COMMISSION
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1 – 7 December 2021

Reference Document for Pacific Bluefin Tuna for the Review of CMM 2020-02 and HS 2017-02, and Highlights from NC17 for Agenda Item 9.3

WCPFC18-2021-19_rev1[1]

Paper prepared by the Secretariat

A. INTRODUCTION

1. The purpose of this paper is to provide a quick reference guide to the recommendations of the NC17 in support of discussions for the review of the amended CMM for Pacific bluefin tuna (PBF), the revised Harvest Strategy for PBF Fisheries, and other highlights from NC17. The proposed amendments to the existing CMM for Pacific bluefin tuna (CMM 2020-02) and the existing HS for PBF fisheries (HS 2017-02) were taken from the NC17 Summary Report and annexed to this paper as **Attachment A** and **Attachment B**, respectively. SC17 did not cover PBF as no new information was provided by the ISC. Previous benchmark stock assessment for PBF was conducted in 2020, and the stock status and management advice are in **Attachment C**.

B. NORTHERN COMMITTEE RECOMMENDATIONS AND HIGHLIGHTS

2. The NC recommends that the Commission adopt the revised *Conservation and Management Measure for Pacific Bluefin Tuna* in Attachment D of the NC17 Summary Report (**Attachment A**).

3. The NC recommends that the Commission adopt the revised *Harvest Strategy for Pacific Bluefin Tuna Fisheries* in Attachment E of the NC17 Summary Report (**Attachment B**).

4. The NC adopted the proposed *NC17 Requests to the ISC* in Attachment F of the NC17 Summary Report (**Attachment D**).

5. Regarding the development of a catch documentation scheme for PBF, the NC Chair reported that the JWG agreed to continue this work next year.

North Pacific swordfish

6. The NC Chair reiterated his concern about any potential negative impacts on this stock, particularly in light of the IUU fishing concerns that exist for the stock, and urged members to present proposals for

[1] Rev 1 replaces the original issued 5 November 2021, it includes an updated version of the NC17 revised CMM for Pacific Bluefin Tuna in Attachment A

developing the CMM at NC18. Japan shared the NC Chair's concern and expressed its intention to submit such a proposal at NC18. The USA said it looked forward to Japan's proposal and expressed its interest in providing input to the proposal.

Work Programme for 2022-2024

7. The NC reviewed and adopted the 2022-2024 Work Programme for the Northern Committee (Attachment H of the NC17 Summary Report).

Next meeting

8. Japan offered to host the Eighteenth Regular Session of the NC, if an in-person meeting is possible. Its venue and time will be informed in due course.

Attachment A

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
Northern Committee
Seventeenth Regular Session
Electronic Meeting
5-7 October 2021

CONSERVATION AND MANAGEMENT MEASURE FOR PACIFIC BLUEFIN TUNA

Conservation and Management Measure 2021-XX

The Western and Central Pacific Fisheries Commission (WCPFC):

Recognizing that WCPFC6 adopted Conservation and Management Measure for Pacific bluefin tuna (CMM 2009-07) and the measure was revised ten times since then (CMM 2010- 04, CMM 2012-06, CMM 2013-09, CMM 2014-04, CMM 2015-04, CMM 2016-04, CMM2017-08, CMM 2018-02, CMM 2019-02 and CMM 2020-02) based on the conservation advice from the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) on this stock;

Noting the latest stock assessment provided by ISC Plenary Meeting in July 2020, indicating the following:

- (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2018), (2) the SSB steadily declined from 1996 to 2010, (3) the slow increase in the stock biomass has been continuing since 2011, (4) total biomass in 2018 exceeded the historical median with an increase in immature fish; and (5) fishing mortality (F%SPR) declined from a level producing about 1% of SPR in 2004-2009 to a level producing 14% of SPR in 2016-2018;
- A substantial decrease in estimated F has been observed in ages 0-2 in 2016-2018 relative to the previous years;
- Since the early 1990s, the WCPO purse seine fisheries, in particular those targeting small fish (age 0-1) have had an increasing impact on the spawning stock biomass, and in 2016 had a greater impact than any other fishery group;
- Harvesting small fish has a greater impact on future spawning stock biomass than harvesting large fish of the same amount;
- The projection results indicate that, under all the examined scenarios, the initial goal of rebuilding the stock to SSB_{MED} by 2024 with at least 60% probability, is reached with 99% or 100% probability, and that the risk of SSB falling below SSB_{loss} is negligible; and
- The projection results also indicate that, under all the examined scenarios, the estimated probability of achieving the second biomass rebuilding target (20% of SSBF=0) 10 years after the achievement of the initial rebuilding target or by 2034, whichever is earlier, is greater than 90%.

Recalling that paragraph (4) of the Article 22 of the WCPFC Convention, which requires cooperation between the Commission and the IATTC to reach agreement to harmonize CMMs for fish stocks such as Pacific bluefin tuna that occur in the convention areas of both organizations;
Adopts, in accordance with Article 10 of the WCPFC Convention that:

General Provision

1 This conservation and management measure has been prepared to implement the Harvest Strategy for Pacific Bluefin Tuna Fisheries (Harvest Strategy 2017-02), and the Northern Committee shall

periodically review and recommend revisions to this measure as needed to implement the Harvest Strategy.

Management measures

2 CCMs shall take measures necessary to ensure that total fishing effort by their vessel fishing for Pacific bluefin tuna in the area north of the 20° N shall stay below the 2002–2004 annual average levels.

3 Japan, Korea and Chinese Taipei shall, respectively, take measures necessary to ensure that its catches of Pacific bluefin tuna less than 30 kg and Pacific bluefin tuna 30 kg or larger shall not exceed the annual catch limits in the tables below. The basis for the limits is as follows; annual catch limits for Pacific bluefin tuna less than 30 kg are 50% of the 2002-2004 average annual levels and annual catch limits for Pacific bluefin tuna 30 kg or larger are 115% of the 2002-2004 average annual levels or 30 metric tons for a CCM who does not have an initial catch limit for Pacific bluefin tuna 30 kg or larger before 2022.

Pacific bluefin tuna less than 30kg

	2002-2004 average annual level	Annual initial catch limit
Japan	8,015 metric tons	4,007 metric tons
Korea	1,435 metric tons	718 metric tons

Pacific bluefin tuna 30kg or larger

	2002-2004 average annual level	Annual initial catch limit
Japan	4,882 metric tons	5,614 metric tons
Korea	0 metric tons	30 metric tons
Chinese Taipei	1,709 metric tons	1,965 metric tons

4 CCMs, not described in paragraph 3, may increase their catch of Pacific bluefin tuna 30kg or larger by 15% above their 2002-2004 annual average levels. CCMs with a base line catch of 10 tons or less of Pacific bluefin tuna 30 kg or larger may increase their catch as long as it does not exceed 10 metric tons per year.

5 Any overage or underage of the catch limit shall be deducted from or may be added to the catch limit for the following year. The maximum underage that a CCM may carry over in any given year shall not exceed 5% of its annual initial catch limit[1].

6 CCMs described in paragraph 3 may use part of the catch limit for Pacific bluefin tuna smaller than 30 kg stipulated in paragraph 3 above to catch Pacific bluefin tuna 30 kg or larger in the same year. In this case, the amount of catch 30 kg or larger shall be counted against the catch limit for Pacific bluefin tuna smaller than 30 kg[2]. CCMs shall not use the catch limit for Pacific bluefin tuna 30 kg or larger to catch Pacific bluefin tuna smaller than 30 kg.

[1] Notwithstanding paragraph 5, a CCM may carry over up to 17% of its initial catch limits in 2021, 2022 and 2023, which remain uncaught, to 2022, 2023 and 2024, respectively.

[2] In 2022, 2023 and 2024, a CCM may count the amount of catch 30 kg or larger adjusted with the conversion factor 0.68 (catch 30 kg or larger multiplied by 0.68) against the catch limit for Pacific bluefin tuna smaller than 30 kg up to 10% of its initial catch limit for Pacific bluefin tuna smaller than 30 kg. Notwithstanding the first sentence of this footnote, a CCM who does not have an initial catch limit for Pacific bluefin tuna 30kg or larger before 2022 may apply the conversion factor 0.68 up to 25% instead of 10% of its initial catch limit for Pacific bluefin tuna less than 30kg for the same period.

7 All CCMs except Japan shall implement the limits in paragraph 3 on a calendar-year basis. Japan shall implement the limits using a management year other than the calendar year for some of its fisheries and have its implementation assessed with respect to its management year. To facilitate the assessment, Japan shall:

a. Use the following management years:
    1. For its fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries, use the calendar year as the management year.
    2. For its other fisheries, use 1 April – 31 March as the management year.[3]

b. In its annual reports for PBF, for each category described in a.1 and a.2 above, complete the required reporting template for both the management year and calendar year clearly identifying fisheries for each management year.

