0	0	2780	6	475	0	72	638	0	0	0	0	2048	0	0	12	0	0	0	0	0	0
2000	3	0	898	963	0	0	934	0	358	0	1	0	0	0	0	0	0	0	0	8	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	0	0	0	0	0	1	0
2001	1	0	409	9	239	1918	0	167	73	0	174	0	57	821	0	0	0	83	0	13	0	275	0	275	21	0
2001	2	0	0	37	0	0	1847	113	293	0	232	683	0	0	0	0	261	0	0	26	0	0	0	0	1	0
2001	3	0	62	160	0	0	988	17	113	0	0	0	0	0	0	0	0	0	0	76	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	0	0	0	0	0	1	0
2002	1	0	959	509	599	2767	0	224	157	0	235	0	61	0	1497	0	0	37	0	45	0	358	0	358	31	0
2002	2	0	0	88	0	0	706	24	231	0	251	409	0	0	0	0	1835	0	0	56	0	0	0	0	2	0
2002	3	0	99	238	0	0	520	11	84	0	0	0	0	0	0	0	0	0	0	95	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	0	0	0	0	0	1	0
2003	1	0	783	88	571	200	0	58	96	0	291	0	84	0	2704	0	0	80	0	78	0	442	0	442	21	0
2003	2	0	0	1881	0	0	416	6	156	0	71	403	0	0	0	0	2159	0	0	85	0	0	0	0	1	0
2003	3	0	38	53	0	0	182	5	109	0	3	0	0	1	0	0	0	0	0	116	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	0	0	0	0	0	1	0
2004	1	0	10	59	2100	2225	0	114	136	0	81	0	93	0	5285	0	0	78	0	154	0	526	0	526	3	0
2004	2	0	0	105	0	0	1868	94	186	0	68	421	0	0	0	0	2131	0	0	205	0	0	0	0	1	0
2004	3	0	586	720	0	0	1173	164	379	0	15	0	0	0	0	0	0	0	0	122	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	0	1	0
2005	1	0	3280	222	3694	77	0	171	414	0	137	0	71	0	2764	0	0	293	0	106	0	454	0	454	5	0
2005	2	0	0	121	0	0	1034	30	346	0	102	413	0	0	0	0	3029	0	0	108	0	0	0	0	0	0
2005	3	0	59	220	0	0	513	68	284	0	7	0	0	0	640	0	0	0	0	81	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	0	0	0	0	0	5	0

Table 4. Cont.

Fishing year	Season	Weight (mt)																			Number (1000 fish)					
		Fleet 1	Fleet 2	Fleet 3	Fleet 4	Fleet 5	Fleet 6	Fleet 7	Fleet 8	Fleet 9	Fleet 10	Fleet 11	Fleet 12	Fleet 13	Fleet 14	Fleet 17	Fleet 18	Fleet 19	Fleet 21	Fleet 23	Fleet 15	Fleet 16	Fleet 20	Fleet 22	Fleet 24	Fleet 25
2006	1	0	252	354	2012	692	0	315	148	0	328	0	48	0	4573	0	0	251	0	115	0	633	0	633	2	0
2006	2	0	0	102	0	0	695	17	229	0	69	331	0	0	1	0	2513	0	0	62	0	0	0	0	0	0
2006	3	0	485	376	0	0	228	32	253	0	10	0	0	0	0	0	0	0	0	61	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	0	0	0
2007	1	0	363	121	2123	364	0	238	150	0	381	0	58	0	2723	4	0	101	0	66	0	876	0	876	1	0
2007	2	0	0	776	0	0	1985	105	314	0	52	1013	0	0	44	0	1968	0	0	71	0	0	0	0	0	0
2007	3	0	214	581	0	0	619	12	268	0	2	0	0	0	0	0	0	0	0	99	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	0	0	0	0	0	1	0
2008	1	0	3007	62	3028	0	0	287	389	0	186	0	35	0	2613	2	0	72	0	33	0	607	0	607	10	0
2008	2	0	0	230	0	0	1163	14	455	0	95	797	0	0	1	0	2361	0	0	40	0	0	0	0	0	0
2008	3	0	702	518	0	0	868	1	449	0	1	0	0	0	0	0	0	0	0	39	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	0	0	0	0	0	1	0
2009	1	0	2891	97	1299	828	0	108	180	0	181	0	82	0	2221	3	0	62	0	26	0	256	0	256	12	0
2009	2	0	0	112	0	0	703	43	143	0	106	677	0	0	3	0	181	0	0	23	0	0	0	0	0	0
2009	3	0	718	617	0	0	264	0	342	0	1	0	0	0	0	0	0	0	0	35	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	0	0	0	0	0	3	0
2010	1	0	123	26	1052	35	0	179	190	0	79	0	45	0	5300	0	0	20	0	27	0	563	0	563	4	0
2010	2	0	0	145	0	0	979	44	237	0	9	693	0	0	1	0	388	0	0	10	0	0	0	0	1	0
2010	3	0	67	191	0	0	492	29	374	0	4	0	0	0	0	0	0	0	0	25	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	0	0	0	0	0	2	0
2011	1	0	611	21	1906	320	0	38	158	0	148	0	48	0	2379	0	0	39	0	49	0	375	0	375	29	0
2011	2	0	0	43	0	0	789	22	217	0	36	567	0	0	19	0	2377	0	0	32	0	0	0	0	1	0
2011	3	0	9	163	0	0	242	70	360	0	5	0	0	0	1	0	0	0	0	20	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	0	0	0	0	0	4	0
2012	1	0	261	559	841	199	0	103	205	0	514	0	26	0	5421	0	0	2	0	24	0	180	0	180	35	0
2012	2	0	0	28	0	0	233	0	176	0	54	644	0	0	3	0	620	0	0	13	0	0	0	0	1	0
2012	3	0	9	76	0	0	256	2	273	0	4	0	0	0	0	0	0	0	0	28	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	0	0	0	0	0	3	0
2013	1	0	10	1	1729	268	0	81	132	0	204	0	40	0	1788	0	0	22	0	28	0	264	0	264	57	0
2013	2	0	0	35	0	0	477	3	217	0	82	895	0	0	8	0	2	0	0	15	0	0	0	0	5	0
2013	3	0	79	516	0	0	789	0	306	0	2	0	0	0	2	0	0	0	0	9	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	0	0	0	0	0	1	0
2014	1	0	654	6	2203	47	0	125	92	0	231	0	21	0	1228	1	0	40	0	21	25	61	0	61	0	0
2014	2	0	0	6	0	0	97	1	107	0	110	679	0	0	2	0	14	0	0	26	2	0	0	0	0	0
2014	3	0	246	607	0	0	60	7	76	0	1	0	0	0	1	0	0	0	0	39	1	0	0	0	0	0
2014	4	191	86	5	0	939	18	12	0	388	261	0	308	0	3133	237	0	0	0	0	2	0	121	0	0	0
2015	1	0	27	0	1864	0	0	11	88	0	210	0	26	0	43	0	0	19	0	25	25	243	27	243	0	0
2015	2	0	0	65	0	0	233	6	77	0	167	808	0	0	3	0	7	0	0	47	0	0	0	0	0	0
2015	3	0	1	981	0	0	153	5	116	0	0	0	0	0	0	0	0	0	0	72	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	0	2	0	267	0	0	0
2016	1	0	463	6	1772	0	0	8	135	0	183	0	23	0	329	0	0	224	0	83	8	261	1	261	0	0
2016	2	0	0	9	0	0	213	52	254	0	62	769	0	0	16	0	805	0	0	20	2	0	0	0	0	0
2016	3	0	83	738	0	0	178	31	479	0	1	0	0	0	1	0	0	0	0	50	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	0	2	0	219	0	0	0
2017	1	0	111	3	1691	0	0	32	259	0	518	0	30	0	479	1	0	82	0	37	10	164	0	164	0	0
2017	2	0	0	2	0	0	299	1	109	0	316	1038	0	0	0	0	375	0	219	35	5	0	0	0	0	0
2017	3	0	11	530	0	0	81	30	148	0	1	0	0	0	418	0	0	0	27	59	1	0	0	0	0	0
2017	4	0	81	0	0	1571	15	28	0	209	36	0	257	0	2429	115	0	0	171	354	2	0	245	12	0	0
2018	1	0	124	0	1536	0	0	5	98	0	37	0	38	0	40	0	0	42	0	11	7	218	1	218	0	0
2018	2	0	0	5	0	0	196	8	110	0	7	533	0	0	17	0	95	0	183	37	5	0	0	0	0	0
2018	3	0	8	542	0	0	375	36	312	0	1	0	0	0	2007	0	0	0	116	195	0	0	0	0	0	0
2018	4	0	152	16	0	1567	51	12	0	233	52	0	284	0	7	194	0	0	1	429	5	0	232	12	0	0
2019	1	0	449	10	1564	0	0	7	101	0	171	0	35	0	248	0	0	39	0	14	10	155	3	155	0	0
2019	2	0	0	12	0	0	198	6	76	0	12	647	2	0	12	0	216	0	224	29	3	0	0	0	0	0
2019	3	0	9	447	0	0	293	20	433	0	0	0	0	0	3271	0	0	0	149	126	0	0	0	0	0	0
2019	4	0	66	115	0	1556	108	26	0	260	191	0	683	0	11	462	0	0	6	740	2	0	183	11	0	0
2020	1	0	2	32	1611	0	0	8	146	0	124	0	49	0	165	2	0	55	2	19	27	126	31	126	0	0
2020	2	0	0	12	0	0	246	4	147	0	43	907	0	0	47	0	289	0	209	111	7	0	0	0	0	0
2020	3	0	4	99	0	0	305	23	799	0	0	0	1	0	3028	1	0	0	192	124	15	0	240	12	0	0
2020	4	0	20	327	0	373	44	16	0	281	175	0	1019	0	5	451	0	0	16	585	15	0	240	12	0	0

