

**JOINT IATTC AND WCPFC-NC WORKING GROUP MEETING ON THE  
MANAGEMENT OF PACIFIC BLUEFIN TUNA  
NINTH SESSION (JWG-09)**

Kushiro, Japan  
10 – 13 July 2024

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**Report on CMM 2023-02 (Pacific bluefin tuna)**

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**IATTC-NC-JWG09-2024/DP-05 (Rev.02)**

**Japan**

## **I. Overview of Japanese PBF Fisheries**

Japan caught 12,897t of PBF in its commercial fisheries on an annual average basis between 2002 and 2004, which is the reference year of CMM 2023-02. Almost all PBF catches were made in the areas under the Japanese jurisdiction and those of coastal fisheries were made primarily within the territorial waters and internal waters. Also, fishing activities targeting PBF are usually seasonal and those fishing vessels target other species outside the PBF fishing season.

## **II. Characteristics of each PBF fishery**

### **1. Purse seine**

Purse seine is managed under the licensing system by the Minister of Agriculture, Forestry and Fisheries. The main target species of purse seine are jack mackerel and mackerel, and PBF is caught only during its migration season in the following three fishing grounds:

- (i) Western Japan ground: 1 year-old fish are caught by 23 vessels.
- (ii) Pacific ground: mainly adult fish are caught by 45 vessels.
- (iii) Northern Japan ground: mainly adult fish are caught by 15 vessels.

### **2. Longline**

Longline is managed under the licensing system by the Minister of Agriculture, Forestry and Fisheries (Distant and Offshore LL) as well as Wide Sea-area Fisheries Adjustment Commissions (Coastal LL). The main target species of longline are bigeye, yellowfin, and albacore. Longline catches mostly adult PBF. PBF catches by about 378 vessels are seasonal.

### **3. Artisanal (mostly Troll)**

Troll is managed under the licensing system by Wide Sea-area Fisheries Adjustment Commissions. It is conducted by small artisanal vessels (smaller than 5 GRT) with one or two fishermen on board. This fishery is traditionally conducted along the Japanese coastlines, frequently in isolated islands and remote peninsulas. Most of the fishing grounds are within the territorial waters. The fishing season is a few months and those vessels are engaged in other fisheries such as squid jigging or bottom longline when PBF does not migrate.

### **4. Set net (trap)**

Set net is managed through the licensing system by the governors of prefectures. Set nets are located in territorial waters or internal waters. Since set net is a passive fishing method waiting for any fish to swim into the net, the amount of catch depends on fish migration and it is not easy for fishermen to control the catch. PBF catches are less than 1% of all catches by set nets. The catch of set nets fluctuates substantially year by year. The number of set net licensed was 1,688 in 2023.

In January 2011, the Ministry of Agriculture, Forestry and Fisheries issued an administrative guidance that requested relevant prefectural governments with the authority to manage this fishery not to increase the number of licenses of set nets whose main catch include PBF.

### **5. Other fisheries**

Other fisheries include pole & line, hand line and drift net, and most of their PBF catches are by-catches.

## **III. Measures taken by Japan for PBF Management**

The government of Japan has a policy of implementing a PBF conservation and management program applicable to the entire PBF fishing activities, based upon the WCPFC decisions and ISC advice.

Since the peak of the fishing season, in general, was toward the end of year, coastal PBF fisheries had been managed by initially setting a management period from July 1 to June 30. However, since it turned out that catches in April had been lowest between 2015 and 2017, the government decided to change the management period to April 1 through March 31 beginning in 2019.

On the other hand, the fisheries managed under the licensing system by the Minister of Agriculture, Forestry and Fisheries use a calendar year as the management period.

These management periods are stipulated in the paragraph 7 of CMM 2023-02.

## **1. Regulation (Paragraph 2, 3 and 4 of CMM 2023-02)**

### **(1) Effort Limitation in terms of fishing vessel**

#### **a. Artisanal fisheries**

##### **Registration system (ended in March 31, 2014)**

For artisanal fishery – mostly troll fishery– operating in the Northern and Western area of Japan, a registration scheme was introduced on April 1, 2011, under which all small-scale fishing vessels fishing for PBF were required to register. Such registration was accompanied by mandatory reporting of their catch. This registration scheme was introduced to small scale fishing vessels operating in the Pacific side on April 1, 2012.