8 CCMs shall report to the Executive Director by 31 July each year their fishing effort and <30 kg and >=30 kg catch levels, by fishery, for the previous 3 year, accounting for all catches, including discards. CCMs shall report their annual catch limits and their annual catches of PBF, with adequate computation details, to present their implementation for paragraph 5 and 6, if the measures and arrangements in the said paragraphs and relevant footnotes applied. The Executive Director will compile this information each year into an appropriate format for the use of the Northern Committee.

9 CCMs shall intensify cooperation for effective implementation of this CMM, including juvenile catch reduction.

10 CCMs, in particular those catching juvenile Pacific bluefin tuna, shall take measures to monitor and obtain prompt results of recruitment of juveniles each year.

11 Consistent with their rights and obligations under international law, and in accordance with domestic laws and regulations, CCMs shall, to the extent possible, take measures necessary to prevent commercial transaction of Pacific bluefin tuna and its products that undermine the effectiveness of this CMM, especially measures prescribed in the paragraph 3 above. CCMs shall cooperate for this purpose.

12 CCMs shall cooperate to establish a catch documentation scheme (CDS) to be applied to Pacific bluefin tuna in accordance with the **Attachment** of this CMM.

13 CCMs shall also take measures necessary to strengthen monitoring and data collecting system for Pacific bluefin tuna fisheries and farming in order to improve the data quality and timeliness of all the data reporting.

14 CCMs shall report to Executive Director by 31 July annually measures they used to implement paragraphs 2, 3, 4, 7, 8, 10, 11 13 and 16 of this CMM. CCMs shall also monitor the international trade of the products derived from Pacific bluefin tuna and report the results to Executive Director by 31 July annually. The Northern Committee shall annually review those reports CCMs submit pursuant to this paragraph and if necessary, advise a CCM to take an action for enhancing its compliance with this CMM.

[3] For the category described a.2 of paragraph 7, the TCC shall assess in year 20XX its implementation during the management year that starts 1 April 20XX-1 (e.g., in the 2020 compliance review, the TCC will assess Japan's implementation for its fisheries licensed by the Ministry of Agriculture, Forestry and Fisheries during calendar-year 2019 and for its other fisheries during 1 April 2019 through 31 March 2020).

15 The WCPFC Executive Director shall communicate this CMM to the IATTC Secretariat and its contracting parties whose fishing vessels engage in fishing for Pacific bluefin tuna in EPO and request them to take equivalent measures in conformity with this CMM.

16 To enhance effectiveness of this measure, CCMs are encouraged to communicate with and, if appropriate, work with the concerned IATTC contracting parties bilaterally.

17 The provisions of paragraphs 2 and 3 shall not prejudice the legitimate rights and obligations under international law of those small island developing State Members and participating territories in the Convention Area whose current fishing activity for Pacific bluefin tuna is limited, but that have a real interest in fishing for the species, that may wish to develop their own fisheries for Pacific bluefin tuna in the future.

18 The provisions of paragraph 17 shall not provide a basis for an increase in fishing effort by fishing vessels owned or operated by interests outside such developing coastal State, particularly Small Island Developing State Members or participating territories, unless such fishing is conducted in support of efforts by such Members and territories to develop their own domestic fisheries.

19 This CMM replaces CMM 2020-02. On the basis of stock assessment conducted by ISC in 2022, and other pertinent information, this CMM shall be reviewed and may be amended as appropriate in 2022.

Attachment

Development of a Catch Document Scheme for Pacific Bluefin Tuna

Background

At the 1st joint working group meeting between NC and IATTC, held in Fukuoka, Japan from August 29 to September 1, 2016, participants supported to advance the work on the Catch Documentation Scheme (CDS) in the next joint working group meeting, in line with the development of overarching CDS framework by WCPFC and taking into account of the existing CDS by other RFMOs.

1. Objective of the Catch Document Scheme

The objective of CDS is to combat IUU fishing for Pacific Bluefin Tuna (PBF) by providing a means of preventing PBF and its products identified as caught by or originating from IUU fishing activities from moving through the commodity chain and ultimately entering markets.

2. Use of electronic scheme

Whether CDS will be a paper based scheme, an electronic scheme or a gradual transition from a paper based one to an electronic one should be first decided since the requirement of each scheme would be quite different.

3. Basic elements to be included in the draft conservation and management measure (CMM)

It is considered that at least the following elements should be considered in drafting CMM.

(1) Objective
(2) General provision
(3) Definition of terms
(4) Validation authorities and validating process of catch documents and re-export certificates
(5) Verification authorities and verifying process for import and re-import
(6) How to handle PBF caught by artisanal fisheries
(7) How to handle PBF caught by recreational or sport fisheries
(8) Use of tagging as a condition for exemption of validation
(9) Communication between exporting members and importing members
(10) Communication between members and the Secretariat
(11) Role of the Secretariat
(12) Relationship with non-members
(13) Relationship with other CDSs and similar programs
(14) Consideration to developing members
(15) Schedule for introduction
(16) Attachment
    (i) Catch document forms
    (ii) Re-export certificate forms
    (iii) Instruction sheets for how to fill out forms
    (iv) List of data to be extracted and compiled by the Secretariat

4. Work plan

The following schedule may need to be modified, depending on the progress on the WCPFC CDS for tropical tunas.

2017	The joint working group will submit this concept paper to the NC and IATTC for endorsement. NC will send the WCPFC annual meeting the recommendation to endorse the paper.
2018	The joint working group will hold a technical meeting, preferably around its meeting, to materialize the concept paper into a draft CMM. The joint working group will report the progress to the WCPFC via NC and the IATTC, respectively.
2019	The joint working group will hold a second technical meeting to improve the draft CMM. The joint working group will report the progress to the WCPFC via NC and the IATTC, respectively.
20XX	The joint working group will hold a third technical meeting to finalize the draft CMM. Once it is finalized, the joint working group will submit it to the NC and the IATTC for adoption. The NC will send the WCPFC the recommendation to adopt it.

Attachment B

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
Northern Committee
Seventeenth Regular Session
Electronic Meeting
5-7 October 2021

HARVEST STRATEGY FOR PACIFIC BLUEFIN TUNA FISHERIES

Harvest Strategy 2021-XX

Introduction and scope

This harvest strategy has been prepared in accordance with the Commission's Conservation and Management Measure on Establishing a Harvest Strategy for Key Fisheries and Stocks in the Western and Central Pacific Ocean.

Although the provisions of this harvest strategy are expressed in terms of a single stock, they may be applied to multiple stocks as appropriate and as determined by the Northern Committee.

1. Management objectives

The management objectives are, first, to support thriving Pacific bluefin tuna fisheries across the Pacific Ocean while recognizing that the management objectives of the WCPFC are to maintain or restore the stock at levels capable of producing maximum sustainable yield, second, to maintain an equitable balance of fishing privileges among CCMs and, third, to seek cooperation with IATTC to find an equitable balance between the fisheries in the western and central Pacific Ocean (WCPO) and those in the eastern Pacific Ocean (EPO).

2. Reference points

Because steepness in the stock-recruitment relationship is not well known but the key biological and fishery variables are reasonably well estimated[1], the stock of PBF is to be treated as a Level 2 stock under the Commission's hierarchical approach for setting biological limit reference points.

2.1 Rebuilding targets

Initial rebuilding target: The initial rebuilding target for the PBF stock size is the median SSB estimated for the period 1952 through 2014, to be reached by 2024 with at least 60% probability.

Recruitment scenario during initial rebuilding period: The low recruitment scenario (resampling from the relatively low recruitment period (1980-1989)) or the recent recruitment scenario (resampling from the last 10 years), whichever is lower, will be used for the ISC's SSB projections until 2024 or until the SSB reaches the initial rebuilding target, whichever is earlier. The ISC is requested to periodically evaluate whether the recruitment scenario used during the initial rebuilding period is

[1] See the information provided by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (WCPFC-NC9-2013/IP-03) in response to a request made by the Northern Committee at its Eighth Regular Session (Attachment F of the report of NC8).

reasonable given current conditions, and to make recommendations on whether a different scenario should be used. If ISC recommends a different scenario, this will be considered by the NC.

Second rebuilding target: The second rebuilding target for the PBF stock size is 20%$SSB_{F=0}$[2], to be reached by 2034, or 10 years after reaching the initial rebuilding target, whichever is earlier, with at least 60% probability.

However, if: (1) the SSB reaches the initial rebuilding target earlier than 2024; (2) ISC recommends a recruitment scenario lower than the average recruitment scenario; and (3) the SSB projections indicate that the second rebuilding target will not be achieved on this schedule, the deadline for rebuilding may be extended to 2034 at the latest.

Also, if there is a recommendation from the Northern Committee that 20%$SSB_{F=0}$ is not appropriate as the second rebuilding target, taking into account consideration from IATTC, scientific advice from ISC, IATTC or WCPFC SC, and socioeconomic factors, another objective may be established.