Table 5. Difference of Catch amount by fleet between 2020 stock assessment and 2022 stock assessment (FY2015-2016). Fleet 1 includes Fleet 28 catch amount to compare between 2020 stock assessment and 2022 stock assessment.

		FY2015											
	Fqt 1			Fqt 2			Fqt 3			Fqt 4			
Fleet	amount_2020	amount_2022	Difference	amount_2020	amount_2022	Difference	amount_2020	amount_2022	Difference	amount_2020	amount_2022	Difference	
1	25.4	25.4	0	47.5	47.5	0	71.7	71.7	0	216.6	216.6	0	
2	26.9	26.9	0				0.9	0.9	0	97.4	97.4	0	
3	0.2	0.2	0	65.0	65.0	0	981.0	981.0	0	33.0	33.0	0	
4	1863.5	1863.5	0										
5										1286.9	1286.9	0	
6				233.2	233.2	0	153.1	153.1	0	82.4	82.4	0	
7	10.7	10.7	0	5.8	5.8	0	4.6	4.6	0	5.4	5.4	0	
8	88.4	88.4	0	77.0	77.0	0	115.9	115.9	0				
9										198.9	198.9	0	
10	210.2	210.2	0	167.3	167.3	0	0.0	0.0	0	283.0	283.0	0	
11				808.0	808.0	0							
12	26.4	26.4	0				0.2	0.2	0	236.7	236.7	0	
14	42.9	42.9	0	3.2	3.2	0	0.2	0.2	0	2716.5	2716.5	0	
15	25.5	25.5	0	0.2	0.2	0	0.0	0.0	0	2.4	2.4	0	
16	242.6	242.6	0										
17	0.4	0.4	0							214.5	214.5	0	
18				6.6	6.6	0							
19	18.9	18.9	0										
20	27.4	27.4	0							267.4	267.4	0	
22	242.6	242.6	0										
25	0.3	0.3	0	0.0	0.0	0				0.1	0.1	0	
		FY2016											
	Fqt 1			Fqt 2			Fqt 3			Fqt 4			
Fleet	amount_2020	amount_2022	Difference	amount_2020	amount_2022	Difference	amount_2020	amount_2022	Difference	amount_2020	amount_2022	Difference	
1	82.6	82.6	0	19.9	19.9	0	49.9	49.9	0	357.9	357.9	0	
2	462.7	462.7	0				82.5	82.5	0	131.2	131.2	0	
3	6.0	6.0	0	9.0	9.0	0	738.0	738.0	0	0.0	0.0	0	
4	1772.3	1772.3	0										
5										1620.4	1620.4	0	
6				212.6	212.6	0	177.8	177.8	0	5.8	5.8	0	
7	8.0	8.0	0	52.0	52.0	0	30.5	30.5	0	63.8	63.8	0	
8	134.9	134.9	0	253.6	253.6	0	479.0	479.0	0				
9										367.7	367.7	0	
10	182.6	182.6	0	62.3	62.3	0	0.9	0.9	0	175.1	175.1	0	
11				768.6	768.6	0							
12	22.6	22.6	0				0.3		-0.3	232.1	232.1	0	
14	329.2	329.2	0	16.0	16.0	0	0.6	0.6	0	3649.7	3649.7	0	
15	8.1	8.1	0	2.0	2.0	0	0.1	0.1	0	1.7	1.7	0	
16	260.5	260.5	0										
17										171.8	171.8	0	
18				805.4	805.4	0							
19	224.0	224.0	0										
20	1.5	1.5	0							218.7	218.7	0	
22	260.5	260.5	0										
25	0.2	0.2	0	0.0	0.0	0				0.0	0.0	0	

Table 5. Cont. (FY 2017-2018)

FY2017

Fleet	Fqt 1 amount_2020	amount_2022	Difference	Fqt 2 amount_2020	amount_2022	Difference	Fqt 3 amount_2020	amount_2022	Difference	Fqt 4 amount_2020	amount_2022	Difference
1	37.0	37.0	0	35.0	35.0	0	59.0	59.0	0	354.2	354.2	0
2	111.4	111.4	0				11.0	11.0	0	81.2	81.2	0
3	3.3	3.3	0	1.7	1.7	0	530.1	530.1	0			
4	1690.7	1690.7	0									
5										1571.4	1571.4	0
6				298.9	298.9	0	81.1	81.1	0	15.0	15.0	0
7	31.6	31.6	0	1.4	1.4	0	30.4	30.4	0	25.1	27.9	2.8
8	259.5	259.5	0	108.8	108.8	0	147.6	147.6	0			
9										209.3	209.3	0
10	518.1	518.1	0	315.9	315.9	0	0.6	0.6	0	36.2	36.2	0
11				1038.5	1038.5	0						
12	30.1	30.1	0	0.2		0	0.3		0	256.5	256.5	0
14	478.6	478.6	0				417.9	417.8	0	2429.1	2429.1	0
15	9.6	9.6	0	5.2	5.2	0	0.6	0.6	0	1.9	1.9	0
16	163.9	163.9	0									
17	0.6	0.6	0							115.3	115.3	0
18				374.7	374.7	0						
19	81.9	81.9	0									
20										245.5	245.5	0
21	0.2	0.2	0	219.0	219.0	0	26.5	26.5	0	171.3	171.3	0
22	163.9	163.9	0							12.3	12.3	0
25	0.3	0.3	0	0.1	0.1	0	0.0	0.0	0	0.0	0.0	0

FY2018

Fleet	Fqt 1 amount_2020	amount_2022	Difference	Fqt 2 amount_2020	amount_2022	Difference	Fqt 3 amount_2020	amount_2022	Difference	Fqt 4 amount_2020	amount_2022	Difference
1	10.7	10.7	0	36.9	36.9	0	194.4	195.4	1.0	423.4	429.0	5.6
2	123.7	123.7	0				8.3	8.4	0.1	152.5	152.5	0
3				5.1	5.1	0	542.1	542.2	0.1	16.0	16.2	0.2
4	1536.2	1536.2	0									
5										1566.6	1566.6	0
6				195.8	195.8	0	296.1	375.3	79.2	50.9	51.1	0.2
7	4.8	4.8	0	7.6	7.6	0	35.1	35.9	0.8	9.1	12.3	3.2
8	98.0	98.0	0	110.5	110.5	0	232.7	312.4	79.7			
9										232.6	232.9	0.2
10	37.4	37.4	0	7.1	7.1	0.0	0.9	0.9	0	51.8	51.8	0
11				528.6	532.6	4.0						
12	37.8	37.8	0	0.3		-0.3	0.1		-0.1	246.5	283.6	37.1
14	40.4	39.8	-0.6	17.7	17.3	-0.5	2007.2	2007.1	-0.1	6.7	6.9	0.2
15	6.4	6.6	0.2	4.2	4.8	0.6	0.0	0.0	0	4.9	5.2	0.3
16	217.8	217.9	0.2									
17										168.5	193.9	25.4
18				94.9	94.9	0						
19	41.8	41.8	0									
20	0.6	0.6	0							232.1	232.1	0
21				183.3	183.3	0	107.5	115.8	8.2	0.8	0.8	0
22	217.8	217.9	0.2							11.6	11.8	0.2
25	0.4	0.4	0	0.1	0.1	0	0.0	0.0	0	0.0	0.0	0

