JOINT IATTC AND WCPFC-NC WORKING GROUP MEETING ON THE MANAGEMENT OF PACIFIC BLUEFIN TUNA
SIXTH SESSION (JWG-06)

ELECTRONIC MEETING
8am-11am, Japan Standard Time
27-29 July 2021

Report of the 21st Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

IATTC-NC-JWG06-2021/IP-01

ISC[1]

[1] International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

REPORT OF THE TWENTY-FIRST MEETING OF THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

PLENARY SESSION

12-15 and 19 July 2021
Virtual Meeting

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

ACRONYMS AND ABBERVIATIONS

Names and FAO Codes of ISC Species of Interest in the North Pacific Ocean

FAO Code	Common English Name	Scientific Name
	TUNAS	
ALB	Albacore	*Thunnus alalunga*
BET	Bigeye tuna	*Thunnus obesus*
PBF	Pacific Bluefin tuna	*Thunnus orientalis*
SKJ	Skipjack tuna	*Katsuwonus pelamis*
YFT	Yellowfin tuna	*Thunnus albacares*
	BILLFISHES	
BIL	Other billfish	Family *Istiophoridae*
BLM	Black marlin	*Makaira indica*
BUM	Blue marlin	*Makaira nigricans*
MLS	Striped marlin	*Kajikia audax*
SFA	Sailfish	*Istiophorus platypterus*
SSP	Shortbill spearfish	*Tetrapturus angustirostris*
SWO	Swordfish	*Xiphias gladius*
	SHARKS	
ALV	Common thresher shark	*Alopias vulpinus*
BSH	Blue shark	*Prionace glauca*
BTH	Bigeye thresher shark	*Alopias superciliosus*
FAL	Silky shark	*Carcharhinus falciformis*
LMA	Longfin mako	*Isurus paucus*
LMD	Salmon shark	*Lamna ditropis*
OCS	Oceanic whitetip shark	*Carcharhinus longimanus*
PSK	Crocodile shark	*Pseudocarcharias kamonharai*
PTH	Pelagic thresher shark	*Alopias pelagicus*
SMA	Shortfin mako shark	*Isurus oxyrinchus*
SPN	Hammerhead spp.	*Sphyrna* spp.

ISC Working Groups

Acronym	Name	Chair
ALBWG	Albacore Working Group	Sarah Hawkshaw (Canada)
BILLWG	Billfish Working Group	Hirotaka Ijima (Japan)
PBFWG	Pacific Bluefin Working Group	Shuya Nakatsuka (Japan)
SHARKWG	Shark Working Group	Mikihiko Kai (Japan)
STATWG	Statistics Working Group	Felipe Carvalho (U.S.A)

Other Abbreviations and Acronyms that may be Used in the Report

CDS	Catch documentation scheme
CIE	Center for Independent Experts
CKMR	Close-kin mark-recapture
CMM	Conservation and Management Measure
CPFV	Charter passenger fishing vessel
CPUE	Catch-per-unit-of-effort
CSIRO	Commonwealth Scientific and Industrial Research Organization
DWLL	Distant-water longline
DWPS	Distant-water purse seine
EEZ	Exclusive economic zone
EPO	Eastern Pacific Ocean
F	Fishing mortality rate
$F_{x\%}$	Fishing mortality that produces x% of the spawning potential ratio, SPR
FAD	Fish aggregation device
FAO	Fisheries and Agriculture Organization of the United Nations
FL	Fork length
HCR	Harvest control rule
HMS	Highly migratory species
H_{MSY}	Harvest rate at MSY
IATTC	Inter-American Tropical Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean
ISSF	International Seafood Sustainability Foundation
LFSR	Low fecundity spawner recruitment relationship
LTLL	Large-scale tuna longline
LRP	Limit reference point
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
NC	Northern Committee (WCPFC)
NRIFSF	National Research Institute of Far Seas Fisheries (Japan)
OFDC	Overseas Fisheries Development Council (Chinese Taipei)
PICES	North Pacific Marine Science Organization
PIFSC	Pacific Islands Fisheries Science Center (U.S.A.)
SAC	Scientific Advisory Committee (IATTC)
SC	Scientific Committee (WCPFC)
SG-SCISC	Study Group on Scientific Cooperation of ISC and PICES
SPC-OFP	Oceanic Fisheries Programme, Secretariat of the Pacific Community
SPR	Spawning potential ratio, spawner per recruit
SSB	Spawning stock biomass
$SSB_{F=0}$	Spawning stock biomass at a hypothetical unfished level
$SSB_{CURRENT}$	Current spawning stock biomass
SSB_{MSY}	Spawning stock biomass at maximum sustainable yield
STLL	Small-scale tuna longline

t, mt	Metric tons, tonnes
WCNPO	Western Central and North Pacific Ocean
WCPFC	Western and Central Pacific Fisheries Commission
WPO	Western Pacific Ocean
WWF	World Wildlife Fund for Nature - Japan
GRT	Gross registered tons

REPORT OF THE TWENTY-FIRST MEETING OF THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