##### **Licensing system (commencing on April 1, 2014)**

While the registration system provided useful information on artisanal fisheries for PBF, the system itself could not control the fishing effort of those fisheries. Therefore, from April 2014, the licensing system has been introduced to regulate the effort. All the vessels fishing for PBF are now obliged to obtain a license issued by the Wide Sea-area Fisheries Adjustment Commission which is responsible for rational use of fishing grounds. The Wide Sea-area Fisheries Adjustment Commission can regulate the fishing effort under the supervision of the national government. This revision also corresponds to the agreement at WCPFC10 on elimination of the exemption for those fisheries on the fishing effort control. In 2023, 16,878 vessels were licensed.

#### **b. Other fisheries**

As stated above, fishing efforts of purse seine fisheries, longline fisheries and other fisheries are managed to be below the target level through the licensing system.

### **(2) Catch limit**

#### **a. Catch limit for small fish**

In accordance with 50% small fish (fish less than 30kg) catch reduction commencing in 2015, Japan set its initial catch limit for small fish at 4,007t. In the 2023 management year, Japan's total catch limit for small fish was 4,094.8 tons (4,007 tons – 542.0 tons (transfer of catch limit for small fish to that for large fish in accordance with paragraph 3 of CMM 2023-02) + 629.8 tons (carry over from the previous management year in accordance with footnote 1 of CMM 2023-02)).

#### **b. Catch limit for large fish**

In accordance with paragraph 3 of the CMM 2023-02, Japan set its initial catch limit for large fish – fish 30kg or larger – at 5,614t. In the 2023 management year, Japan's total catch limit for large fish was 6,845.7 tons (5,614 tons + 730.0 tons (transfer of catch limit for small fish to that for large fish in accordance with paragraph 3 of CMM 2023-02) + 501.7 tons (carry over from the previous management year in accordance with footnote 1 of CMM 2023-02)).

#### **c. Major actions to improve management of catch limit**

- (i) A legally binding Total Allowable Catch (TAC) system that imposes penalties on violators has been introduced since 2018.
- (ii) An individual quota (IQ) system was introduced in Offshore LL fishery and purse seine fishery in a part of its 2022 fishing season.
- (iii) Improved monitoring and more frequent reporting as described in “4. Data collecting system”.
- (iv) Pilot projects to avoid bycatch in set nets have been conducted, such as development of gear configurations to avoid bycatch of PBF, installation of fish finders at set nets to detect PBF in nets and development of techniques for live release from set nets.
- (v) Regulation has been implemented in recreational fishing since the 2021 season, through the regulatory instruction by the Wide Sea-area Fisheries Adjustment Commission, including catch

reporting requirement, catch prohibition of small fish and catch limit and temporal catch prohibition of large fish.

d. Unreported catch detected in Aomori Prefecture

As reported last year, Aomori Prefecture in August, 2022 reported to JFA that it had detected unreported catches of 55.7 tons (54.9 tons of large fish and 0.8 tons of small fish) of PBF for the 2021 management period (April 2021 – March 2022) in a major fishing town of the prefecture. In February 2023, the Aomori Police Department arrested two wholesalers who engaged in the unreporting cases. On the basis of the findings by the Aomori Police Department, Aomori Prefecture, the primary responsible body for the TAC management of small scale fisheries in the prefecture, further conducted its investigation, and confirmed that the total unreported catch was 88.1 tons (85.4 tons of large fish and 2.7 tons of small fish) in the 2021 management period. Japan's catch report to the WCPFC was corrected based on this finding, accordingly. Any further correction in catch data will be reported to WCPFC.

e. Enhanced and strengthened monitoring and control measures

Following the above serious unreporting incident, FAJ has stepped up its efforts to enhance and strengthen its monitoring and control measures for the PBF fisheries to prevent similar cases from recurring.

As of April 1, 2024, JFA established a new division in the agency that dedicates itself to the monitoring of catches and landings by fisheries. This division is assigned the task to monitor catch records of and conduct on-site inspections to not only large-scale fisheries licensed by the central government but also small scall fisheries managed by prefectural governments.