Table 6-(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.	**1993-2019**	JP Longline	Fleet 1 : JPLL	Standardized by VAST	ISC/22/PBFWG-1/01	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**	JP Troll	Fleet 6 : JP Troll (Seas 2-4)	Standardized by lognormal model	ISC/20/PBFWG-1/04	
S5	Taiwanese longline CPUE (South area)	**2002-2020**	TW Longline	Fleet 12 : TWLL (South)	Standardized by GLMM	ISC/21/PBFWG-2/02	X
S12	Japanese Recruitment monitoring in the East China Sea	**2017-2020**	JP Troll	Fleet 6 : JP Troll (Seas 2-4)	Standardized by VAST	ISC/21/PBFWG-2/03	X

Table6-(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	
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	
S8	Taiwanese longline GLMM CPUE (North whole area)	**2003-2018**	TW Longline	Fleet 17 : TWLL (North)	Standardized by GLMM	ISC/20/PBFWG-1/03	
S10	Korean Offshore Large scale Purse Seine CPUE	**2004-2018**	KR Purse Seine	Fleet 3: KROLPS	Standardized by GLM	ISC/19/PBFWG-2/13	
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	

Table 7. 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	S12
1952		1.32									
1953		1.19									
1954		1.06									
1955		0.80									
1956		0.55									
1957		0.63									
1958		1.52									
1959		2.49									
1960		1.87									
1961		1.83									
1962		1.66									
1963		1.17									
1964		1.21									
1965		0.95									
1966		1.21									
1967		0.59									
1968		0.53									
1969		0.62									
1970		0.44									
1971		0.28									
1972		0.26									
1973		0.18									
1974			0.52								
1975			0.37								
1976			0.88								
1977			0.95								
1978			1.17								
1979			0.76								
1980			0.99	0.67							
1981			1.15	1.19							
1982			0.66	0.62							
1983			0.39	0.92							
1984			0.43	0.94							
1985			0.39	0.88							
1986			0.45	0.99							
1987			0.45	0.72							
1988			0.52	0.83							
1989			0.79	0.65							
1990			0.79	1.29							
1991			1.26	1.34							
1992			1.36	0.59							
1993	2.29			0.49							
1994	1.67			2.03							
1995	2.03			1.11							
1996	2.09			1.62							
1997	1.93			0.95							
1998	1.49			0.84							
1999	1.06			1.53							
2000	0.77			1.16							
2001	0.92			1.16							
2002	1.40			0.76	2.11						
2003	1.50			0.65	2.06						
2004	1.53			1.30	1.36			0.92			
2005	0.88			1.44	1.57			1.18			
2006	0.96			0.74	1.18	2.92	0.72	0.73			
2007	0.60			1.43	0.91	1.56	1.04	1.03			
2008	0.35			1.46	0.77	0.94	1.20	1.11			
2009	0.22			1.16	0.40	0.68	0.50	0.65			
2010	0.18			1.13	0.34	0.50	0.74	0.77			
2011	0.14			0.98	0.32	0.41	0.54	0.63	0.68	1.32	
2012	0.30			0.50	0.33	0.47	0.75	0.76	0.67	0.64	
2013	0.30			0.90	0.46	0.66	1.23	1.25	1.17	1.06	
2014	0.38			0.43	0.65	0.69	1.49	1.14	0.33	0.38	
2015	0.40			0.50	0.67	0.84	1.57	1.48	0.60	0.63	
2016	0.65			1.10	0.71	0.86	1.26	1.21	1.40	0.94	
2017	0.66				0.79	1.25	0.71	0.73	2.02	1.65	1.60
2018	0.90				0.86	1.22	1.23	1.41	1.14	1.37	1.30
2019	1.38				1.50						0.47
2020					2.01						0.63

Table 8. 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.

CV

Fishing year	JP LL			JP Troll	TW LL				JP Troll Monitoring		
	S1	S2	S3	S4	S5	S6	S7	S8	S10	S11	S12
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	0.07		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	0.06		0.01	0.02							
2002	0.05			0.02	0.04						
2003	0.04			0.02	0.07						
2004	0.04			0.01	0.05			0.13			
2005	0.05			0.02	0.04			0.05			
2006	0.05			0.03	0.05	0.07	0.16	0.03			
2007	0.06			0.02	0.04	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	0.09	0.12	0.14	0.05			
2011	0.09			0.02	0.05	0.12	0.16	0.06	0.07	0.06	
2012	0.07			0.02	0.05	0.12	0.12	0.04	0.09	0.08	
2013	0.08			0.02	0.04	0.12	0.12	0.03	0.05	0.06	
2014	0.08			0.04	0.06	0.10	0.11	0.02	0.12	0.12	
2015	0.09			0.02	0.04	0.12	0.12	0.03	0.07	0.10	
2016	0.07			0.02	0.04	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	0.31
2018	0.09			0.02	0.06	0.12	0.12	0.03	0.05	0.05	0.30
2019	0.14				0.05						0.35
2020					0.04						0.33

*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 reference doc.

Table 9. 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			
Fleet 1	JPLL	Length bin	JPLL (Season 4)		1952-1968, 1993-2018	Scaled Number of fish measured	X
Fleet 2*1	JPSPPS (Seas1, 3, 4)	Length bin	JPSPPS (Season 1, 3, 4)		2002-2020	Number of landing well measured	X
Fleet 3*1	KROLPS	Length bin	KROLPS		2010-2020		X
Fleet 4	TPSJS	Length bin	JP TPSJS		1987-1989, 1991-2020	same velue with the last assessment	X
Fleet 5	TPSPO	Length bin	JP TPSPO		1995-2006 and 2014-2020	Number of landing well measured	X
Fleet 6	JP Troll (Seas2-4)	Length bin	JP Troll (Season 2-4)		1994-2020	Total month of well sampled port	X
Fleet 7*2	PL	Length bin	JP Pole-and-Line		1994-1996, 1998-2004, 2006-2010		
Fleet 8	SetNet (Seas1-3)	Length bin	JP Setnet (Season 1-3)		1993-2018	Total month of well sampled port	X
Fleet 9	SetNet (Seas4)	Length bin	JP Setnet (Season 4)		1993-2018	Total month of well sampled port	X
Fleet 10*3	SetNet_HK_AM	Weight bin	JP Setnet in Hokkaido and Aomori	JP Handline & Tsugaru Longline	1994-2018	Total month of well sampled port	X
Fleet 11*3	JP Others	Weight bin	JP Handline & Tsugaru Longline		1994-2018	Total month of well sampled port	X
Fleet 12	TWLL (South)	Length bin	TWLL (South area)		1992-2020	Scaled Number of fish measured	X
Fleet 13	USCOMM (-2001)	Length bin	US Commercial Fisheries (PS)		1952-1965, 1969-1982	Number of haul well measured	
Fleet 14	MXCOMM (2002-)	Length bin	MX Commercial Fisheries (PS)		2005-2006, 2008-2020	Number of haul well measured	X
Fleet 15*4	EPOSP	Length bin	US Recreational Fisheries		2014-2020		X
Fleet 16*5	Troll4Pen	Age (age-0 only)					
Fleet 17	TWLL (North)	Length bin	TWLL (North area)		2009-2020	Scaled Number of fish measured	X
Fleet 18	JPSPPS (Seas2)	Length bin	JPSPPS (Season 2)		2012-2020	Number of landing well measured	X
Fleet 19	JP Troll (Seas1)	Length bin	JP Troll (Season 1)		1994-2004, 2006-2008, 2011,2012, 2016, 2018	Total month of well sampled port	X
Fleet 20	JSSPS for Pen	Length bin	JSSPS for farming		2016-2020		X
Fleet 23	JPLL (1993- ,S3)	Length bin	JPLL (1993-2018, Season 3)	JPLL (2019-2020)	1993-2020		X
Fleet 24	EPOSP_early	Length bin	US Recreational Fisheries		1993-2003, 2005-06, 2008-11		