Recruitment scenario during second rebuilding period: After the initial rebuilding target is reached and until the second rebuilding target is reached, the recruitment scenario to be used for the SSB projections will tentatively be the average recruitment scenario (resampling from the entire recruitment period).

The ISC is requested to periodically evaluate whether the recruitment scenario used during the second rebuilding period is reasonable given current conditions, and to make recommendations on whether a different scenario should be used. If ISC recommends a different scenario, this will be considered by the NC.

2.2 Development of reference points

The Northern Committee will develop more refined management objectives as well as limit reference point(s) and target reference point(s) through MSE process specified in Section 6.

3. Acceptable levels of risk

Until the stock is rebuilt, the Northern Committee will recommend conservation and management measures as needed to ensure rebuilding in accordance with the probabilities specified in sections 2.1 and 5 for each of the two rebuilding targets.

Once the stock is rebuilt, in accordance with Article 6.1(a) of the Convention, the Northern Committee will recommend conservation and management measures as needed to ensure that any target reference point(s) (once adopted) are achieved on average in the long term, and ensure that the risk of the stock size declining below the B-limit (once adopted) is very low.[3]

4. Monitoring strategy

The ISC will periodically evaluate the stock size and exploitation rate with respect to the established reference points and the report will be presented to the Scientific Committee. Until 2024, while the MSE

[2] $SSB_{F=0}$ is the expected spawning stock biomass under average recruitment conditions without fishing.
[3] WCPFC13 agreed that any risk level greater than 20 percent to be inconsistent with the limit reference point related principles in UNFSA (as references in Article 6 of the Convention) including that the risk of breaching limit reference points be very low.

is being developed (see section 6), the ISC is requested to conduct stock assessments in 2018, 2020 and 2022.

In order to cope with the adverse effects on the rebuilding of the stock due to drastic drops of recruitment: (1) all the available data and information will be reviewed annually, including recruitment data provided by the ISC and in National Reports; and (2) the ISC is requested to conduct in 2019, and periodically thereafter as resources permit and if drops in recruitment are detected, projections to see if any additional measure is necessary to achieve the initial rebuilding target by 2024 with at least 60% probability.

5. Decision rules

Harvest control rules during initial rebuilding period: The interim harvest control rules below will be applied based on the results of stock assessments and SSB projections to be conducted by ISC.

(a) If the SSB projection indicates that the probability of achieving the initial rebuilding target by 2024 is less than 60%, management measures will be modified to increase it to at least 60%. Modification of management measures may be (1) a reduction (in %) in the catch limit for fish smaller than 30 kg (hereinafter called "small fish") or (2) a transfer of part of the catch limit for small fish to the catch limit for fish 30 kg or larger (hereinafter called "large fish"). For this purpose, ISC will be requested, if necessary, to provide different combinations of these two measures so as to achieve 60% probability.

(b) If the SSB projection indicates that the probability of achieving the initial rebuilding target by 2024 is at 75% or larger, the WCPFC may increase their catch limits as long as the probability is maintained at 70% or larger, and the probability of reaching the second rebuilding target by the agreed deadline remains at least 60%. For this purpose, ISC will be requested, if necessary, to provide relevant information on potential catch limit increases.

Harvest control rules during second rebuilding period: The harvest control rules during the second rebuilding period below will be applied based on the results of stock assessments and SSB projections to be conducted by ISC.

(a) If the SSB projection indicates that the probability of achieving the second rebuilding target by 2034 or 10 years after reaching the initial rebuilding target, whichever is earlier, is less than 60%, management measures shall be modified to increase it to at least 60%. For this purpose, the ISC will be requested, if necessary, to provide information on possible management measures to achieve 60% probability.

(b) If the SSB projection indicates that the probability of achieving the second rebuilding target by 2034, or 10 years after reaching the initial rebuilding target, whichever is earlier, is at 75% or larger, fishery controls may be changed, including adjustment of catch limits, as long as the probability is maintained at 70% or larger. For this purpose, ISC will be requested, if necessary, to provide relevant information on potential fishery controls.

(c) Any adjustments to management measures shall be considered in cooperation between the two RFMOs taking into account historical and future projected proportional fishery impacts on SSB between fisheries in the EPO and fisheries in the WCPO. For this purpose, ISC will be requested, if necessary, to provide relevant information, including projected proportional fishery impact of potential management measures changes.

(d) This harvest control rule will be reviewed and modified, as necessary, if depletion estimates across the time-series have been adjusted due to changes in assumptions and/or settings of the stock assessment model.

The Northern Committee will, through MSE development process, develop decision rules related to the limit reference points once adopted including for the case of their being breached.

6. Performance evaluation

Until the stock is rebuilt, the Northern Committee will work with the ISC and the Scientific Committee and consult with the IATTC to identify and evaluate the performance of candidate rebuilding strategies with respect to the rebuilding targets, schedules, and probabilities.

The ISC is requested to start the work to develop a management strategy evaluation (MSE) for Pacific bluefin tuna fisheries in 2019 and have a goal of completing it by 2024.

To support development of the MSE, ISC is encouraged to identify at least two experts and NC members are encouraged to provide additional funds for the ISC's work on the MSE.

The Joint WG will start to discuss in 2018, and aim to finalize no later than 2019, guidelines for the MSE, including at least one candidate long-term target reference point (TRP), two candidate limit reference points (LRPs) and candidate harvest control rules (HCRs), which will be provided to the ISC. Those candidate TRPs, LRPs and HCRs will be tested and changed if appropriate during the MSE development process.

In preparation for the Joint WG meeting in 2019, the ISC is requested to organize workshops in early 2018 and 2019 to support the identification of specific management objectives, including level of risks and timelines. The workshops will include managers, scientists and stakeholders, taking into account any recommendations of the Joint WG, and the number of representatives should be relatively small, as it was for the MSE workshop for North Pacific albacore.

In evaluating the performance of candidate target reference points, limit reference points, and harvest control rules, the Northern Committee, in consultation with the ISC and the Scientific Committee, should consider the following criteria:

1. Probability of achieving each of the rebuilding targets within each of the rebuilding periods (if applicable).
2. Time expected to achieve each of the rebuilding targets (if applicable).
3. Expected annual yield, by fishery.
4. Expected annual fishing effort, by PBF-directed fishery.
5. Inter-annual variability in yield and fishing effort, by fishery.
6. Probabilities of SSB falling below the B-limit and the historical lowest level.
7. Probability of fishing mortality exceeding F_{MSY} or an appropriate proxy, and other relevant benchmarks.
8. Expected proportional fishery impact on SSB, by fishery and by WCPO fisheries and EPO fisheries.

Recognizing that developing the operating model and other aspects of the MSE will take time and additional resources, and might require further dialogue between the Northern Committee, the ISC, and the IATTC, while the MSE is in development the ISC is requested to perform this work using the best means

at its disposal.

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Attachment C

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
Scientific Committee
Sixteenth Regular Session
Electronic Meeting
12 – 19 August 2020

PACIFIC BLUEFIN TUNA STOCK ASSESSMENT
(Refer to Paragraphs 150 – 166 of the SC16 Summary Report for the detailed discussions)

Provision of scientific information

1. ISC presented a working paper *Stock assessment of Pacific Bluefin tuna in the Pacific Ocean in 2020* (SC16-SA-WP-06[2]) and full text for the stock status and management advice are annexed below.

a. Stock status and trends

2. **SC16 noted that the ISC provided the following conclusions on the stock status of Pacific bluefin tuna.**

> The base-case model results show that: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2018); (2) the SSB steadily declined from 1996 to 2010; (3) there has been a slow increase of the stock biomass continues since 2011; (4) total biomass in 2018 exceeded the historical median with an increase in immature fish; and (5) fishing mortality ($F_{\%SPR}$) declined from a level producing about 1% of SPR[3] in 2004-2009 to a level producing 14% of SPR in 2016- 2018 (Table PBF-1). Based on the model diagnostics, the estimated biomass trend for the last 30 years is considered robust although SSB prior to the 1980s is uncertain due to data limitations. The SSB in 2018 was estimated to be around 28,000 mt (Table PBF-1 and Figure PBF-1), which is a 3,000 mt increase from 2016 according to the base-case model. An increase of young fish (0-2 years old) is observed in 2016-2018 (Figure PBF-2), likely resulting from low fishing mortality on those fish (Figure PBF-3) and is expected to accelerate the recovery of SSB in the future.
>
> Historical recruitment estimates have fluctuated since 1952 without an apparent trend. Relatively low recruitment levels estimated in 2010-2014 were of concern in the 2016 assessment. The 2015 recruitment estimate is lower than the historical average while the 2016 recruitment estimate (about 17 million fish) is higher than the historical average (Table PBF-1 and Figure PBF-1). The recruitment estimates for 2017 and 2018, which are based on fewer observations and more uncertain, are below the historical average.