PLENARY SESSION

12/13-15/16 and 19/20 July 2021

Highlights of the ISC21 Plenary Meeting

The 21st ISC Plenary, held as a virtual meeting, July 12-15 and 19, 2021 (Pacific Daylight Time) was attended by Members from Canada, Chinese Taipei, Japan, Republic of Korea, Mexico and the United States as well as the Inter-American Tropical Tuna Commission and Western and Central Pacific Fisheries Commission representatives. Observers from Monterey Bay Aquarium/Duke University, Pew Charitable Trusts, Western Fishboat Owners' Association, and the Western Pacific Fisheries Management Council, World Wildlife Fund-Japan, and Wild Oceans also attended the ISC21 Plenary session. The Plenary reviewed results, conclusions, new data, and updated analyses of the Billfish, Albacore, Shark, and Pacific Bluefin Tuna working groups. The Plenary endorsed the Pacific Blue Marlin (BUM) stock assessment and considers it to be the best available scientific information on this stock. Although reference points have not been established for the BUM stock, the stock is very likely (>90%) not overfished and overfishing is very likely (>90%) not occurring relative MSY-based reference points. An indicator analysis was conducted for North Pacific Shortfin Mako Shark (SMA) based on trends in catches and abundance indices supplemented by size frequency data because of the long period between benchmark stock assessments. The Plenary endorsed the conclusion that there were no obvious signs of shifts in abundance or fishery dynamics and the conclusion that a change in the date for the next benchmark stock assessment of SMA in 2024 was not warranted. The Plenary endorsed the BILLWG recommendation to expedite the next WCNPO MLS assessment for completion in 2022 and the responses prepared by the BILLWG to questions posed by WCPFC17 regarding discrepancies in catches of Western and Central Pacific Ocean Striped Marlin (MLS) stock. The Plenary revised the conservation information for WCNPO MLS with additional information related to updating the rebuilding plan with the most recent scientific information produced by the expedited benchmark assessment in 2022 and some remarks regarding the rebuilding target definition. The Plenary re-iterated stock status and conservation information provided at ISC20 for North Pacific Albacore (NPALB), Pacific Bluefin Tuna (PBF), WCNPO Swordfish (SWO), Eastern Pacific Ocean Swordfish (EPO SWO), Pacific Blue Marlin (BUM), North Pacific Blue Shark (BSH), and North Pacific Shortfin Mako Shark (SMA). The ISC work plan for 2021-22 includes benchmark stock assessments of MLS and BSH, an update assessment for PBF, advancing biological sampling for billfish and shark species, engaging the IATTC and WCPFC-NC on a PBF MSE process, reviewing the ISC Operations Manual to improve accountability and transparency, and continued implementation of enhancements to database and website management. Sarah Hawkshaw (CAN) was elected Chair of the ALBWG and Felipe Carvalho (USA) was elected Chair of the STATWG. Mikihiko Kai (JPN) and Michael Kinney (USA) were reelected to their second 3-yr term as Chair and Vice-Chair, respectively, of the SHARKWG. The next ISC Plenary will be hosted by the United States of America in Kona, Hawai'i, July 12-18, 2022.

1 INTRODUCTION AND OPENING OF THE MEETING

1.1 Introduction

The ISC was established in 1995 through an intergovernmental agreement between Japan and the United States (U.S.A.). Since its establishment and first meeting in 1996, the ISC has undergone a number of changes to its charter and name (from the Interim Scientific Committee to the International Scientific Committee) and has adopted a number of guidelines for its operations. The two main goals of the ISC are (1) to enhance scientific research and cooperation for conservation and rational utilization of the species of tuna and tuna-like fishes that inhabit the North Pacific Ocean during a part or all of their life cycle; and (2) to establish the scientific groundwork for the conservation and rational utilization of these species in this region. The ISC is made up of voting Members from coastal states and fishing entities of the region as well as coastal states and fishing entities with vessels fishing for highly migratory species in the region, and non-voting Members from relevant intergovernmental fishery and marine science organizations, recognized by all voting Members.

The ISC provides scientific advice on the stocks and fisheries of tuna and tuna-like species in the North Pacific Ocean to the Member governments and regional fisheries management organizations. Fishery data tabulated by ISC Members and peer-reviewed by the species and Statistics Working Group (STATWG) form the basis for research conducted by the ISC. Although some data for the most recent years are incomplete and provisional, the total catch of highly migratory species (HMS) by ISC Members estimated from available information is in excess of 500,000 metric tons (t) annually and dominated by the tropical tuna species. Catches of priority species by ISC Member countries in 2020 were 36,226 t of North Pacific albacore tuna (NPALB, *Thunnus alalunga*), 13,779 t of Pacific Bluefin tuna (PBF, *T. orientalis*), 8,508 t of North Pacific swordfish (SWO, *Xiphias gladius*), 2,443 t of North Pacific striped marlin (MLS, *Kajikia audax*), 4,703 t of Pacific blue marlin (BUM, *Makaira nigricans*), 1,259 t of North Pacific shortfin mako shark (SMA, *Isurus oxyrinchus*) and 22,415 t of North Pacific blue shark (BSH, *Prionace glauca*).[1] The total estimated catch of these seven species is 89,333 t, or approximately 80% of the 2020 total estimated catch of 112,186 t. Annual catches of priority stocks throughout their ranges reported by ISC Members are shown in Table 5 through

---

[1] FAO three-letter species codes are used throughout this report interchangeably with common names.

Table 11.

1.2 Opening of the Meeting

The Twenty-first Plenary session of the ISC (ISC21) was convened as a virtual meeting, at 18:00 on 12 July 2021 by the ISC Chair, J. Holmes.[2] A roll call confirmed the presence of delegates from Canada, Chinese-Taipei, Japan, Mexico, Republic of Korea, and U.S.A. (**ISC/21/ANNEX/01**). Non-voting members from the Secretariat of the Pacific Community (SPC), the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) were also present. Representatives from Monterey Bay Aquarium/Duke University, Pew Charitable Trusts, Western Fishboat Owners' Association, and the Western Pacific Fisheries Management Council, World Wildlife Fund-Japan, and Wild Oceans were present as observers.

ISC Member China, as well as the non-voting Members, the Fisheries and Agriculture Organization of the United Nations (FAO) and North Pacific Marine Science Organization (PICES), while extended an invitation, did not attend the Plenary.

2 ADOPTION OF AGENDA

The proposed agenda for the session (**ISC/21/ANNEX/02**) was considered and adopted. C. Dahl was assigned lead rapporteur duties. A list of meeting documents is contained in **ISC/21/ANNEX/03**.