(a)
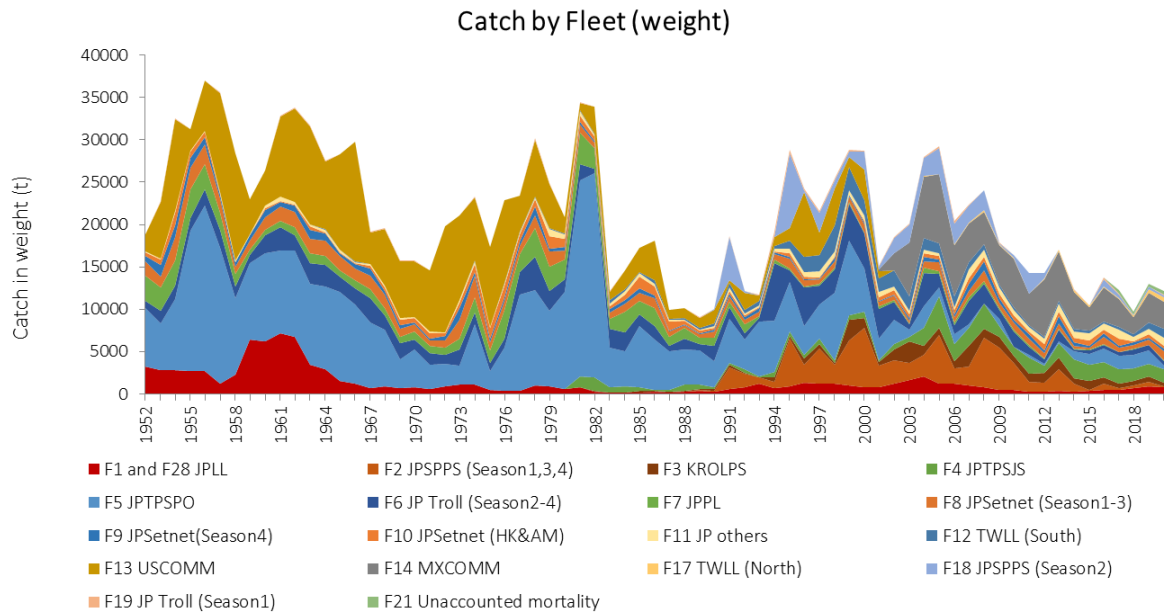
(b)
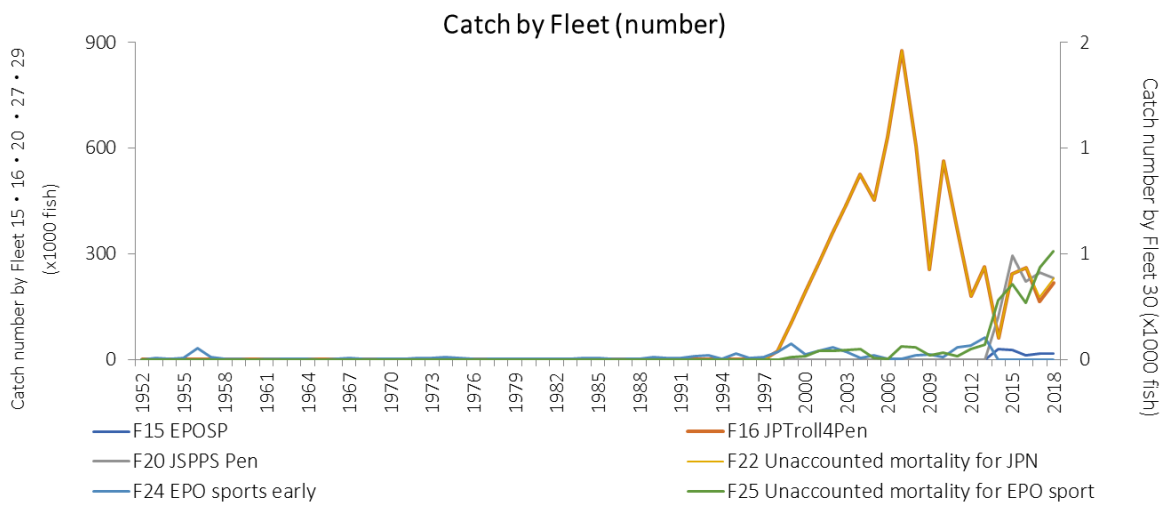
Fig. 1. Historical annual catch of Pacific bluefin tuna (*Thunnus orientalis*) by Fleets 1-14,17-19 (a: upper panel) and by Fleets 15, 16, 20 and 27 (b: lower panel), for fishing year 1952-2018.
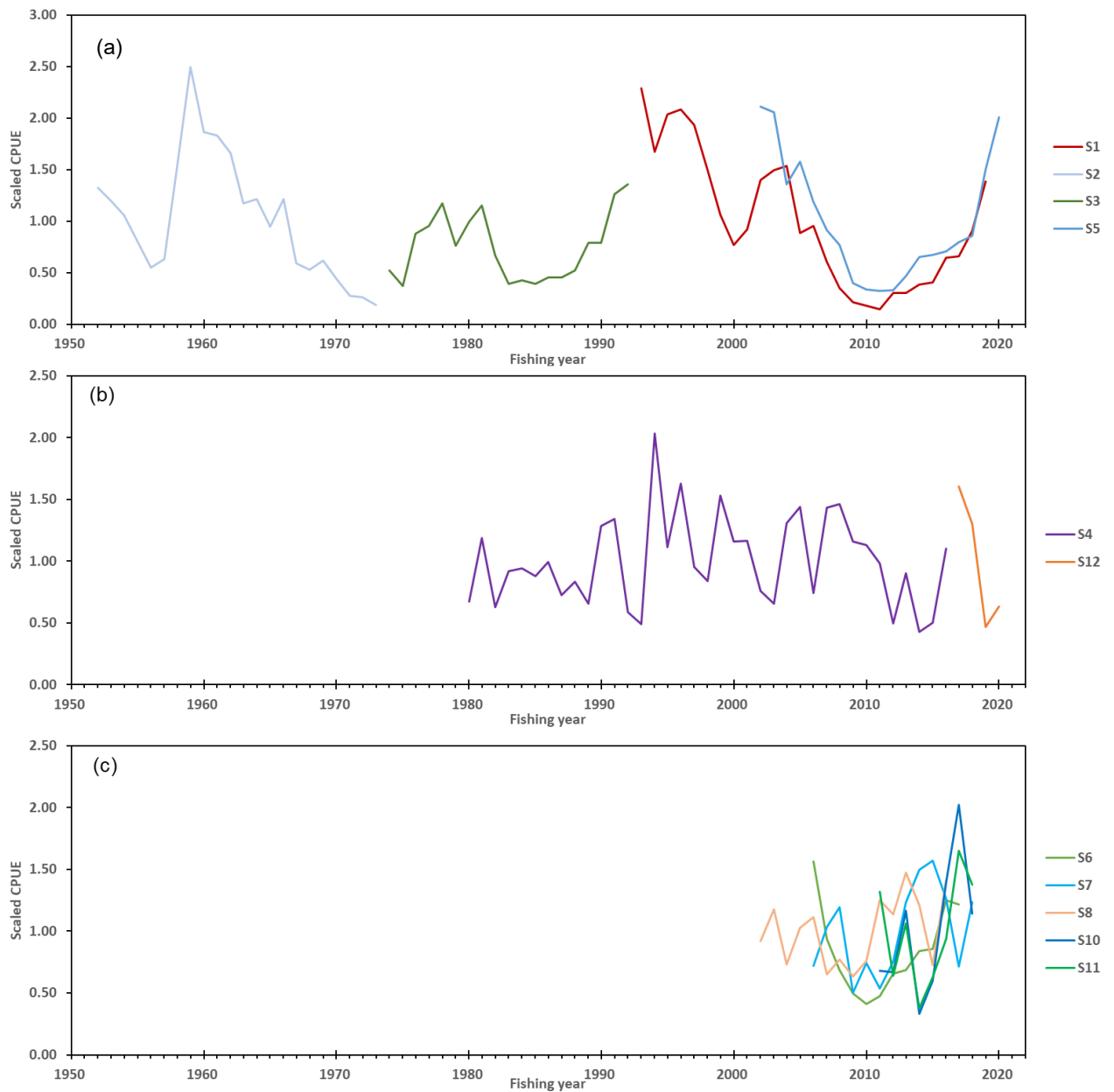
Fig. 2. Abundance indices of Pacific bluefin tuna (*Thunnus orientalis*) submitted to ISC PBFWG. The longline indices of Japanese fisheries (S1, S2, and S3) and Taiwanese fishery in southern area (S5) will be used to represent adult abundance (Fig.-(a)), and the index of Japanese troll fishery (S4) will 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) .
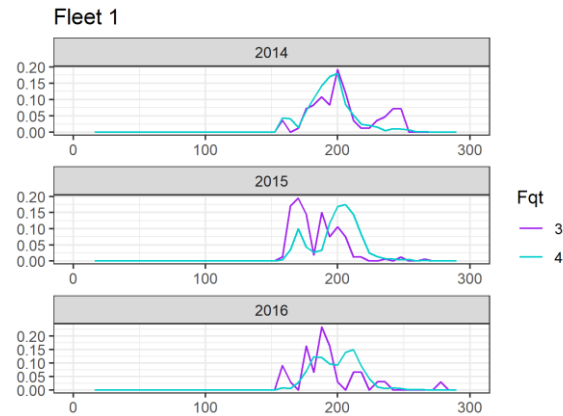
Fig.3. Size composition data of Fleet 1 (JPLL) for recent 3 years and updated periods. Fork length frequency is available from 1952 to 1968, and from 1993 to 2016 (fishing year).
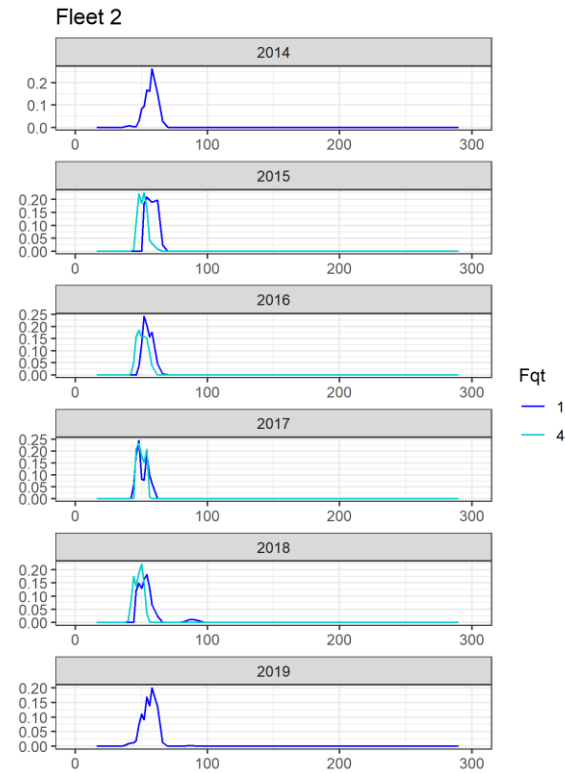