[2] https://www.wcpfc.int/node/46614

[3] SPR (spawning potential ratio) is the ratio of the cumulative spawning biomass that an average recruit is expected to produce over its lifetime when the stock is fished at the current fishing level to the cumulative spawning biomass that could be produced by an average recruit over its lifetime if the stock was unfished. F%SPR: F that produces % of the spawning potential ratio.

Estimated age-specific fishing mortalities (F) on the stock during the periods of 2011-2013 and 2016-2018 compared with 2002-2004 estimates (the reference period for the WCPFC Conservation and Management Measure) are presented in Figure PBF-3. A substantial decrease in estimated F is observed in ages 0-2 in 2016-2018 relative to the previous years. Note that stricter management measures in the WCPFC and IATTC have been in place since 2015.

Figure PBF-5 depicts the historical impacts of the fleets on the PBF stock, showing the estimated biomass when fishing mortality from the respective fleets is zero. Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fishery group targeting small fish (ages 0-1) has had a greater impact and the effect of this group in 2018 was greater than any of the other fishery groups. The impact of the EPO fisheries group was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fisheries group has had a limited effect on the stock throughout the analysis period because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish. There is greater uncertainty regarding discards than other fishery impacts because the impact of discarding is not based on observed data.

3. **SC16 noted the following stock status from ISC:**

The WCPFC and IATTC adopted an initial rebuilding biomass target (the median SSB estimated for the period from 1952 through 2014) and a second rebuilding biomass target (20%$SSB_{F=0}$ under average recruitment), without specifying a fishing mortality reference level. The 2020 assessment estimated the initial rebuilding biomass target ($SSB_{MED1952-2014}$) to be 6.4%$SSB_{F=0}$ and the corresponding fishing mortality expressed as $F_{6.4\%SPR}$. The Kobe plot shows that the point estimate of the SSB_{2018} was 4.5%$SSB_{F=0}$ and the recent (2016-2018) fishing mortality corresponds to $F_{14\%SPR}$ (Table PBF-1 and Figure PBF-4). Although no reference points have been adopted to evaluate the status of PBF, an evaluation of stock status against some common reference points (Table PBF-2) shows that the stock is overfished relative to biomass-based limit reference points adopted for other species in WCPFC (20%$SSB_{F=0}$) and fishing mortality has declined but not reached the level corresponding to that reference point ($F_{20\%SPR}$).

The PBF spawning stock biomass (SSB) has gradually increased in the last 8 years (2011-2018). Young fish (age 0-2) shows a more rapid increase in recent years (Figure PBF-1 and PBF-2). These changes in biomass coincide with a decline in fishing mortality over the last decade (Figure PBF-3). Based on these findings, the following information on the status of the Pacific bluefin tuna stock is provided:

1. **The latest (2018) SSB is estimated to be 4.5% of $SSB_{F=0}$ which is increased from 4.0% in 2016 (Figure PBF-4 and Table PBF-1). No biomass-based limit or target reference points have been adopted for PBF. However, the PBF stock is overfished relative to the potential biomass-based reference points (SSB_{MED} and 20%$SSB_{F=0}$) adopted for other tuna species by the IATTC and WCPFC.**
2. **The recent (2016-2018) $F_{\%SPR}$ is estimated to produce 14%SPR (Figure PBF-4 and Table PBF-2). Although no fishing mortality-based limit or target reference points have been adopted for PBF by the IATTC and WCPFC, recent fishing mortality is above the level producing 20%SPR. However, the stock is subject to rebuilding measures including catch limits and the capacity of the stock to rebuild is not compromised, as shown by the projection results.**

4. **In addition, SC16 noted that, although the WCPFC has not established any reference points for PBF, recent fishing mortality is above the level producing 20%SPR, which is the second rebuilding target established by the WCPFC indicating that overfishing is taking place relative to the possible reference point of 20%SPR and some of the other commonly used F-related reference points. SC16 also noted that the projection results, while projected from a single base case model, estimate that the stock may continue to rebuild.**

5. **SC16 noted that regarding the probability of meeting the rebuilding targets, the approach taken in this assessment is not based on the structural uncertainty grid approach used to characterize uncertainty in the assessment of other stocks in the WCPO. The majority of CCMs recommend that such an approach is adopted in future, especially when using these models to drive management action.**

6. **However, ISC currently does not see the need for structural uncertainty grid because of internally consistency of the assessment model of PBF.**

b. ***Management advice and implications***

7. **SC16 noted that the improved recruitment in 2016, relative to recent years, noted by SC14 in the previous assessment has now been followed by two much lower recruitments. Apart from the low recruitment in 2014 these estimated recruitments for 2017 and 2018 are the lowest since the early 1990s, while noting that the recruitment in these years is uncertain. The majority of CCMs noted that, given ongoing uncertainty in the stock-recruitment relationship and the very low levels of current spawning biomass estimated by this assessment (4.5%), future recruitments may remain low until there is sufficient recovery in spawning biomass. Indeed, the increase seen in young fish in recent years may be transient unless followed up with a series of higher recruitments.**

8. **While SC16 recognized the existence of an interim Harvest Strategy for this stock, noting ongoing concerns of low stock size, the current level of overfishing relative to the possible reference point of 20%SPR and some of the other commonly used F-related reference points, and uncertain future recruitments, the majority of CCMs reiterate their advice from SC14 and urge the Commission to take a precautionary approach to the management of Pacific Bluefin tuna, especially in relation to the timing of increasing catch levels, until the rebuilding of the stock to higher biomass levels is achieved.**

9. **SC16 also noted the following conservation information from ISC:**

> After the steady decline in SSB from 1995 to the historically low level in 2010, the PBF stock has started recovering slowly, consistent with the management measures implemented in 2014-2015. The spawning stock biomass in 2018 was below the two biomass rebuilding targets adopted by the WCPFC while the 2016-18 fishing mortality ($F_{\%SPR}$) has reduced to a level producing 14%SPR.
> The projection results based on the base-case model under several harvest and recruitment scenarios and time schedules requested by the RFMOs are shown in Tables PBF3 and PBF4. The projection results show that PBF SSB recovers to the biomass-based rebuilding targets due to reduced fishing mortality by applying catch limits as the stock increases (Figure PBF-6). In most of the scenarios, the SSB biomass is projected to recover to the initial rebuilding target (SSB_{MED}) in the fishing year 2020 (April of 2021) with a probability above the 60% level prescribed in the WCPFC CMM 2019-02 (Table PBF-4).

A Kobe chart and impacts by fleets estimated from future projections under the current management scheme are provided for information, (Figures PBF6 and PBF7, respectively). Because the projections include catch limits, fishing mortality ($F_{x\%SPR}$) is expected to decline, i.e., SPR will increase, as biomass increases. Further stratification of future impacts is possible if the allocation of increased catch limits among fleets/countries is specified.

Based on these findings, the following conservation information is provided:

1. **Under all examined scenarios the initial goal of WCPFC and IATTC, rebuilding to SSB_{MED} by 2024 with at least 60% probability, is reached and the risk of SSB falling below historical lowest observed SSB at least once in 10 years is negligible.**
2. **The projection results assume that the CMMs are fully implemented and are based on certain biological and other assumptions. For example, these future projection results do not contain assumptions about discard mortality. Although the impact of discards on SSB is small compared to other fisheries (Figure PBF-7), discards should be considered in the harvest scenarios.**
3. **Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment has on stock biomass, monitoring recruitment and SSB should continue so that the recruitment level can be understood in a timely manner.**

Table PBF-1. Total biomass, spawning stock biomass, recruitment, and spawning potential ratio of Pacific bluefin tuna (*Thunnus orientalis*) estimated by the base-case model, 1952-2018.