In addition, on June 19, 2024, the National Diet of Japan adopted proposed amendments to the Fishery Act and the Act on Ensuring the Proper Domestic Distribution and Importation of Specified Aquatic Animals and Plants for the improved management of PBF fisheries. These amendments aim at enhanced and strengthened monitoring and control on catch and distribution (traceability) for large PBF (30kg or larger) which has high economic values and therefore, requires stricter monitoring and control, as we learned from the unreporting cases in Aomori prefecture. The measures to be introduced through these amendments include:

(Amendment of Fishery Act)

- (a) Requirement for fishers to report the number of fish in addition to the weight;
- (b) Requirement for fishers to maintain the information used for PBF catch reporting (e.g. name of fishing vessel) to enable the tracing and investigation of catch; and
- (c) Strengthened penalties for violation of catch reporting;

(Amendment of Act on Ensuring the Proper Domestic Distribution and Importation of Specified Aquatic Animals and Plants for the improvement of PBF fisheries)

- (a) Requirement for sellers to transfer the catch information the buyers;
- (b) Requirement for the sellers and the buyers to maintain the catch information; and
- (c) Requirement for exporters to acquire a legal harvest certificate at the time of export.

Furthermore, since October, 2023, JFA has been conducting a pilot project for further enhanced monitoring of PBF fisheries, including the tagging to individual fish, installation of monitoring cameras at major landing sites, and random patrolling by a private company entrusted by JFA for PBF landing activities. JFA intends to further enhance its management and control measures for the PBF fisheries on the basis of the outcomes of the pilot project.

### (3) Aquaculture

#### A registration system and mandatory reporting

Fries used for PBF farming in Japan are mainly caught by troll and purse seine fisheries. As a first step towards better management of PBF farming, starting in April 2011, all PBF aquaculture sites are required to register and report their farming activities, including information on caging and harvest. As of December 2023, 160 aquaculture sites were on the registration.

### **Administrative instruction on PBF aquaculture**

As stated above, wild seeds for aquaculture are mainly caught by troll and purse seine fisheries. To prevent an increase in fry catches, the Minister of Agriculture, Forestry and Fisheries instructed prefectural governments in October 2012 not to increase the capacity of PBF farms which use wild seeds.

## **2. Monitoring of recruitment of juveniles (Paragraph 10 of CMM 2021-02)**

To have a better understanding of the recruitment status, the Fisheries Resources Institute (FRI) of Japan commenced a real-time monitoring survey of troll fleet's operations in 2011. In this survey, the catch information (Number of fish by species) with its geographic position and Sea Surface Temperature (SST) are sent to the FRI in near-real time fashion using a data transmitter, which was equipped on the troll vessels. Furthermore, since 2021 fishing year, fishery independent charter real-time monitoring surveys were initiated to ensure sufficient operations in each spatial and temporal stratum, in addition to the conventional real-time monitoring. Based on those data, the FRI reported the latest recruitment index, which informs the relative strength of the cohorts over 2011-to-2023-year classes, to the PBFWG meeting held in Kaohsiung in February 2024. By function of the data collection system, the PBFWG could see the relative strength of the latest cohort before that cohort turns to age 1 (PBF turns their age in July by the assessment assumption).

Totally 3,863 days operational data from 14 real-time monitoring vessels, which mainly targeted for age-0 PBF (i.e., 30-60 cm fork length) during the winter season (November to following February) in the East China Sea were used to standardize the CPUE by Vector Autoregressive Spatio-Temporal (VAST) model formulated a delta-generalized linear mixed model. Estimated indices for 2011-2023 were quite similar to the traditional sales slip index throughout the overlapping period (2011-2016). In the PBFWG meeting held in February-March 2024, the PBFWG concluded that it was still premature to include this index into the base-case model, however, the WG considered that this index could be useful for qualitative validation of the recruitment estimated by the assessment base case or for the early warning of the sudden recruitment drop. With this regard, the PBF recruitment in 2023 would not show an indicative decline in the level of the strength of the cohort based on this index.