Fig.4. Size composition data of Fleet 2 (JPSPPS) for recent 6 years and updated periods. The data from both fleets were combined, and the selectivity information was sheared. The data are available from 2002 to 2019 (fishing year).
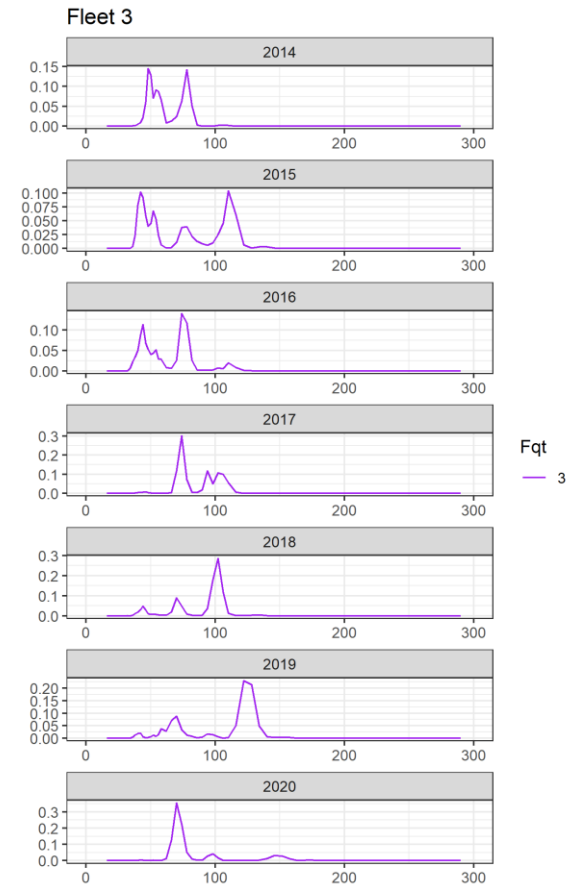
Fig.5. Size composition data of Fleet 3 (KROLPS) for recent 7 years and updated periods. These data were included in the size composition data shown in Fig. 5 (combined size composition).
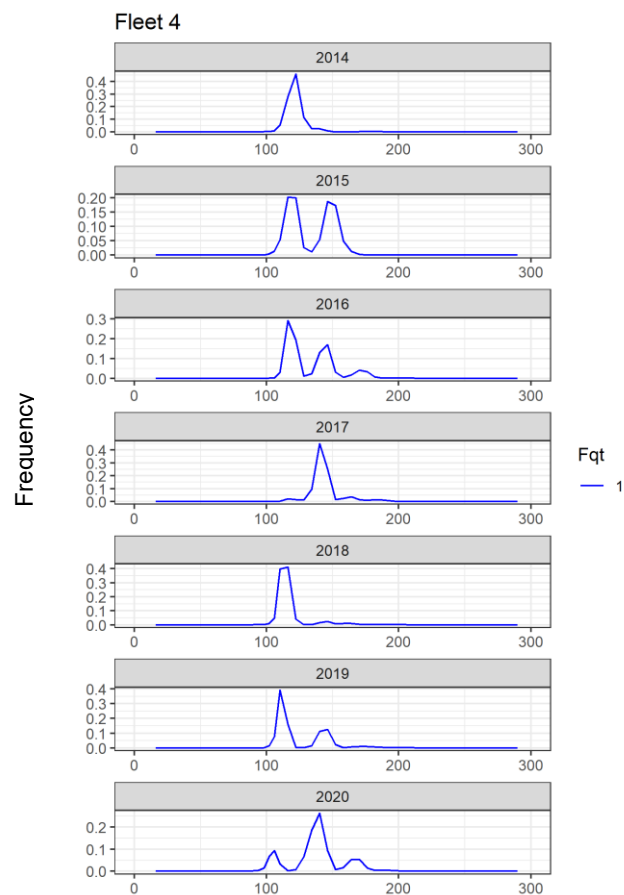
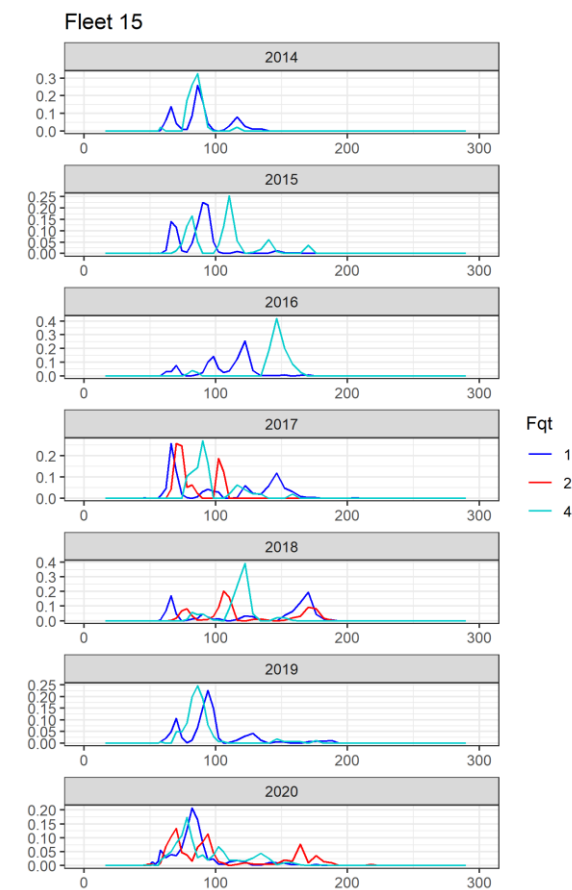**Fig.6.** Size composition data of Fleet 4 (TPSJS) for recent 7 years and updated periods. Fork length frequency is available from 1987 to 1989, and from 1991 to 2020 (fishing year).
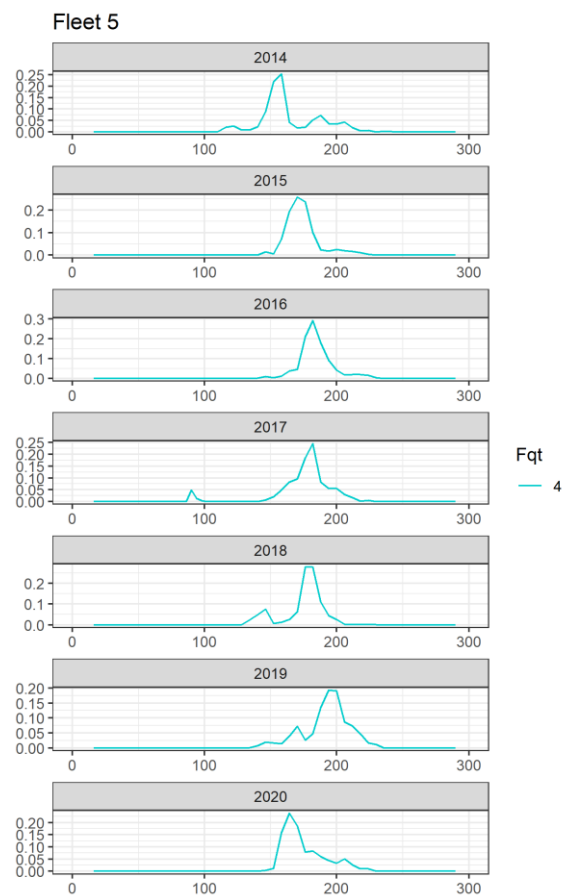
Fig.7. Size composition data of Fleet 5 (TPSPO) for recent 7 years. These data have not been updated. Available period is 1995, 1997-2005 and 2014-2020 (fishing year).
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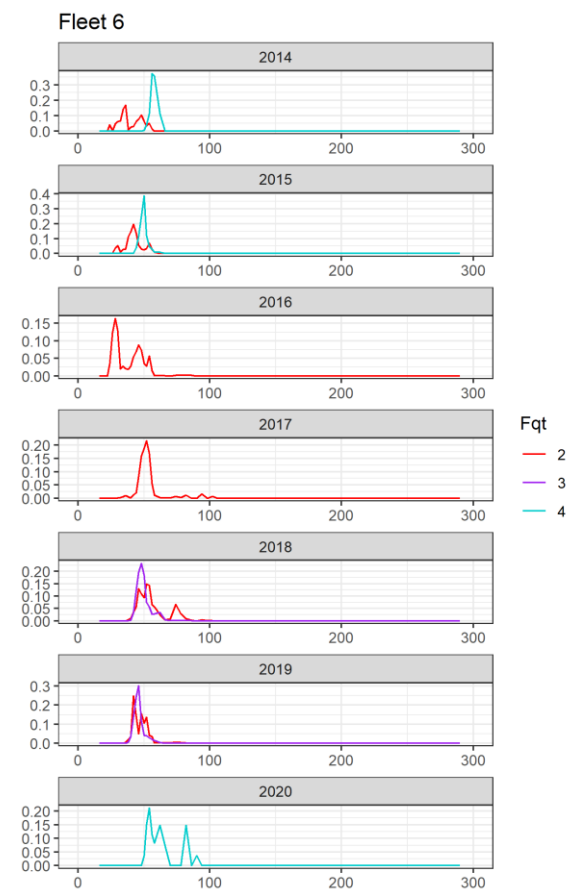
Fig.8. Size composition data of Fleet 6 (Troll Season 2-4) for recent 7 years and updated periods. Selectivity pattern estimated from this fork length frequency is also used for Fleet 7 (PL). The data are available from 1994 to 2020 (fishing year).