Fishing Year	Total Biomass (t)	Spawning Stock Biomass (t)	Recruitment (1,000 fish)	Spawning Potential Ratio
1952	134,751	103,502	4,857	0.11
1953	136,428	97,941	20,954	0.13
1954	146,741	87,974	34,813	0.08
1955	156,398	75,360	13,442	0.11
1956	175,824	67,700	33,582	0.16
1957	193,597	76,817	11,690	0.11
1958	201,937	100,683	3,195	0.19
1959	209,300	136,430	7,758	0.23
1960	202,121	144,411	7,731	0.17
1961	193,546	156,302	23,339	0.03
1962	176,618	141,277	10,737	0.11
1963	165,892	120,244	28,112	0.07
1964	154,192	105,870	5,696	0.07
1965	142,548	93,222	10,710	0.03
1966	119,683	89,236	8,680	0.00
1967	105,084	83,208	10,897	0.01
1968	91,408	77,466	14,535	0.01
1969	80,523	64,299	6,484	0.09
1970	74,222	53,961	7,027	0.03
1971	66,114	46,839	12,420	0.01
1972	64,114	40,447	23,552	0.00
1973	63,023	35,273	10,968	0.06
1974	64,885	28,502	13,322	0.06
1975	65,074	26,410	11,252	0.08
1976	64,512	29,274	9,253	0.03
1977	74,670	35,105	25,601	0.04
1978	76,601	32,219	14,037	0.06
1979	73,615	27,093	12,650	0.08
1980	72,809	29,657	6,910	0.05
1981	57,482	27,928	13,340	0.00
1982	40,398	24,240	6,512	0.00
1983	33,210	14,456	10,133	0.06
1984	37,464	12,651	9,184	0.05
1985	39,591	12,817	9,676	0.03
1986	34,349	15,147	8,181	0.01
1987	32,008	13,958	6,026	0.08
1988	38,086	14,931	9,304	0.11
1989	41,849	14,839	4,409	0.14
1990	58,122	18,953	18,096	0.18
1991	69,351	25,294	10,392	0.10
1992	76,228	32,252	3,958	0.15
1993	83,624	43,639	4,450	0.16
1994	97,731	50,277	29,314	0.14
1995	94,279	62,784	16,533	0.05
1996	96,463	61,826	17,787	0.09
1997	90,349	56,393	11,259	0.06
1998	95,977	55,888	16,018	0.04
1999	92,232	51,705	22,842	0.04
2000	76,795	48,936	14,383	0.02
2001	78,052	46,408	17,384	0.10
2002	76,110	44,492	13,761	0.06
2003	68,707	43,806	7,110	0.02
2004	66,433	36,701	27,930	0.01
2005	55,778	30,004	15,256	0.01
2006	43,912	24,089	13,660	0.01
2007	43,765	19,061	23,146	0.00
2008	39,646	14,805	21,265	0.01
2009	35,135	11,422	8,002	0.01
2010	38,053	10,837	18,230	0.02
2011	38,901	12,096	12,574	0.05
2012	41,058	14,578	6,845	0.07
2013	49,383	16,703	12,798	0.05
2014	47,864	18,503	3,783	0.09
2015	52,725	21,014	8,778	0.10
2016	62,069	25,009	16,504	0.10
2017	71,228	25,632	6,663	0.17
2018	82,212	28,228	4,658	0.15
Median (1952-2018)	73,615	35,273	11,259	0.06
Average(1952-2018)	86,908	49,388	13,199	0.07

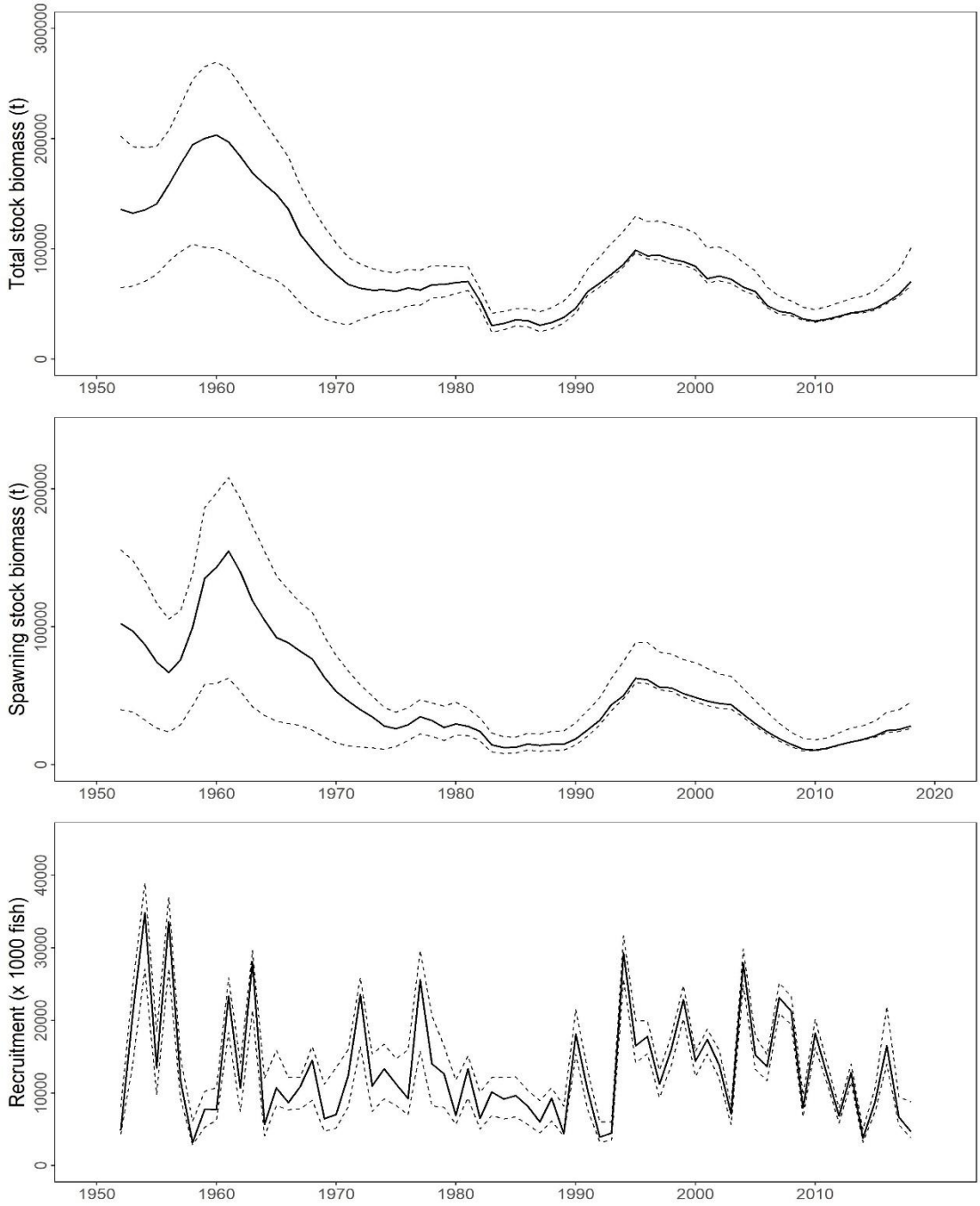

Figure PBF-1. Total stock biomass (top), spawning stock biomass (middle), and recruitment (bottom) of Pacific bluefin tuna (*Thunnus orientalis*) (1952-2018) estimated from the base-case model. The solid line is the point estimate and dashed lines delineate the 90% confidence interval.

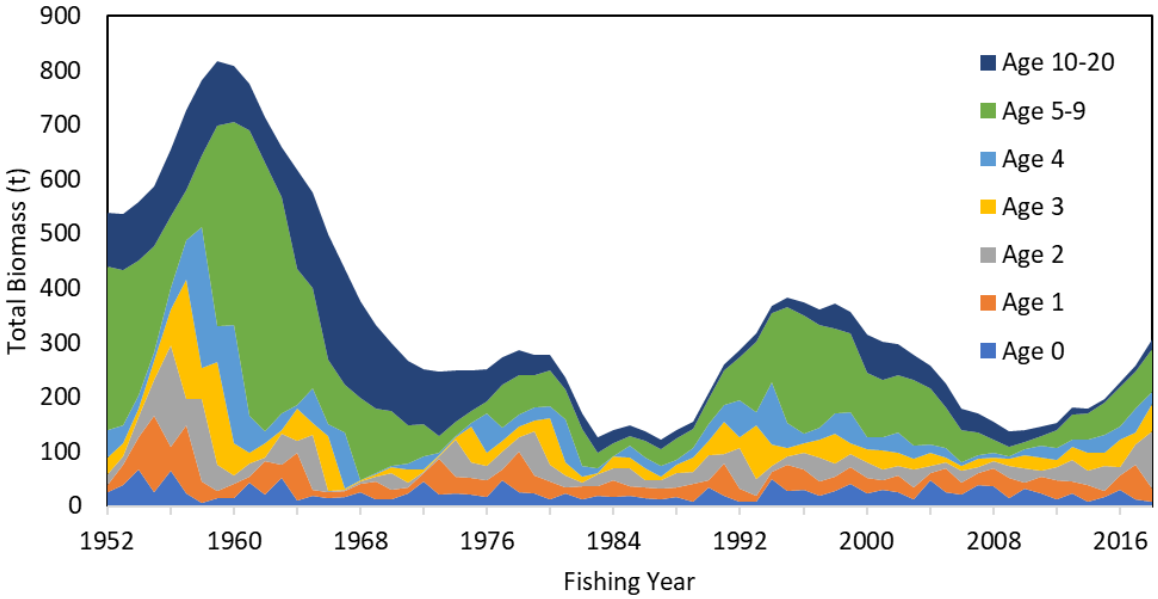

Figure PBF-2. Total biomass (tonnes) by age of Pacific bluefin tuna (*Thunnus orientalis*) estimated from the base-case model (1952-2018).