## **3. Commercial Transaction (Paragraph 11 of CMM 2021-02)**

### **(1) International Trade of Products derived from Pacific Bluefin tuna**

#### **● PBF Import in 2023**

According to the trade statistics of Japan, Japan imported 1,874t of PBF; 1,375t (73%) imported from Mexico followed by Korea (412t (22%)), NZ (80t), Australia (7t) and Chinese Taipei (0.3t). (Table1 and Figure1)

In 2023, Japan detected extremely high number of imports from NZ in the middle of year, which suggested possible overage of NZ's catch limit. Japan contacted NZ and shared its concern through email and received explanation about the situation faced by NZ and measures to be taken toward 2024. Japan looks forward to receiving detailed information through NZ's report on CMM 2023-02.

#### **● PBF Export in 2023**

800.5t of PBF were exported from Japan in 2023; 88% of product was exported to China and 3% of product was exported to Thailand. (Table2 and Figure2)

#### **● PBF Import in 2024 (As of April 31)**

As of April 31, a total of 484t of PBF was imported in 2024; 275t (57%) of products imported from Korea followed by Mexico (155t (32%)).

Table1 and Figure1: The amount of import of PBF (Jan.-Dec.2023 (unit: t)

	Fresh	Frozen	Total
Mexico	1,374.9	0.0	1,374.9
Korea	284.8	127.4	412.1
New Zealand	79.8	0.0	79.8
Australia	6.8	0.0	6.8
Chinese Taipei	0.3	0.0	0.3
Total	1,746.6	127.4	1,874.3

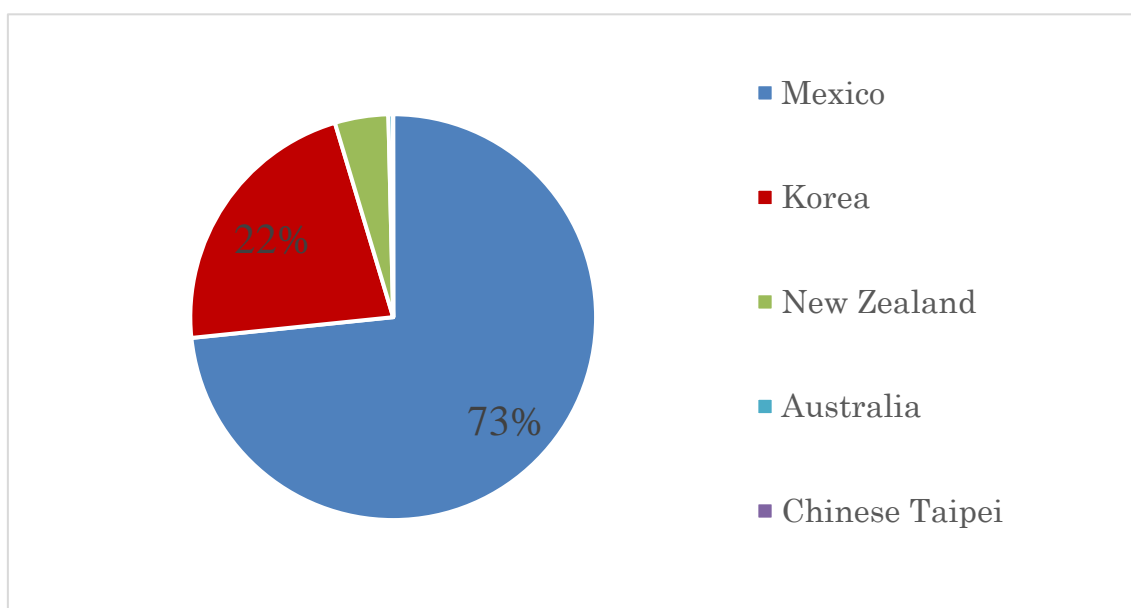
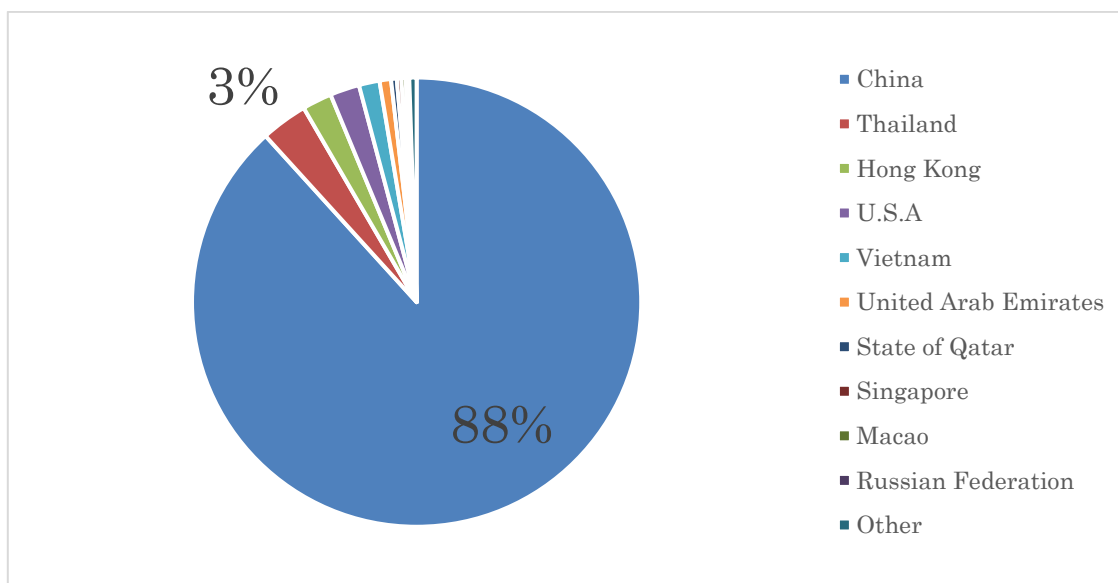