Due to the constraints of the online format, national reports were not presented during Plenary. Written reports are compiled as documents **ISC/21/PLENARY/04** through **ISC/21/PLENARY/09**.

A list of common abbreviations and acronyms used by the ISC is provided in the preface to this report.

3 REPORT OF SPECIES WORKING GROUPS AND STOCK STATUS AND CONSERVATION INFORMATION

3.1 North Pacific Albacore

3.1.1 ALBWG Working Group Report and Review of Assignments

S. Teo reported on the activities of the ALBWG over the past year (**ISC/21/ANNEX/11/13/XX**). There were three ALBWG workshops focusing on the NPALB management strategy evaluation (MSE), as well as three MSE workshops for managers and stakeholders. All workshops were held online due to COVID-19 related travel restrictions. The first ALBWG management strategy

[2] Time given as Pacific Daylight Time (UTC -7) or for other members 09:00 China Standard Time (UTC +8), 10:00 Japan/Korea Standard Time (UTC +9) (July 13), or 15:00 Hawai'i Standard Time (UTC -10).

evaluation (MSE) workshop was held during 31 August – 3 September, and 8 September 2020 (EPO dates) to: 1) review the progress of the MSE after the initial round of the MSE; 2) asses if any additional modifications to the MSE framework or additional analyses were required; and 3) provide feedback on presentation of results. The second ALBWG MSE workshop was held during 1 – 4, and 8 December 2020 (EPO dates) to: 1) review the progress of the MSE after the first MSE workshop in September; 2) draft the final report of the NPALB MSE; and 3) organize the MSE workshops for managers and stakeholders in 2021. The ALBWG organized three separate MSE workshops for managers and stakeholders to alleviate issues with different languages and time zones (Japan: 17 – 19 March 2021; Canada and U.S.: 22 – 25 March 2021; and Taiwan: 7 – 8 April 2021). The objectives of these workshops were to: 1) help managers and stakeholders understand the MSE results; and 2) provide feedback to the ALBWG on the presentation of results. The third ALBWG MSE workshop was held during 18 – 19, and 24 May 2021 (EPO dates) to: 1) review feedback from the NPALB MSE workshops with managers and stakeholders; 2) propose and review response to the feedback; and 3) election if new ALBWG Chair. The ALBWG supported the main results of the MSE and agreed with the ISC Chair that the MSE results need to be assimilated by managers and stakeholders before further iterations of the MSE.

The ALBWG proposed the following 2021 – 2022 meeting schedule:

Date	Location/Method	Task/Event
11 – 19 Aug 2021	Online	WCPFC SC17. Report of MSE results and recorded video presentation provided for posting on SC17 online discussion forum website. Authors are responsible for any text communications.
5 – 7 Oct 2021	Online	WCPFC NC17. Format of presentation of MSE results to be determined.
Early 2022	Yokohama, Japan	ALBWG: Workshop for Assessment Improvements

Discussion

The Plenary endorsed the ALBWG’s proposed work plan.

3.1.2 North Pacific Albacore Stock Status and Conservation Information

The ALBWG recommended carrying forward the stock status and conservation information from ISC20, because there is no new stock assessment or other substantive information that would suggest a need to change these determinations. The Plenary endorsed this recommendation.

The Plenary discussed whether the adoption of additional biological reference points for the stock, based on the results of the management strategy evaluation (see Section 3.1.3), could potentially affect this stock status and conservation information. The ALBWG Vice Chair suggested that the WG could consider the implications of any newly adopted reference points at its proposed meeting in early 2022 and bring forward recommendations to ISC22.

In response to a question about the relationship between "current" fishing intensity ($F_{2015-2017}$) and the conservation measures adopted by the WCPFC and IATTC that limit fishing effort to the average of the 2002-2004 level (IATTC Resolution C-05-02 only specifies that the 'current' level of fishing is not to be exceeded but the 'current' in the Resolution is interpreted as the average of 2002-2004), it was noted that current fishing intensity would correspond to fishing effort below the 2002-2004 level.

<u>Stock Status and Conservation Information</u>

The Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC20 (see Section 3.1.2 pp. 5-15 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables.

Stock Status

Estimated total stock biomass (males and female at age-1+) declines at the beginning of the time series until 2000, after which biomass becomes relatively stable. Estimated female SSB exhibits a similar population trend, with an initial decline until 2003 followed by fluctuations without a clear trend through 2018. However, estimated recruitment reached historical lows in 2014 (~125 million fish; 95% CI: 69 – 180 million fish) and 2015 (~113 million fish; 95% CI: 56 – 170 million fish), which may have contributed to relatively low catches of fisheries catching juvenile albacore in recent years. It is currently unclear whether recruitment improved after 2015 because recruitment during the terminal years of the assessment (2016 – 2018) have large uncertainties.

The estimated average SPR (spawners per recruit relative to the unfished population) during 2015 – 2017 is 0.50 (95% CI: 0.36 – 0.64), which corresponds to a moderate fishing intensity (i.e., 1-SPR = 0.50). Instantaneous fishing mortality at age (F-at-age) is similar in both sexes through age-5, peaking at age-4 and declining to a low at age-6, after which males experience higher F-at-age than females up to age 12. Juvenile albacore aged 2 to 4 years comprised approximately 70% of the annual catch between 1994 and 2018. The dominance of juveniles is also reflected in the larger impact of surface fisheries (primarily troll, pole-and-line), which remove juvenile fish, relative to longline fisheries, which primarily remove adult fish).

The WCPFC -NC, which manages this stock in conjunction with the IATTC, adopted a biomass-based LRP in 2014 of 20% of the current spawning stock biomass when F=0 ($20\%SSB_{current,\ F=0}$). The $20\%SSB_{current,\ F=0}$ LRP is based on dynamic biomass and fluctuates depending on changes in recruitment. This LRP is calculated for NPALB as 20% of the unfished dynamic female spawning biomass in the terminal year of this assessment (i.e., 2018) (WCPFC-NC13 Summary Report). However, neither the IATTC nor the WCFPC-NC have adopted F-based reference points for the NPALB stock.