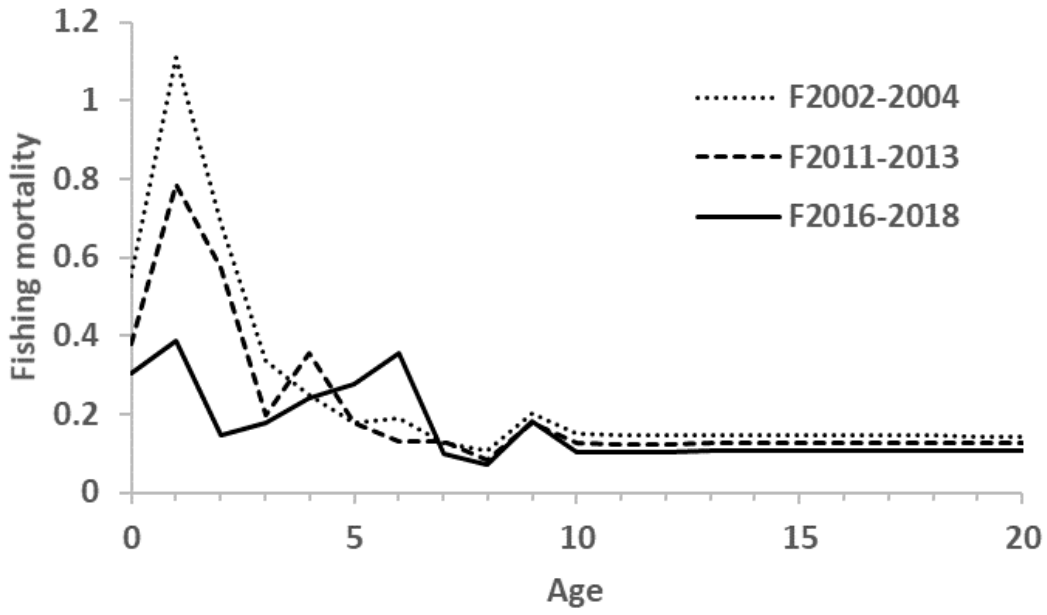

Figure PBF-3. Geometric means of annual age-specific fishing mortalities (F) of Pacific bluefin tuna (*Thunnus orientalis*) for 2002-2004 (dotted line), 2011-2013 (broken line) and 2016-2018 (solid line).

Table PBF-2. Ratios of the estimated fishing mortalities (Fs and 1-SPRs for 2002-04, 2011-13, 2016-18) relative to potential fishing mortality-based reference points, and terminal year SSB (t) for each reference period, and depletion ratios for the terminal year of the reference period for Pacific bluefin tuna (*Thunnus orientalis*) from the base-case model**.** F_{max}: Fishing mortality (F) that maximizes equilibrium yield per recruit (Y/R). $F_{0.1}$: F at which the slope of the Y/R curve is 10% of the value at its origin. F_{med}: F corresponding to the inverse of the median of the observed R/SSB ratio. $F_{xx\%SPR}$: F that produces given % of the unfished spawning potential (biomass) under equilibrium condition.

Reference period	F_{max}	$F_{0.1}$	F_{med}	(1-SPR)/(1-SPRxx%)				Estimated SSB for terminal year of each period (ton)	Depletion rate for terminal year of each period (%)
				SPR10%	SPR20%	SPR30%	SPR40%		
2002-2004	1.92	2.84	1.14	1.08	1.21	1.38	1.61	36,701	5.80
2011-2013	1.54	2.26	0.89	1.05	1.18	1.35	1.57	16,703	2.64
2016-2018	1.14	1.65	0.57	0.95	1.07	1.23	1.43	28,228	4.46

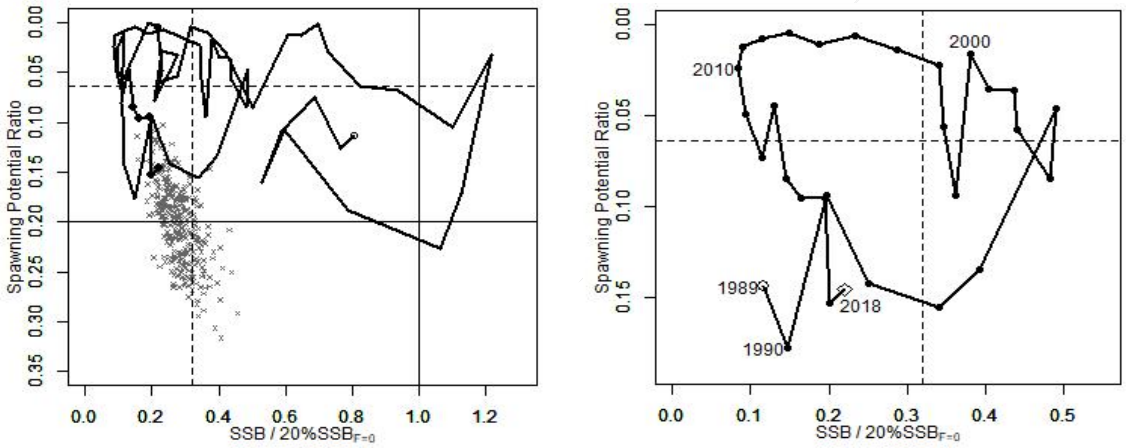

Figure PBF-4. Kobe plots for Pacific bluefin tuna (*Thunnus orientalis*) estimated from the base-case model. The X-axis shows the annual SSB relative to 20%$SSB_{F=0}$ and the Y-axis shows the spawning potential ratio (SPR) as a measure of fishing mortality. Vertical and horizontal solid lines in the left figure show 20%$SSB_{F=0}$ (which corresponds to the second biomass rebuilding target) and the corresponding fishing mortality that produces SPR, respectively. Vertical and horizontal broken lines in both figures show the initial biomass rebuilding target (SSB_{MED} = 6.4%$SSB_{F=0}$) and the corresponding fishing mortality that produces SPR, respectively. SSB_{MED} is calculated as the median of estimated SSB over 1952-2014. The left figure shows the historical trajectory, where the open circle indicates the first year of the assessment (1952), solid circles indicate the last five years of the assessment (2014-2018), and grey crosses indicate the uncertainty of the terminal year estimated by bootstrapping. The right figure shows the trajectory of the last 30 years.