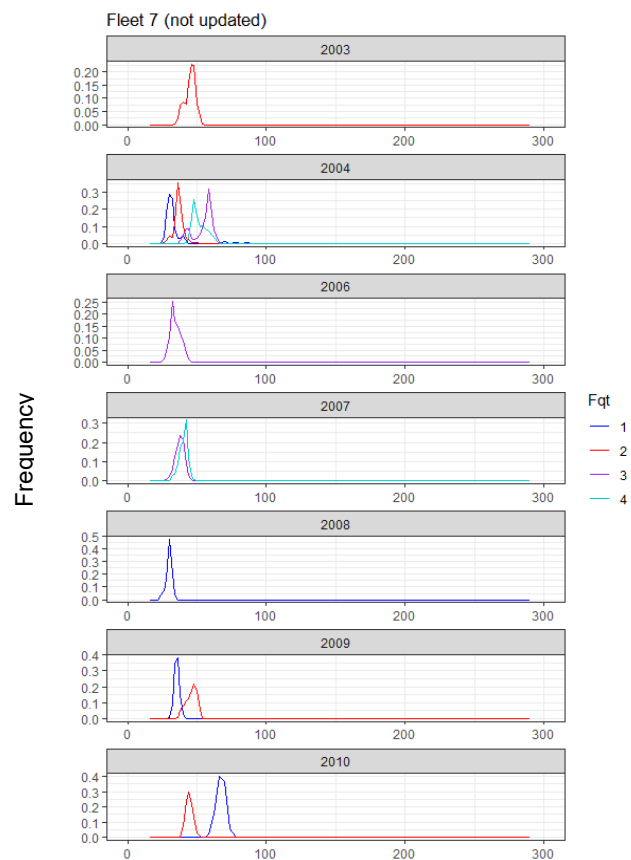
Fig.9. Size composition data of Fleet 7 (PL) for recent 5 years. The data has not been updated, and is available for 1994-1996, 1998-2004, and 2006-2010 (fishing year). These data are not used for the estimation of selectivity for Fleet 7.
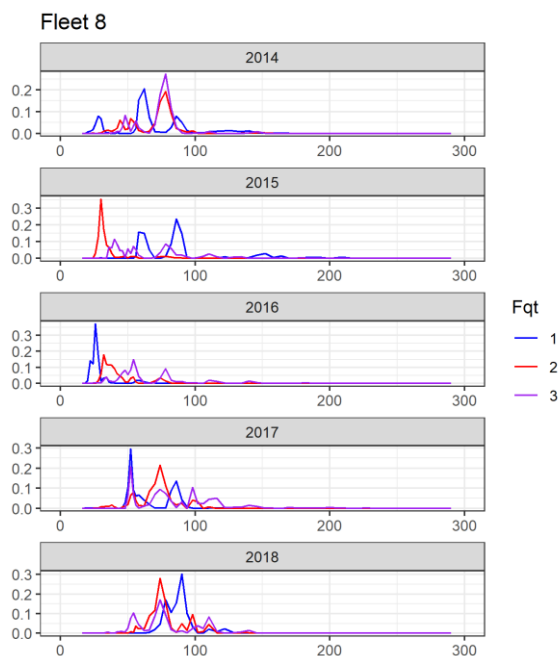
Fig.10. Size composition data of Fleet 8 (Set-net Season 1-3) for recent 5 years and updated periods. Fork length frequency is available from 1993 to 2018 (fishing year).
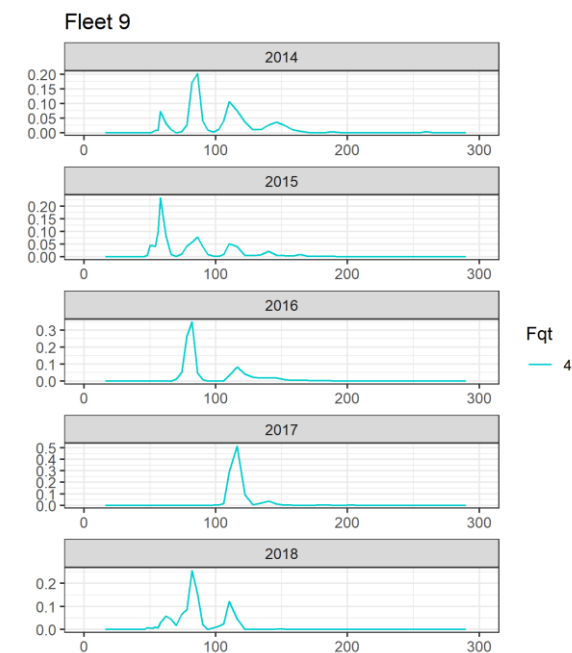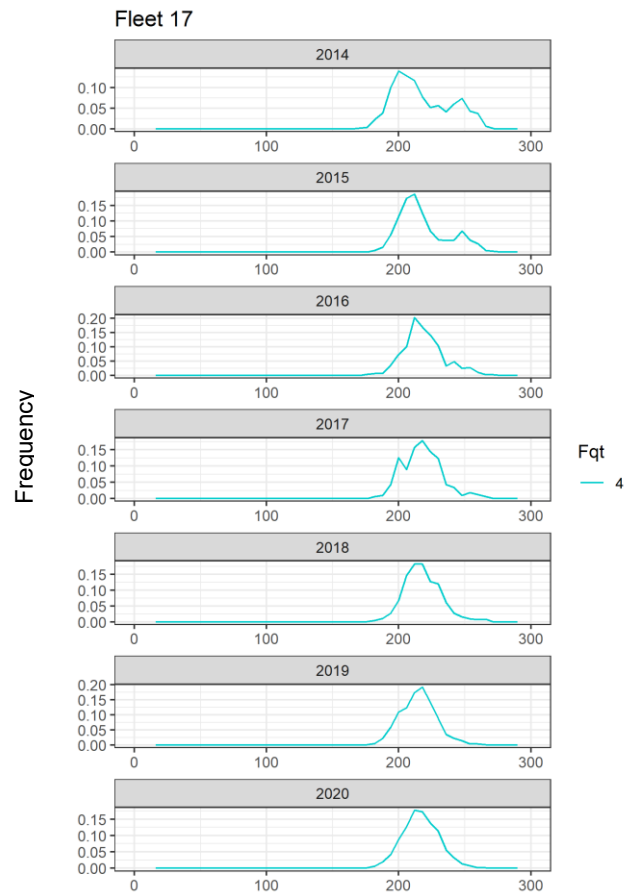
Fig.11. Size composition data of Fleet 9 (Set-net Season 4) for recent 5 years and updated periods. Fork length frequency is available from 1993 to 2018 (fishing year).
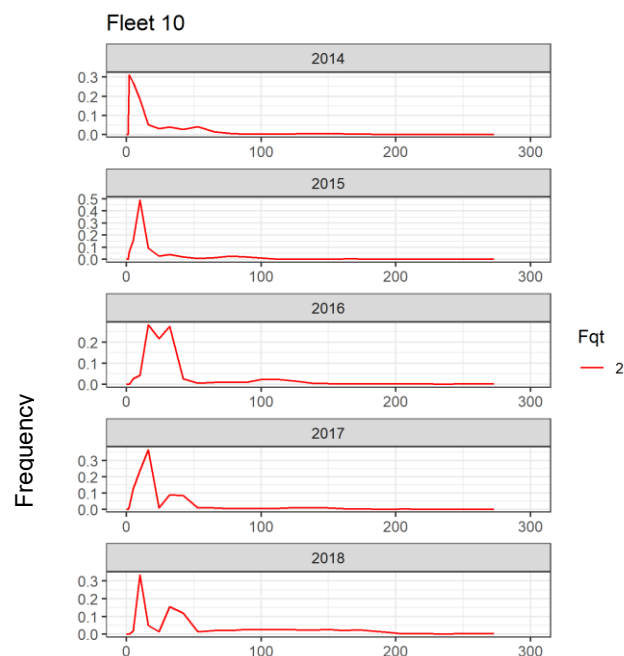
Fig.12. Size composition data of Fleet 10 (Set-net in Hokkaido and Aomori prefectures) for recent 5 years and updated periods. Weight frequencies from 10 and11 fleets are combined. The data are available from 1994 to 2018 (fishing year).