Stock status is depicted in relation to the LRP ($20\%SSB_{current,\ F=0}$) for the stock and the equivalent fishing intensity ($F_{20\%}$; calculated as $1\text{-}SPR_{20\%}$). Fishing intensity (F, calculated as 1-SPR) is a measure of fishing mortality expressed as the decline in the proportion of the spawning biomass produced by each recruit relative to the unfished state. For example, a fishing intensity of 0.8 will result in an SSB of approximately 20% of SSB_0 over the long run. Fishing intensity is considered a proxy of fishing mortality.

The Kobe plot shows that the estimated female SSB has never fallen below the LRP since 1994, albeit with large uncertainty in the terminal year (2018) estimates. Even when alternative hypotheses about key model uncertainties such as growth were evaluated, the point estimate of female SSB in 2018 (SSB_{2018}) did not fall below the LRP, although the risk increases with the more extreme assumption. SSB_{2018} was estimated to be 58,858 t (95% CI: 27,751 – 89,966 t) and 2.30 (95% CI: 1.49 – 3.11) times greater than the estimated LRP t of 25,573 t (95% CI: 19,150 – 31,997 t). Current fishing intensity, $F_{2015\text{-}2017}$ (0.50; 95% CI: 0.36 – 0.64; calculated as 1-$SPR_{2015\text{-}2017}$) , was at or lower than all seven potential F-based reference points identified for the NPALB stock.

Based on these findings, the following information on the status of the north Pacific albacore stock is provided:

1. **The stock is likely not overfished relative to the limit reference point adopted by the Western and Central Pacific Fisheries Commission (20%$SSB_{current,\ F=0}$), and**

2. **No F-based reference points have been adopted to evaluate overfishing. Stock status was evaluated against seven potential reference points. Current fishing intensity ($F_{2015\text{-}2017}$) is likely at or below all seven potential reference points.**

Conservation Information

Two harvest scenarios were projected to evaluate impacts on future female SSB: F constant at the 2015-2017 rate over 10 years ($F_{2015\text{-}2017}$) and constant catch[3] (average of 2013-2017 = 69,354 t) over 10 years. Median female SSB is expected to increase to 62,873 t (95% CI: 45,123 - 80,622 t) by 2028, with a low probability of being below the LRP by 2028, if fishing intensity remains at the 2015-2017 level. If future catch is held constant at 69,354 t, then the female SSB is expected to increase to 66,313 t (95% CI: 33,463 - 99,164 t) by 2028 and the probability that female SSB will be below the LRP by 2028 is slightly higher than the constant F scenario. Although the projections appear to underestimate the future uncertainty in female SSB trends, the probability of breaching the LRP in the future is likely small if the future fishing intensity is around current levels.

Based on these findings, the following information is provided:

1. **If a constant fishing intensity ($F_{2015\text{-}2017}$) is applied to the stock, then median female spawning biomass is expected to increase to 62,873 t and there will be a low**

3 It should be noted that the constant catch scenario is inconsistent with current management approaches for north Pacific albacore tuna adopted by the Inter-American Tropical Tuna Commission (IATTC) and the Western and Central Pacific Fisheries Commission (WCPFC).

probability of falling below the limit reference point established by the WCPFC by 2028.

2. **If a constant average catch ($C_{2013\text{-}2017}$ = 69,354 t) is removed from the stock in the future, then the median female spawning biomass is also expected to increase to 66,313 t and the probability that SSB falls below the LRP by 2028 will be slightly higher than the constant fishing intensity scenario.**

3.1.3 Final Management Strategy Evaluation Report

The ALBWG conducted an MSE for NPALB to examine the performance of alternative harvest control rules (HCRs) and associated reference points for the stock. Performance was evaluated based on management objectives pre-agreed upon with managers and stakeholders in a series of workshops.

Management objectives and performance metrics were finalized in October 2017, at the 3rd ISC NPALB MSE Workshop in Vancouver, Canada, where candidate reference points and HCRs for testing were also agreed upon. An initial set of MSE results was presented to managers and stakeholders during the 4th ISC NPALB MSE Workshop in February 2019 in Yokohama, Japan. Managers and stakeholders at the 4th MSE Workshop recommended removal from further consideration of two candidate harvest strategies and target reference points (TRPs) and assessment of performance of additional candidate HCRs focused on the best performing TRPs of $F_{40\%}$ and $F_{50\%}$.

The results presented here focus on evaluation of the 16 HCRs and associated reference points proposed at the 4th MSE Workshop. The MSE tested HCR performance under total allowable catch (TAC) control and mixed control management procedures. Under the mixed control procedure, longline fleets catching NPALB incidentally are subject to a TAC, while the surface fleets targeting NPALB are controlled by total allowable effort (TAE). Mixed control maintained higher and less variable stock biomass than TAC control because the catches of surface fleets under effort control responded quickly to changes in biomass and their catch levels were not impacted by assessment errors in biomass estimates.

Because the NPALB stock is in good condition – even when considering the range of uncertainties in stock productivity; recruitment variability; availability to the EPO surface fleet; and observation, assessment, and implementation error – SSB rarely fell below the WCPFC's adopted LRP of 20% unfished dynamic spawning stock biomass ($20\%SSB_{current,\ F=0}$). This was true across the range of the candidate HCRs under both TAC and mixed control management procedures across all the reference stock productivity scenarios that were tested.

Under mixed control, there was a tradeoff between the odds of biomass being above the LRP and catch-related performance metrics. Under TAC control, the tradeoff between fishing intensity and catch variability led to the comparable odds of catch being above the historical average with both the $F_{50\%}$ and $F_{40\%}$ TRP families of HCRs.