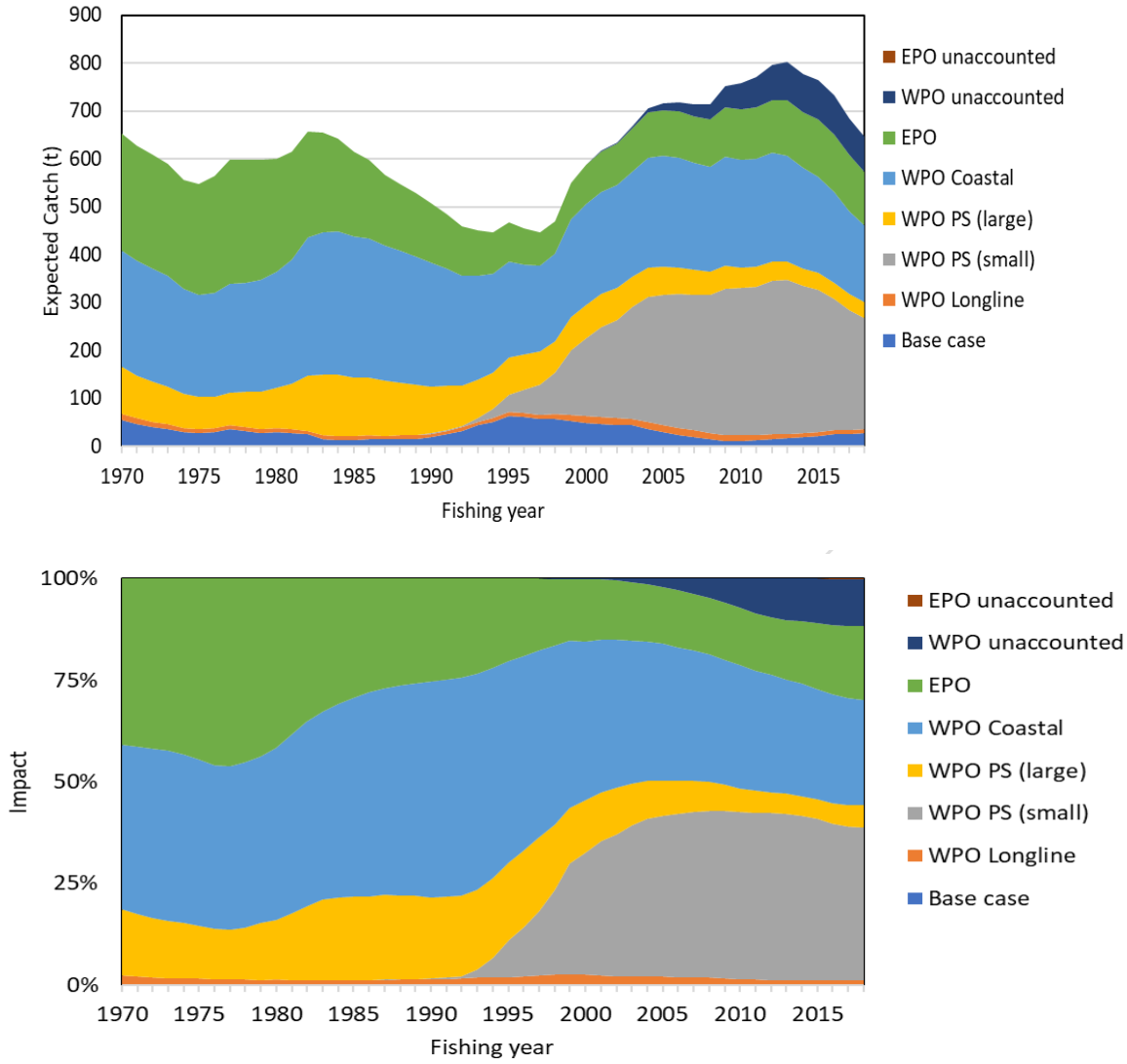

Figure PBF-5. The trajectory of the spawning stock biomass of a simulated population of Pacific bluefin tuna (*Thunnus orientalis*) when zero fishing mortality is assumed, estimated by the base-case model. (top: absolute SSB, bottom: relative SSB). Fisheries group definition; WPO longline fisheries: F1, F12, F17, 23. WPO purse seine fisheries for small fish: F2, F3, F18, F20. WPO purse seine fisheries for large fish: F4, F5. WPO coastal fisheries: F6-11, F16, F19. EPO fisheries: F13, F14, F15, F24. WPO unaccounted fisheries: F21, 22. EPO unaccounted fisheries: F25. For exact fleet definitions, please see the 2020 PBF stock assessment report on the ISC website.

Table PBF-3. Future projection scenarios for Pacific bluefin tuna (*Thunnus orientalis*) and their probability of achieving various target levels by various time schedules based on the base-case model.

scenario #	Upper Limit increase				Probability of SSB is below the Initial rebuilding target at 2024 in case the low recruitment continue	The fishing year expected to achieve the initial rebuilding target with >60% probability	The fishing year expected to achieve the 2nd rebuilding target with >60% probability	Probability of achiving the initial rebuilding target at 2024	Probability of achiving the second rebuilding target at 2034	Probability of SSB falling below the historical lowest at any time during the projection period.	Probability of Catch falling below the historical lowest at any time during the projection period.	Median SSB at 2024	Median SSB at 2034
	WCPO		EPO										
	Small	Large	Small	Large									
1	0%				0%	2020	2026	100%	99%	0%	100%	107,098	286,958
2	0%				0%	2020	2026	100%	99%	0%	100%	104,973	287,020
3	5%				0%	2020	2027	100%	98%	0%	100%	99,968	272,814
4	10%				0%	2020	2027	100%	96%	0%	100%	95,096	258,850
5	15%				0%	2020	2028	99%	94%	0%	100%	90,293	244,959
6	20%				0%	2020	2028	99%	91%	0%	100%	85,618	231,003
7	0%	500	500		0%	2020	2027	100%	98%	0%	100%	99,903	277,396
8	250	250	500		0%	2020	2027	100%	97%	0%	100%	98,164	268,473
9	0	600	400		0%	2020	2027	100%	98%	0%	100%	100,035	278,004
10	5%	1300	700		0%	2020	2027	99%	96%	0%	100%	92,504	259,802
11	10%	1300	700		0%	2020	2027	99%	95%	0%	100%	89,951	249,996
12	5%	1000	500		0%	2020	2027	100%	97%	0%	100%	94,952	264,218
13	0	1650	660		0%	2020	2027	99%	97%	0%	100%	93,897	267,976
14	125	375	550		0%	2020	2027	100%	98%	0%	100%	98,729	272,323
15	0	0	0		0%	2019	2022	100%	100%	0%	100%	221,391	560,259

* The numbering of Scenarios is different from those given by the IATTC-WCPFC NC Joint WG meeting and same as Table 3.

* Recruitment is switched from low recruitment during 1980-1989 to average recruitment over the whole assessment period in the following year of achieving the initial rebuilding target.

Table PBF-4. Expected yield for Pacific bluefin tuna (*Thunnus orientalis*) under various harvesting scenarios based on the base-case model.

scenario #	Upper Limit increase				Median SSB at 2024	Median SSB at 2034	Expected annual yield in 2019, by area and size category (t)				Expected annual yield in 2024, by area and size category (t)				Expected annual yield in 2034, by area and size category (t)			
	WPO		EPO				WPO		EPO		WPO		EPO		WPO		EPO	
	Small	Large	Small	Large			Small	Large	Commercial	Sport	Small	Large	Commercial	Sport	Small	Large	Commercial	Sport
1	0%				107,098	286,958	4,396	5,444	3,310	508	4,583	6,739	3,315	800	4,499	6,871	3,321	1,167
2	0%				104,973	287,020	4,396	6,924	3,541	504	4,580	6,771	3,724	799	4,495	6,851	3,746	1,168
3	5%				99,968	272,814	4,614	7,260	3,468	501	4,809	7,101	3,468	767	4,720	7,187	3,465	1,130
4	10%				95,096	258,850	4,833	7,590	3,633	499	5,038	7,433	3,634	737	4,945	7,523	3,630	1,091
5	15%				90,293	244,959	5,052	7,914	3,797	496	5,267	7,764	3,798	708	5,171	7,859	3,794	1,053
6	20%				85,618	231,003	5,269	8,223	3,964	494	5,493	8,093	3,963	680	5,394	8,195	3,960	1,014
7	0%	500	500		99,903	277,396	4,396	7,411	3,802	500	4,583	7,269	3,803	781	4,497	7,349	3,800	1,150
8	250	250	500		98,164	268,473	4,640	7,172	3,802	499	4,824	7,017	3,802	756	4,734	7,105	3,800	1,118
9	0	600	400		100,035	278,004	4,396	7,506	3,701	501	4,583	7,370	3,703	783	4,496	7,449	3,699	1,152
10	5%	1300	700		92,504	259,802	4,627	8,153	4,003	497	4,814	8,073	4,005	745	4,723	8,156	4,000	1,107
11	10%	1300	700		89,951	249,996	4,858	8,157	4,003	495	5,042	8,074	4,004	721	4,947	8,163	4,000	1,076
12	5%	1000	500		94,952	264,218	4,627	7,881	3,803	498	4,813	7,773	3,805	753	4,722	7,857	3,800	1,115
13	0	1650	660		93,897	267,976	4,396	8,444	3,963	498	4,587	8,426	3,967	769	4,498	8,501	3,960	1,138
14	125	375	550		98,729	272,323	4,517	7,291	3,852	499	4,703	7,142	3,853	767	4,614	7,226	3,850	1,132
15	0%	0%	0		221,391	560,259	0	0	0	0	0	0	0	0	0	0	0	0

* Catch limits for EPO commercial fisheries are applied for the catch of both small and large fish made by the fleets.