Table2 and Figure2: The amount of export of PBF (Jan.-Dec. 2023) (unit: t)

	Fresh	Frozen	Total
China	706.5	0.3	706.5
Thailand	26.0	0.9	26.9
Hong Kong	16.9	0.1	17.0
U.S.A	17.0	0.0	17.0
Vietnam	11.9	0.0	11.9
United Arab Emirates	6.6	0.0	6.6
State of Qatar	3.3	0.0	3.3
Singapore	2.5	0.1	2.6
Macao	2.5	0.0	2.5
Russian Federation	2.0	0.0	2.0
Other	4.2	0.0	4.2
Total	799.4	1.4	800.5



## (2) Strengthened data collection for import

### a. Korea

In January 2010, a data collection system was established to require importers to make mandatory reporting for each import transaction when they import PBF from Korea. From March 2011, the number of size categories in the reporting format has been expanded from 5 categories to 7 categories in order to acquire more detailed data on import of juvenile fish:

#### **Before February 2011:**

smaller than 2kg, 2 - 3kg, 3 - 5kg, 5 - 50kg, over 50kg

#### **After March 2011:**

smaller than 2kg, 2 - 3kg, 3 - 5kg, 5 - 10kg, 10 - 30kg, 30 - 50kg, over 50kg

### b. Mexico

Starting in February 2011, the same mandatory reporting has been applied to importers that import PBF from Mexico.

## 4. Data collecting system (Paragraph 13 of CMM 2021-02)

### (1) Artisanal fisheries, set nets and other local fisheries

Prefectural governments monitor and collect the catch information from regional fisheries (including artisanal fisheries, set nets and other small fisheries) at least every month (daily reporting when more than 1 tons of PBF is harvested) and submit the data to the Japan Fisheries Information Service Center (JAFIC). The Japanese Fisheries Agency (JFA) monitors the data.

### (2) Purse Seine

Fisheries associations collect the fishing report from purse seines every time of landing and report the information to JAFIC.

### (3) Aquaculture

JFA collects the data about PBF aquaculture, including size and number of cages, the number of fries to be input, the sources of fries, the date of input and the amount of final products. The data about fries are treated separately divided into wild seeds and artificial seeds from hatcheries. JFA annually publishes the compiled data about PBF aquaculture.

Fries from wild are caught by purse seine and troll fisheries. In accordance with instruction by JFA, the number of fries put into aquaculture ponds from the purse seine fishery is monitored by stereo video cameras. Regarding fries from the troll fishery, troll fishermen directly sell them to aquaculture farmers, and sometimes to brokers who then sell them to farmers. In any case, the number of fries to be sold is reported to the fishery cooperative association by fishermen.