Both mixed and TAC control were able to maintain the stock above the LRP with high probability (>0.8) even with increasing catches from an unknown, unmanaged fleet. This result occurred because the estimation model (the simulated stock assessment) correctly detects the decrease in biomass from the abundance indices and composition data despite observation error. As the TAC and TAE of the managed fleets are dependent on stock biomass, they are reduced over time and catches of the managed fleets diminish. Thus, maintenance of stock biomass comes at the cost of decreased catches for the managed fleets.

Discussion

The Plenary endorsed the MSE results, reiterating that no additional work is anticipated at this time.

The Plenary discussed the future validity of MSE results if a new benchmark stock assessment changes our understanding of stock status. The MSE evaluated management procedures across a wide range of operating models consolidated into four productivity scenarios. This approach should make the results robust in the face of changes in stock status. However, if assessment results suggest conditions outside the evaluated range, the MSE may need to be revisited. Otherwise, in presentations to managers it should be emphasized that no further iterations of the MSE results is planned at present.

It was noted that the recruitment scenarios used for MSE projections were not explicitly based on potential changes in environmental conditions, but the historical time series upon which they were based exhibits some year-to-year autocorrelation, suggesting environmental conditions that propagate across several years.

It was clarified that the ALBWG developed additional catch-related performance metrics by subsetting years within the 1981-2010 times series based on stakeholder recommendations.

It was noted that the robustness of management procedures under the scenario of undetected catch by a "ghost fleet" is a result of the simulated stock assessments interpreting changes in the abundance index and composition data as a reduction in spawning biomass resulting from a drop in recruitment. Corresponding controls are imposed on the managed fleets, which are thus "paying the price" for the catch of unmanaged fleets.

The upcoming presentation of the MSE in regional fishery management forums was discussed at length. Finding the right balance between technical detail, clarity, and conciseness is challenging. A more technical presentation would be appropriate for an audience such as the WCPFC Scientific Committee while focusing on the MSE results with less technical detail would be better for fishery managers participating in the next Northern Committee meeting. Providing materials in advance, including a prerecorded presentation, would likely enhance uptake by managers. The ISC Chair will work with the Northern Committee Chair to ensure necessary time is allocated on its meeting agenda and that other arrangements discussed by the Plenary are accommodated.

3.2 Pacific Bluefin Tuna

3.2.1 PBFWG Report and Review of Assignments

S. Nakatsuka, PBFWG Chair, reported the activities of WG for the past year (**ISC/21/ANNEX/12**). The WG did not conduct a PBF stock assessment last year and held one intersessional meeting in April 2021. In the intersessional meeting, the WG reviewed the latest catch data and noted catch increases by several members that were within the catch limits of the CMMs currently in force (WCPFC CMM 2020-02; IATTC Resolution C-20-02). The WG also reviewed abundance indices. The longline indices from Japan and Chinese Taipei, from which SSB abundance is inferred, showed a strong increase, supporting the continuing recovery trend of the stock. As to the recruitment index that has been used in the assessment, the WG is concerned with the impact of stricter management controls implemented in 2017 on data availability. Because these controls affect fishery behavior, the WG believes that the current index may be negatively biased after the 2016 fishing year and thus the index from subsequent years should not be included in future stock assessments. This bias is related to management measures in Japan encouraging the voluntary release of young PBF, which are not captured in the sales slip records (landings) that are the data source for this index. The WG will consider options for the inclusion of an appropriate recruitment index for the next stock assessment. The WG further noted that the terminal year (2018 fishing year) recruitment estimate was low in the last assessment, which was primarily informed by the Japanese troll recruitment index that is likely to be negatively biased. However, the effect of this issue on the stock status or conservation information is considered minimal, because the assessment and projections take into account the high uncertainty of recruitment estimates. The WG concluded that there is no new information that necessitates revisions to the 2020 ISC Stock Status and Conservation Information for PBF.

The WG also reviewed the model structure of the current stock assessment and developed a basic framework for the updated stock assessment scheduled for completion in 2022. The WG also discussed how to proceed with a PBF MSE. One of the main benefits of an MSE is to account for data uncertainties. The WG concluded that given the high quality of the PBF assessment and lack of data inconsistencies, that is the catch data explained indices with good contrast, the need for a full MSE analysis is diminished. Therefore, the WG discussed using an ensemble approach rather than MSE to evaluate harvest strategies based on the 2020 stock assessment. However, if uncertainty cannot be captured in the ensemble approach, an MSE with a feedback loop may be needed. The WG agreed to discuss this issue further in fall 2021, based on the preliminary results from the ensemble model. In addition, the WG discussed the current status of close-kin mark recapture (CKMR) research on PBF. Members reported on their domestic research activities related to CKMR, but several members noted difficulties with continuing domestic CKMR research, because of the lack of a clear workplan endorsed by the ISC. WG members agreed to continue their domestic CKMR projects as they see fit.

The WG proposed the following schedule of meetings and deadlines as part of its workplan.

Date	Topic
November 2021	Data preparation workshop, including MSE progress review (Webinar);

December 31, 2021	Data submission for Catch and Size composition data, and preliminary results for the abundance indices
January 31, 2022	Data submission for the abundance indices
Early March 2022	Assessment meeting (format TBD)
April 1st, 2022	Submit the executive summary of the stock assessment report to the ISC chair for his review

Discussion

The Plenary discussed the barriers to progress on the PBF CKMR research agenda. Effective collaboration has been stymied by limitations of domestic capacity in the necessary analytical techniques and the reluctance to share confidential information on genetic markers in the interest of further developing such capacity. As a result, lack of coordination of research methods, such as which genetic markers to use, threatens the international research program. Overall, the lack of a coherent research plan agreed to by the Plenary has been the main contributor to these impediments. The Plenary asked the PBFWG to report back to the Plenary in 2022 on the need for CKMR to improve the accuracy and reliability of future stock assessments. Based on that advice, the Plenary may decide on any further development of an ISC sponsored CKMR research program.