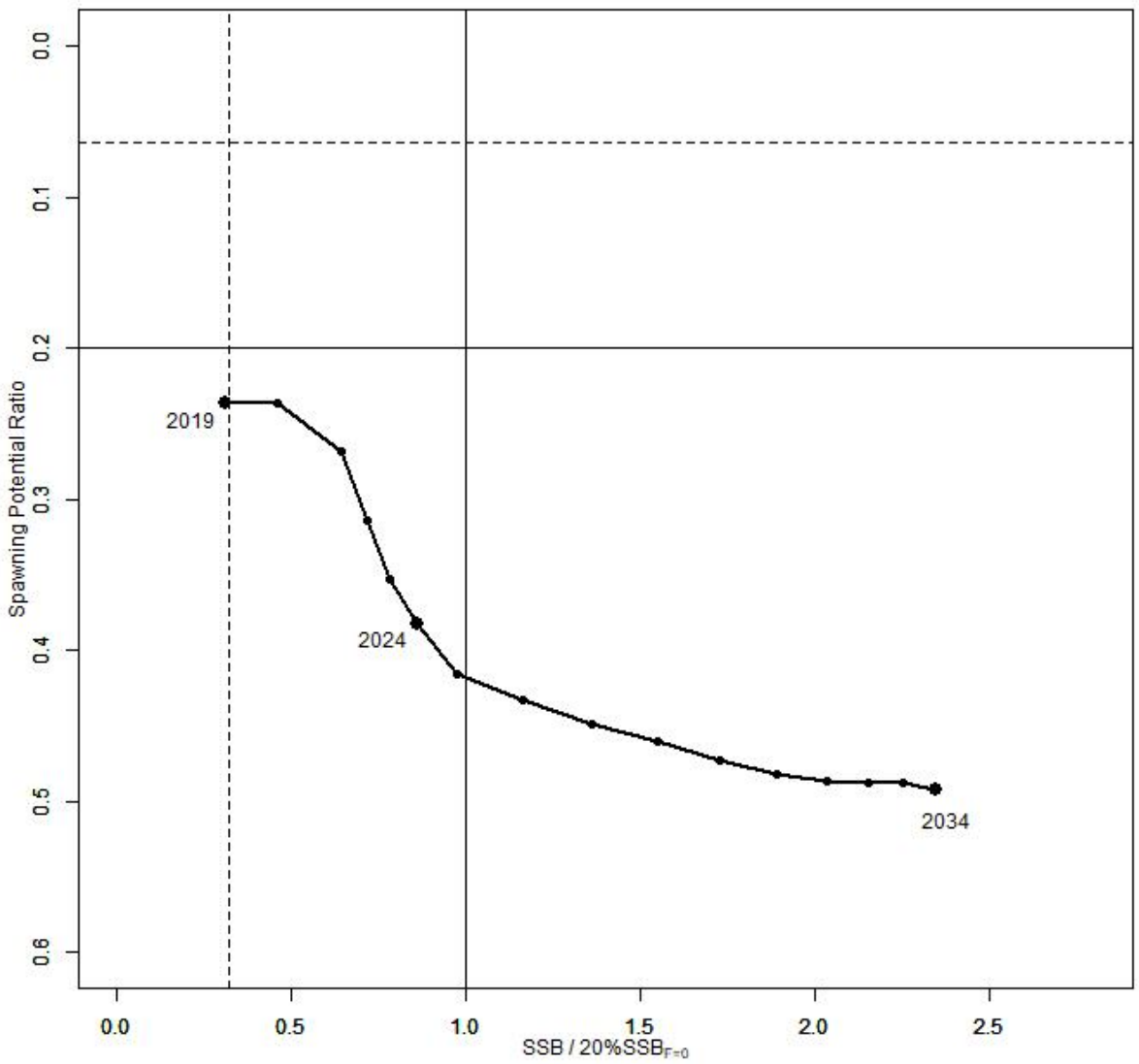

Figure PBF-6. "Future Kobe Plot" of projection results for Pacific bluefin tuna (*Thunnus orientalis*) from Scenario 1 from Table PBF-3.

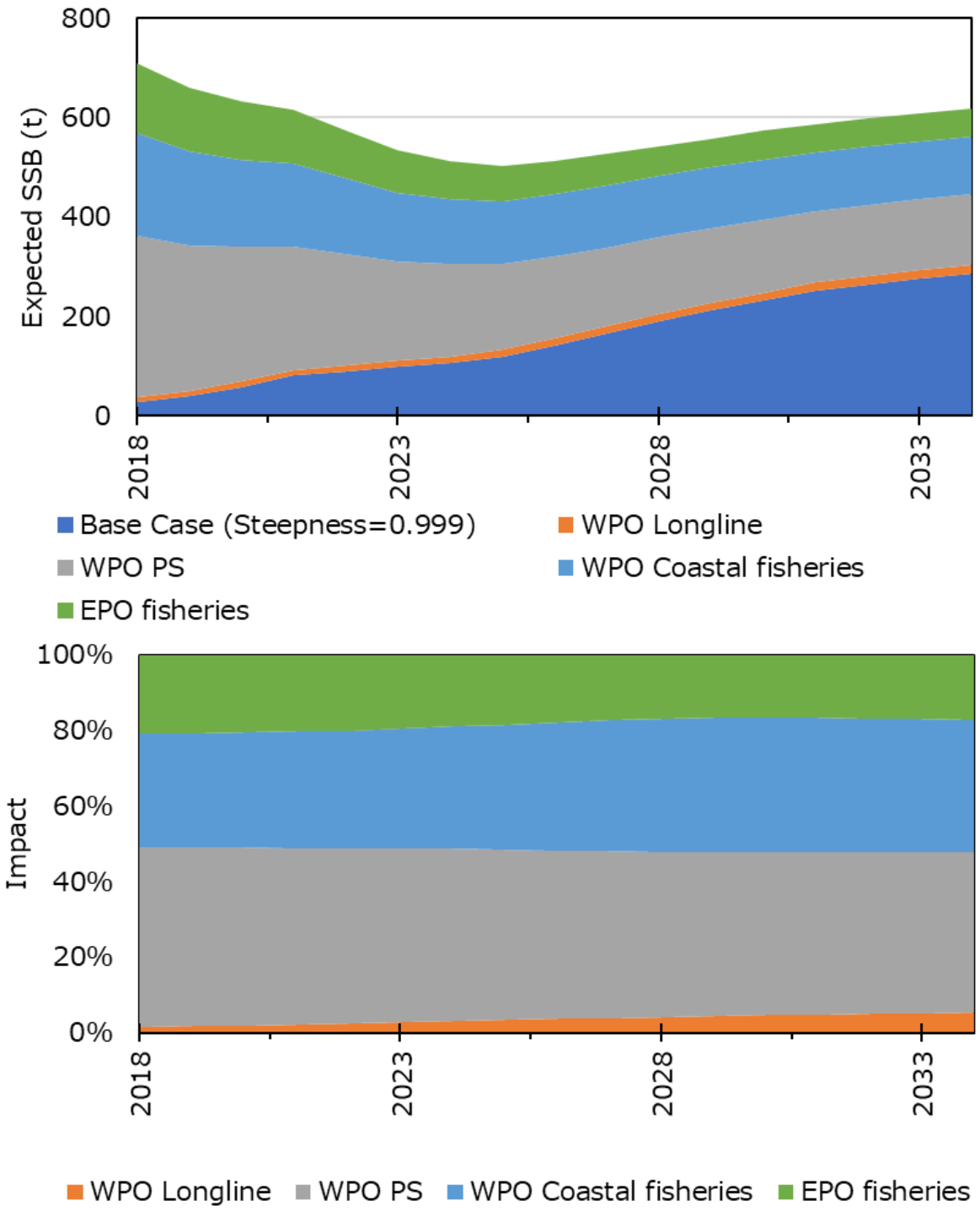

Figure PBF-7. "Future impact plot" from projection results for Pacific bluefin tuna (*Thunnus orientalis*) from Scenario 1 of Table S-3. The impact is calculated based on the expected increase of SSB in the absence of the respective group of fisheries.

Attachment D

The Commission for the Conservation and Management of
Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
Northern Committee
Seventeenth Regular Session
Electronic Meeting
5-7 October 2021

NC17 REQUESTS TO THE ISC

1. The Northern Committee (NC) requests the ISC to perform projections based on the new stock assessment and on catch increases agreed to at the 6th Meeting of the Joint Working Group and the revised conservation and management measures adopted in WCPFC and IATTC meetings in 2021 and to provide the proportionate fishery impact of WCPO fisheries and EPO fisheries on SSB over the projection period. Additionally, NC requests that the ISC provide projections of the scenarios in the **Appendix** as well as projections with at least one scenario that achieve

   a. Effort and catch limits for EPO and WCPO that would satisfy the rebuilding objective and by 2034, or 10 years after reaching the initial rebuilding target, whichever is earlier achieve a proportional fishery impact on SSB of approximately 75% from WCPO fisheries and 25% from EPO fisheries or
   b. Effort and catch limits for EPO and WCPO that would satisfy the rebuilding objective and by 2034, or 10 years after reaching the initial rebuilding target, whichever is earlier achieve a proportional fishery impact on SSB of approximately 80% from WCPO fisheries and 20% from EPO fisheries.

The NC does not recommend the ISC perform projections of the scenarios performed in the 2020 stock assessment.

2. The NC reiterates to the ISC the standing request in the current harvest strategy that "[t]he ISC...periodically evaluate whether the recruitment scenario used during the second rebuilding period is reasonable given current conditions, and to make recommendations on whether a different recruitment scenario should be used." In 2022 and with each benchmark or update stock assessment thereafter, the NC requests the ISC to conduct such an evaluation and make recommendations on whether a different recruitment scenario should be used. If the ISC recommends alternative recruitment scenarios, then they should be included as projection runs in the benchmark or update stock assessment.

3. The NC requests that the ISC analyze in the projections the impacts of a transfer of 10% for Japan and 25% for Korea of small fish limit to large fish limit using a conversion factor of 0.68:1 small:large.

Appendix: Scenarios for catch increase

West Pacific		East Pacific
Small fish	Large fish	
0	500t	500t
10%		10%
20%		20%