#### **(4) Other fisheries**

Other fisheries report the catch data directly to JFA. JFA checks the data and the aggregated catch volume is posted on the JFA's web-site and updated monthly.

#### **5. Work with other IATTC members (Paragraph 16 of CMM 2021-02)**

- (1) In May 2011, the NC chair held a meeting with IATTC members who have fisheries for PBF in the eastern Pacific. Japan assisted the NC Chair's work and joined the meeting.
- (2) During the 82nd IATTC meeting held in July 2011 at La Jolla, the Director General of JFA sent a letter to the Commissioner of Mexican Fisheries Agency (CONAPESCA) calling on Mexico to cooperate in establishing sound conservation and management measures for PBF in the eastern Pacific.
- (3) During the 83rd IATTC meeting held in June 2012 at La Jolla, the Japanese delegation cooperated with IATTC member countries so that Conservation and Management Measures for PBF during 2012 and 2013 was adopted.
- (4) During the 85th IATTC meeting held in June 2013 at Veracruz (Mexico), the Japanese delegation cooperated with IATTC member countries so that Conservation and Management Measures for PBF during 2014 was adopted.
- (5) During the 87th IATTC meeting (Resumed) in October 2014 at La Jolla California (USA), the Japanese delegation consulted with major stakeholders, Mexico and US, so that Conservation and Management Measure for PBF between 2015 and 2016 was adopted.
- (6) During the 90th IATTC meeting Japanese delegation cooperated with IATTC member countries so that IATTC agreed to hold the joint meeting with NC on Pacific Bluefin Tuna management during NC12.
- (7) During the 90th IATTC meeting (Resumed) in October 2016 at La Jolla California (USA), the Japanese delegation consulted with major stakeholders, Mexico and the US, so that Conservation and Management Measure for PBF between 2017 and 2018 was adopted.
- (8) During the 93rd IATTC meeting held in August 2018 at San Diego (USA), the Japanese delegation consulted with major stakeholders, Mexico and the US, so that Conservation and Management Measure for PBF between 2019 and 2020 was adopted.
- (9) During the 95th IATTC meeting held in November to December 2020 by videoconference, the Japanese delegation consulted with major stakeholders, Mexico and the US, so that Conservation and Management Measure for PBF during 2021 was adopted.
- (10) During the 98th IATTC meeting held in October 2021 by videoconference, the Japanese delegation consulted with major stakeholders, Mexico and the US, so that Conservation and Management Measure for PBF between 2022 and 2024 was adopted.



**Reporting template for the CMM 2021-02 (Pacific bluefin tuna)**

Table 1. Fishing effort by vessels fishing for Pacific bluefin tuna *in the area north of 20° N in the Convention Area*

Fishery	Unit of fishing effort (e.g., sets, fishing days, vessels)	2019	2020	2021	2022	2023
Purse Seine	Number of vessels	35	45	51	44	42
Longline Dist.&Off	Number of vessels	439	437	413	383	378
Longline Coastal	Number of vessels	337	311	328	303	298
Artisanal fisheries	Number of vessels	18,127	18,138	17,412	17,408	16,878
Set Net	Number of licenses	1,784	1,784	1,784	1,784	1,688

Table 2-1. Catches (mt) in calendar year basis, including discards, of Pacific bluefin tuna *in the Convention Area* (include all the fisheries in the previous table, plus all other fisheries that catch any Pacific bluefin tuna)

Fishery		2019		2020		2021		2022		2023	
		<30 kg	≥30 kg	<30 kg	≥30 kg	<30 kg	≥30 kg	<30 kg	≥30 kg	<30 kg	≥30 kg
Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries	Purse Seine	1,328	3,131	783	3,165	962	3,230	1,010	3,676	757	3,779
	Longline Dist.&Off.	56	415	31	585	80	562	0	723	0	745
Other fisheries	Longline Coastal	112	440	118	755	101	912	98	825	98	749
	Artisanal fisheries	677	42	687	73	557	96	919	160	974	186
	Set Net	691	260	943	399	1,319	423	1,471	655	1,339	549
	Others	178	180	184	288	147	176	232	314	258	311
Recreational fishing						0	20	0	28	0	46
Total		3,042	4,467	2,745	5,265	3,165	5,419	3,731	6,381	3,426	6,366