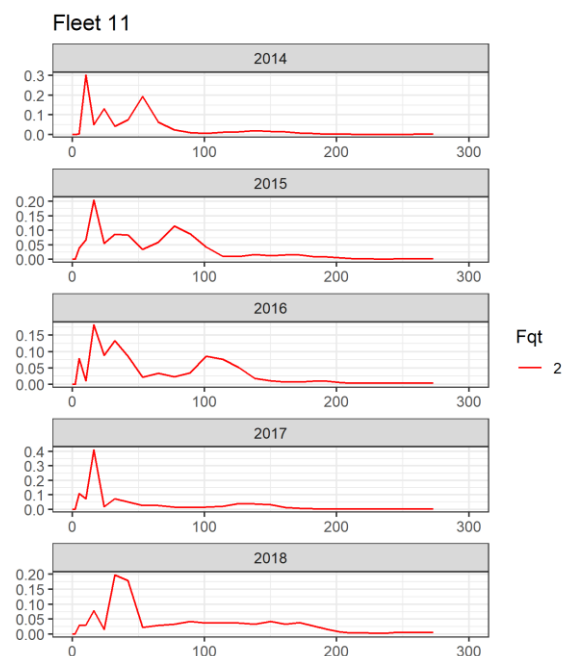
Fig.13. Size composition data of Fleet 11 (JP Others) for recent 5 years and updated periods. These data were included in the weight composition data shown in Fig. 13. (combined size composition).
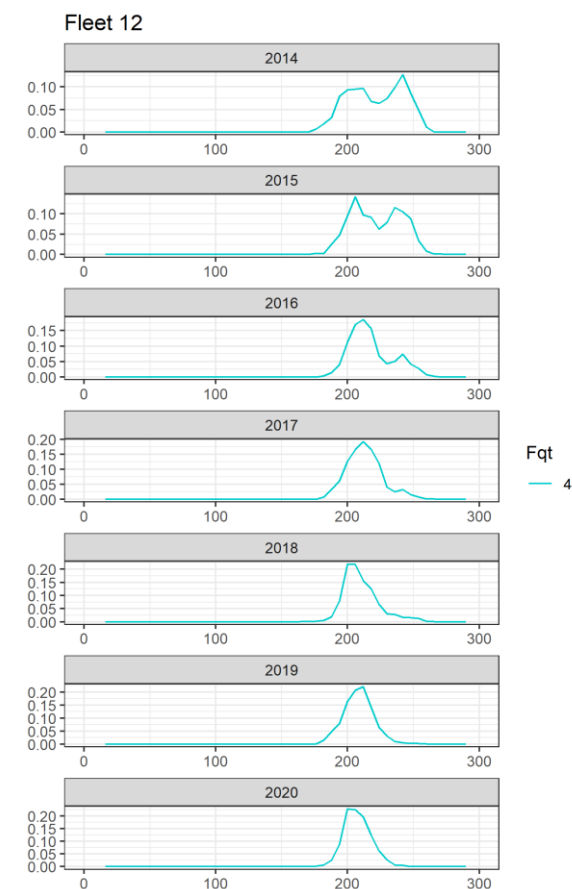
Fig.14. Size composition data of Fleet 12 (TWLL south area) for recent 7 years and updated periods. Fork length frequency is available from 1992 to 2020 (fishing year).
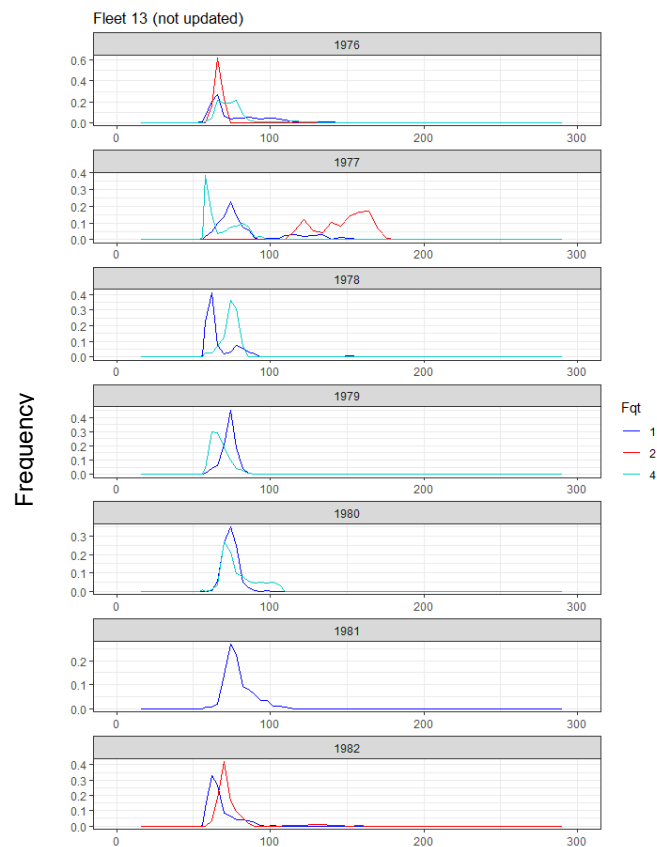
Fig.15. Size composition data of Fleet 13 (USCOMM) for recent 7 years. These data have not been updated. Selectivity pattern estimated from this data is also used for Fleet 15 (EPOSP). Available period is from 1952 to 1965, and from 1969 to 1982 (fishing year).
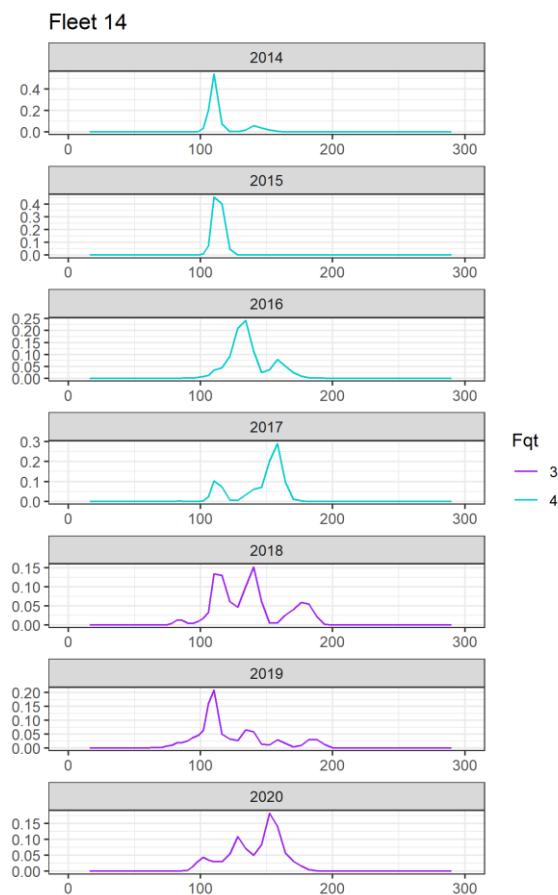
Fig.16. Size composition data of Fleet 14 (MXCOMM) for recent 7 years and updated periods. Fork length frequency is available in 2005-06 and 2008-20 (fishing year).