The Plenary discussed progress on the MSE and its importance for strategic decision making. A major impediment to the development of the MSE has been the lack of input from managers on management objectives and alternatives management procedures (BRPs, HCRs, management controls, etc.) despite PBFWG efforts. Concern was expressed regarding the capacity needed to conduct an MSE, given the assessment workload and the fact that the WCPFC and IATTC have not provided clear direction and guidance on the MSE process. It was agreed that the ISC Chair and the PBFWG Chair would draft a document describing these concerns and submit it for discussion at the Sixth Meeting of the IATTC-WCPFC NC Joint Working Group on the Management of Pacific Bluefin Tuna scheduled for July 27-29, 2021.

Issues with the current recruitment indices were discussed. As noted by the PBFWG, the Japanese troll index may be negatively biased since 2017 because of management controls affecting landings, the data source for this index. Japan has also developed an index based on electronic monitoring of troll vessels that is expected to be less affected by these changes in behavior because it is not landings based, but this index has a much shorter time series. The PBFWG Chair noted that the problems with the current Japanese troll index and the implications of switching to an alternative index will be further discussed at the WG's planned November 2021 meeting.

The selection of the Taiwanese longline index from the results of different statistical methods was also discussed. A delta-generalized linear mix model (delta-GLMM) has heretofore been used while a vector-auto-regressive spatiotemporal (VAST) model was tested since 2018. The two methods produce similar results, but the VAST model approach has the disadvantage that it can only be applied to a shorter historical time period with detailed geo-location information in the data.

The Plenary endorsed the PBFWG's proposed workplan.

3.2.2 Pacific Bluefin Tuna Stock Status and Conservation Information

The Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC20 (see Section 3.2.2, pp. 17-31 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables and clarifying modifications.

Stock Status

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 $F_{14\%SPR}$. Although no reference points have been adopted to evaluate the status of PBF, an evaluation of stock status against some common reference points 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). These changes in biomass coincide with a decline in fishing mortality over the last decade. 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 an increase from 4.0% estimated for 2016 (the terminal year in the previous assessment). 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. 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 by this fishing mortality, as shown by the projection results.**

Conservation Information

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 in the ISC20 Plenary Report. 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. In most of the scenarios, the SSB biomass is projected to recover to the initial rebuilding target (SSB_{MED}) in the 2020 fishing year (April of 2021) with a probability above the 60% level prescribed in the WCPFC CMM 2019-02.

A Kobe chart and impacts by fleets estimated from future projections under the current management scheme are provided for information. Because the projections include catch limits, fishing mortality ($F_{x\%}$) 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 comments, 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, the future projection results do not contain assumptions about discard mortality. Although the impact of discards on SSB is small compared to other fisheries, discards should be considered in the harvest scenarios.**
3. **Given the low SSB, the uncertainty in future recruitment, and the influence recruitment has on stock biomass, monitoring recruitment and SSB should continue so that the recruitment level can be understood in a timely manner.**

3.3 Billfish

3.3.1 BILLWG Report and Review of Assignments

H. Ijima, Chair of the BILLWG, outlined four WG meetings held in 2020 and 2021.

In the 3-4 and 13 November 2020 biological research workshop, the number of samples for each length bin was determined based on the analysis of length composition data from Japan, Chinese Taipei, and the United States. The BILLWG also established a standard sampling methodology for billfish species. The workshop also addressed the use of the updated growth curve for BUM used in the stock assessment. The BILLWG updated the BUM growth curve based on new research; however, the BILLWG decided to build the SS3 model using both the old growth curve and the new growth curve and to adopt the growth curve exhibiting better model diagnosis results as the base case model.

At its 6-7, 10 and 13 November 2020 data preparation workshop the WG agreed on the input data and the model settings for conducting a benchmark stock assessment for BUM using Stock Synthesis 3.

At its 9-11 and 15 March 2021 intersessional meeting, in addition to reviewing progress on the BUM stock assessment, the WG also prepared a response to three questions posed by WCPFC 17 about the status of the WCNPO MLS stock. To formulate the WCNPO MLS stock rebuilding plan, the WG proposed, first, to conduct the MLS stock assessment in 2022 and update the rebuilding plan accordingly. The next SWO assessment would be delayed to 2023 to accommodate this work. The IATTC has proposed a new stock boundary dividing WCNPO and EPO SWO stocks. In consultation with SPC-OFP scientists, the WG agreed to consider this new stock boundary.

While WCPFC-NC14 requested that the BILLWG prepare a rebuilding plan for WCNPO MLS, the WG needs clarification on the rebuilding target, 20%$SSB_{F=0}$. It is not clear whether the rebuilding target is based on equilibrium SSB_0 or whether dynamic SSB_0 is required. If the rebuilding target is defined with a dynamic SSB_0, then the WG requests that the WCPFC-NC specify the target year for rebuilding.

WCPFC17 requested that the ISC address the three issues arising from the most recent WCNPO MLS stock assessment. The BILLWG recommended responses are summarized for each of these requests below. More detail is provided in **ISC/21/ANNEX/08**:

1. *Examine differences between ISC stock assessment catch estimates by CCM and WCPFC catch estimates, and work with the Scientific Services Provider to provide an assessment of the shortcomings.*

The BILLWG, which includes members from the Scientific Services Provider, SPC, discussed this question at a workshop in early 2021 in the context of a retrospective review of the quality of Japanese catch statistics (**Working Paper ISC/21/BILLWG-01/05**). The differences in catch estimates between the ISC stock assessment and the WCPFC occurs for longline fisheries that record the catch in numbers. These differences in catch estimates are due to the different methods used to convert numbers to biomass for the WCPFC catch estimates and for the stock assessment, whether it is SS or MFCL model. The WCPFC catch estimates conversion is based on the product of the number of fish caught and average weight of the individuals caught on a trip or within the reporting strata. The stock assessment estimates catch as product of the numbers caught, the fishery selectivity function, and the weight-at-age of individuals. When conducting a stock assessment it is important to account for potential conversion error by using the catch in the original recorded units, which for longline fisheries is numbers. The BILLWG noted that in the early part of the longline catch time series prior to 2000, the WCPFC catch estimates did not include Japanese longline training vessel catches. The inclusion of these catches after 2000 resulted in similar trends and catches although small differences remain. Based on these observations, the BILLWG concluded that WCPFC Japanese longline fishery statistics and the output from SS are similar.