Table 2-2. Catches (mt) in management year<sup>\*3</sup> basis, including discards, of Pacific bluefin tuna *in the Convention Area* (include all the fisheries in the previous table, plus all other fisheries that catch any Pacific bluefin tuna)

Fishery		2019		2020		2021		2022		2023	
		<30 kg	≥30 kg	<30 kg	≥30 kg	<30 kg	≥30 kg	<30 kg	≥30 kg	<30 kg	≥30 kg
Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries	Purse Seine	1,328	3,131	783	3,165	962	3,230	1,010	3,676	757	3,779
	Longline Dist.&Off.	56	415	31	585	80	562	0	723	0	745
Other fisheries	Longline Coastal	112	467	118	785	114	926	97	833	93	719
	Artisanal fisheries	565	72	687	86	713	141	887	114	1,043	205
	Set Net	725	352	1,307	401	1,312	554	1,401	553	1,156	481
	Others	165	173	181	297	174	172	233	329	268	321
Recreational fishing						0	20	0	28	0	46
Total		2,950	4,609	3,107	5,320	3,354	5,605	3,629	6,257	3,317	6,296
Catch limit <sup>*2</sup>		3,757	5,132	4,238	6,160	4,238	6,162	4,258	6,789	4,095	6,846

\*1 Management year is as follows.

- 1<sup>st</sup> management period: January 2015 - December 2015 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, January 2015 - June 2016 for Other fisheries.
- 2<sup>nd</sup> management period: January 2016 - December 2016 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, July 2016 - June 2017 for Other fisheries.
- 3<sup>rd</sup> management period: January 2017 - December 2017 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, July 2017 - June 2018 for Other fisheries.
- 4<sup>th</sup> management period: January 2018 - December 2018 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, July 2018 - March 2019 for Other fisheries.
- 5<sup>th</sup> management period: January 2019 - December 2019 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, April 2019 - March 2020 for Other fisheries.
- 6<sup>th</sup> management period: January 2020 - December 2020 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, April 2020 - March 2021 for Other fisheries.
- 2021 management period: January 2021 - December 2021 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, April 2021 - March 2022 for Other fisheries.
- 2022 management period: January 2022 - December 2022 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, April 2022 - March 2023 for Other fisheries.
- 2023 management period: January 2023 - December 2023 for Fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, April 2023 - March 2024 for Other fisheries.

\*2 Catch limit is as follows.

- 2016 small fish: 4,007 tons  
large fish: 4,882 tons
- 2017 small fish: 4,007 tons - 250 tons (transfer from small fish to large fish) - 333.5 tons (overage in 2016 fishing year)  
large fish: 4,882 tons + 250 tons (transfer from small fish to large fish)
- 2018 small fish: 4,007 tons - 250 tons (transfer from small fish to large fish)  
large fish: 4,882 tons + 250 tons (transfer from small fish to large fish)
- 2019 small fish: 4,007 tons - 250 tons (transfer from small fish to large fish)  
large fish: 4,882 tons + 250 tons (transfer from small fish to large fish)

- 2020 small fish: 4,007 tons - 450 tons (transfer from small fish to large fish) + 681.1 tons (carry over from the previous management year)  
     large fish: 4,882 tons + 450 tons (transfer from small fish to large fish) + 527.5 tons (carry over from the previous management year)  
         + 300 tons (transfer from Chinese Taipei)
- 2021 small fish: 4,007 tons - 450 tons (transfer from small fish to large fish) + 681.1 tons (carry over from the previous management year)  
     large fish: 4,882 tons + 450 tons (transfer from small fish to large fish) + 829.9 tons (carry over from the previous management year)
- 2022 small fish: 4,007 tons - 429.9 tons (transfer from small fish to large fish) + 681.1 tons (carry over from the previous management year)  
     large fish: 5,614 tons + 617.9 tons (transfer from small fish to large fish) + 527.0 tons (carry over from the previous management year)
- 2023 small fish: 4,007 tons - 542.0 tons (transfer from small fish to large fish) + 629.8 tons (carry over from the previous management year)  
     large fish: 5,614 tons + 730.0 tons (transfer from small fish to large fish) + 501.7 tons (carry over from the previous management year)