Fig.17. Size composition data of Fleet 15 (EPOSP) for recent 7 years and updated periods. Fork length composition data in 1993-2003, 2005-2006, and 2008-2020 (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 2020 (fishing year).
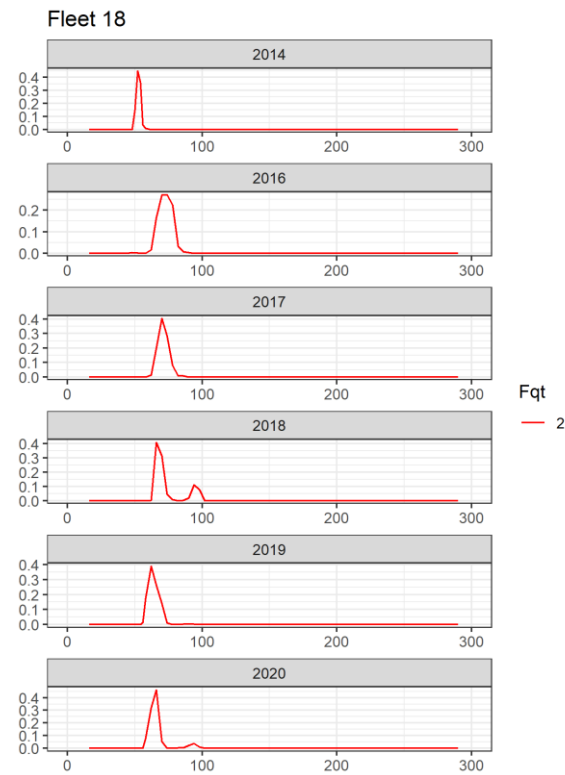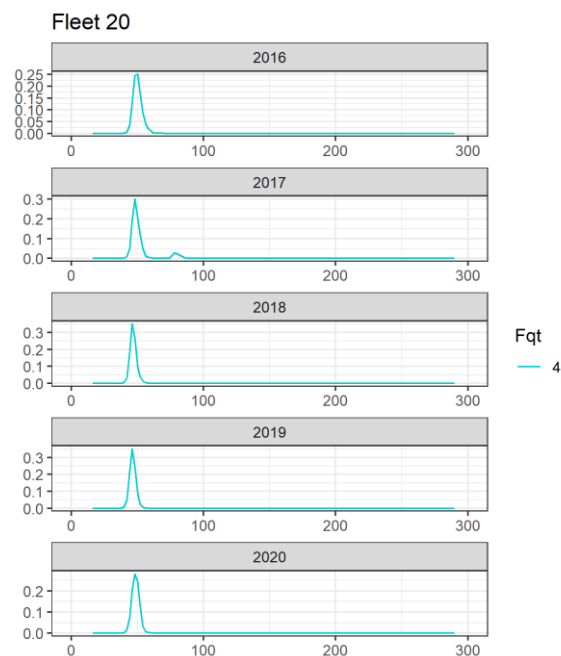
Fig.19. Size composition data of Fleet 18 (JPSPPS season 2) for recent 5 years and updated periods. Fork length frequency is available for 2003-2012, 2014 and 2016-2020 (fishing year).
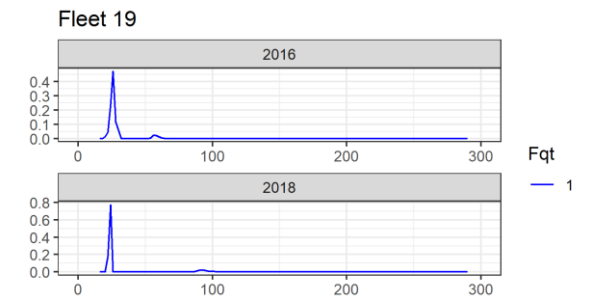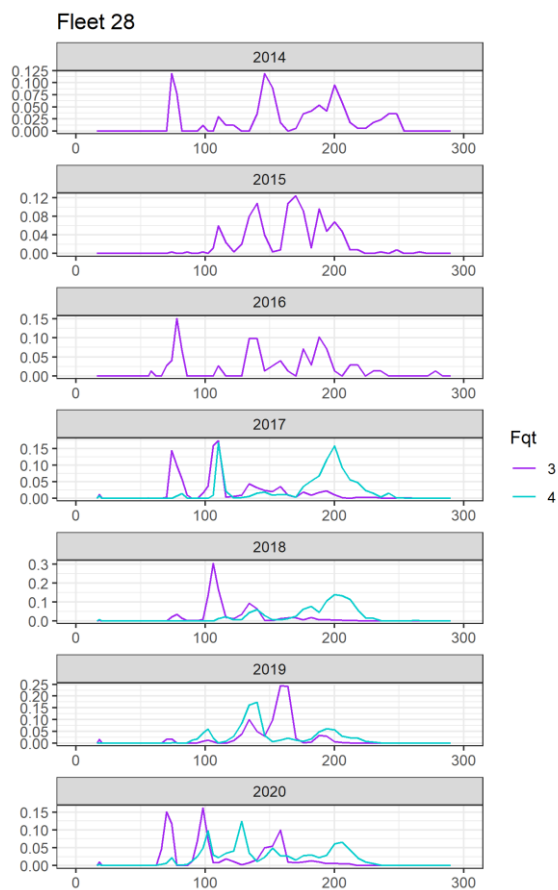
Fig.20. Size composition data of Fleet 19 (Troll season 1) for recent 3 years and updated periods. Fork length frequency is available for 1994-2004, 2006-2008, 2011,2012, 2016, 2018(fishing year).

Fig.21. Size composition data of Fleet 20 (JPSPPS for Pen) for recent 5 years and updated periods. Fork length frequency is available for 2016-2020 (fishing year).

Fig.22. Size composition data of Fleet 23 (JPLL) for recent 7 years and updated periods. Fork length frequency is available from 1952 to 1968, and from 1993 to 2020 (fishing year). After 2017, this fleet includes Fqt 4 information.