2. *Explain why the striped marlin stock decreased and the fishing mortality increased after a drastic decrease in fishing effort by high seas driftnet fisheries in the early 1990s.*

The BILLWG identified three potential contributing factors: (1) The model assumes that selectivity for Japanese driftnet catches in the 1975-1993 period is the same selectivity as in the Japanese coastal driftnet fishery from 1994 to 2017, although there are no size data available from 1975-1993. The coastal driftnet fishery targets large adult MLS, which means that the model is assuming the majority of the catch from 1975 to 1993 also is large adult fish. In 1994, the majority of the catch is from CCM longline fleets, which caught predominately juvenile MLS. This assumed shift from catching large adults to small juveniles would result in an increase in fishing mortality even if the overall catch decreased; (2) The CPUE time series has a break in 1993 to 1994, which could be driving a shift in the model results due to a lack of continuity; and (3) the Japanese logbook data also change their reporting requirements in 1993 to 1994, which could contribute to the shift in fishing mortality, however not all CCMs agreed that this would drive the change in fishing mortality.

The WG noted that excluding data prior to 1994 in the MLS assessment was explored in the 2019 assessment meeting. The WG compared two models that started in 1994. A sensitivity run fixing the initial equilibrium catch (run 22, MLS SAR, ISC19, Figure 3 a) showed no difference relative to the base-case model results. In contrast, estimating the initial equilibrium catch (Model 2 in the Carvalho, et al. 2019, Figure 3 b) resulted in the same trend but produced different estimates of initial population size. It was noted that SSB_0 is strongly associated with the initial equilibrium catch. However, the WG did not have strong information to justify setting the initial catch (5,000mt). **Based on this discussion, the WG agreed to estimate the initial equilibrium catch in the stock assessment model, and agreed that differences due to starting year were likely driven by the uncertainty in catches before 1993**.

3. *Develop a roadmap to address the issues identified in the latest stock assessment by ISC.*

The BILLWG recommends revising its work plan to assess WCNPO MLS in 2022 and postpone the WCNPO SWO assessment to 2023 to address the concerns identified by the questions above and by the WG in its WCNPO MLS stock assessment report (**ISC/19/ANNEX/11**). For example, there were concerns about providing a rebuilding plan in 2021 and then reassessing the stock in 2022. However, the proposed revised workplan would permit updating of the rebuilding plan after the stock assessment in 2022.

The WG presented the following schedule of upcoming meetings as part of its workplan.

Year	Meeting	Remarks
October 2021	WCPFC-NC17	Confirm the definition of rebuilding target and suggest the change of stock assessment schedule.
December 2021	WCPFC18	Confirm the definition of rebuilding target and suggest the change of stock assessment schedule.
Mid December 2021	Data preparatory meeting for MLS	
March 2022	Benchmark stock assessment meeting for MLS	
April 2022	Rebuilding meeting for MLS	

Year	Meeting	Remarks
November 2022	Data preparatory meeting for SWO	

At its April 2021 BUM stock assessment meeting, the ensemble model for Pacific BUM was finalized, diagnostics were discussed, and projections and sensitivity runs were completed. While the ensemble model approach was not initially planned for Pacific BUM, it became apparent that it was most appropriate approach for this assessment.

Discussion

The Plenary endorsed the BILLWG's responses to the questions posed by WCPFC17, the request for clarification of the MLS rebuilding target and the BILLWG proposed workplan for 2021-22.

3.3.2 Pacific Blue Marlin Stock Assessment

Stock Identification and Distribution: The Pacific blue marlin (*Makaira nigricans*) is considered a pan-Pacific stock caught primarily in tropical and sub-tropical waters. All available fishery data from the IATTC and the WCPFC were used for this benchmark stock assessment. For modeling observations of CPUE and size composition data, it was assumed that there was instantaneous mixing of fish throughout the stock area on a quarterly basis.

Catches: Pacific blue marlin catches increased from the 1970s to the 1990s, and remained high until the 2000s when they started to decline. The relative catch by Japanese fleets has decreased and the relative catch from the Chinese Taipei and other longline fleets has increased since 2000 (Figure 1). Overall, longline gear has accounted for the majority of Pacific BUM catches (67%), Japanese fleets dominating the catch before 2000, and Chinese Taipei and other longline fleets dominating thereafter.

Data and Assessment: Catch and size composition data were collected from three ISC countries (Japan, Chinese Taipei, and the USA), the IATTC, and the WCPFC. Standardized catch-per-unit effort data used to measure trends in relative abundance were provided by Japan, the USA, and Chinese Taipei. The BUM stock was assessed using a two-model ensemble of age- and length-structured Stock Synthesis models fit to time series of standardized CPUE and size composition data. The two models in the ensemble differed only in the assumption of the growth curve used. One model used the growth curve from the 2016 Pacific blue marlin assessment (hereafter referred to as the "old growth" model). The other model used a growth curve presented to the working group that was a collaboration between ISC members (hereafter the "new growth" model see Figure 2). The BILLWG noted some substantial differences between the two growth models, including the parameterization (von Bertalanffy vs. two-stanza growth) and the asymptotic length (L_{inf}) for old fish, which was about 50 cm larger for the old growth model. Previous work has demonstrated that stock assessment models can be highly sensitive to the L_{inf} parameter; therefore, the WG explored both models for their ability to describe the input data. Neither model could be discarded based upon model fit and diagnostics; therefore, biological reference points, spawning stock biomass, and fishing mortality were averaged between the two models using the multivariate lognormal approximation method assuming equal weights. The value for stock-recruitment steepness used for the base case model was $h = 0.87$. The assessment model was fit to relative abundance indices and size composition data in a likelihood-based statistical framework with smoothing penalties for fishery selectivity. Maximum likelihood estimates of model parameters, derived outputs, and their covariances were used as inputs to the model averaging using the multivariate lognormal approach to characterize stock status and to develop stock projections. Several sensitivity analyses were conducted to evaluate the effects of changes in model parameters, including the natural mortality rate, the stock-recruitment steepness, the growth curve parameters, and the female age at 50% maturity, as well as uncertainty in the input data (i.e., CPUE indices used and the weighting of the size composition data) and model structure (i.e., initial fishing mortality).

Biological Reference Points: Biological reference points were computed for the combined ensemble model using a multivariate lognormal approximation that accounts for the inherent covariance between F/F_{MSY} and SSB/SSB_{MSY} (Table 2). The combined estimate of the spawning biomass to produce MSY (adult female biomass) was SSB_{MSY} = 20,677 mt. The point estimate of F_{MSY}, the fishing mortality rate to produce MSY (average fishing mortality on ages 1 – 10) was $F_{MSY} = 0.23$ and the corresponding equilibrium value of spawning potential ratio at MSY was SPR_{MSY} = 17%.

Projections: Stock projections were conducted with Stock Synthesis to evaluate the impact of alternative future levels of harvest intensity on female spawning stock biomass, fishing mortality, and yield for Pacific blue marlin. These projections were considered deterministic, because future recruitment was predicted based on the stock-recruitment curve. These projections used all the multi-fleet, multi-season, size- and age-selectivity, and complexity in the assessment model to produce consistent results. The stock projections started in 2020 and continued through 2029 (10 years) under 4 levels of constant fishing mortality: (1) constant fishing mortality equal to the 2003-2005 average ($F_{2003–2005}$); (2) constant fishing mortality equal to F_{MSY}; (3) constant fishing mortality equal to the 2016-2018 average defined as current; and (4) constant fishing mortality equal to $F_{30\%}$ (corresponding to the fishing mortality that produces 30% of the spawning potential ratio). Stock projections for each F scenario were run for both growth models in the ensemble and combined using the multivariate lognormal method. Using the deterministic projection result, the multivariate lognormal approximation was applied to generate 10,000 trajectories of SSB and F to calculate the model-averaged results of the new and old growth models. Results showed the projected female spawning stock biomasses, fishing mortality, and the catch biomasses under each of the combined scenarios (Table 3 and Figure 5).

Discussion

The WG Chair was asked about the rationale for using an ensemble model approach. The WG did not make an *a priori* decision to employ an ensemble approach. Rather, model diagnostics indicated both the old growth model used in the previous assessment and the new growth model were equally plausible and both provide useful information about different aspects of growth. The Plenary noted that this is the first use of an ensemble modeling approach in an ISC stock assessment.

The ISC Plenary endorsed the North Pacific BUM stock assessment and considers it to be the best available scientific information on the stock.

3.3.3 Pacific Blue Marlin Stock Status and Conservation Information

Based on the stock assessment results, the Plenary adopted the following stock status and conservation advice for Pacific BUM.

Stock Status

Stock status, biomass trends, and recruitment of Pacific blue marlin (*Makaira nigricans*) for both models in the ensemble had similar trends, although the estimates of initial conditions are different. All reported results are the model-averaged estimates from the ensemble model unless otherwise noted. Estimates of population biomass declined until the mid-2000s, increased again until 2021, and has been relatively flat until the present. The minimum spawning stock biomass is estimated to be 17,592 mt in 2006 (5% above SSB_{MSY}, the spawning stock biomass to produce MSY, 95% C.I. 14,512-20,703 mt, SSB/SS_{MSY} 95% C.I. 0.70-1.01, Figure 3). In 2019, SSB = 24,272 mt and the relative SSB/SSB_{MSY} = 1.17 (95% C.I. 0.87-1.51). Combined median fishing mortality on the stock (average F on ages 1-10) is currently below F_{MSY} (Figure 3). It averaged roughly F = 0.13 during 2017-2019, or 40% below F_{MSY}, and in 2019, F=0.11 with a relative fishing mortality of F/F_{MSY} = 0.50 (95% C.I. 0.37-0.69). Median fishing mortality has been below F_{MSY} every year except 2003 to 2006. The predicted value of the spawning potential ratio (SPR, the predicted spawning output at current F as a fraction of unfished spawning output) is currently $SPR_{2017\text{-}2019}$ = 31% for the combined model, which is above the SPR required to produce MSY (17%). Recruitment was relatively consistent throughout the assessment time period, with occasional pulses in recruitment, but no notable periods of below-average recruitment (Figure 3). No target or limit reference points have been established for Pacific BUM under the auspices of the WCPFC. Blue marlin is expected to be highly productive due to its rapid growth and high resilience to reductions in spawning potential. Although fishing mortality has approached MSY and exceeded MSY from 2003 to 2006, the biomass of the stock has remained above MSY (Figure 4). With continued decreases in Pacific BUM catch and fishing effort, the stock is expected to remain within MSY limits. When the status of BUM is evaluated relative to MSY-based reference points, the 2019 spawning stock biomass of 24,272 mt is 17% above SSB_{MSY} (20,677 mt, 95% C.I. -13% to +50%) and the 2017-2019 fishing mortality is 50% below F_{MSY} (95% C.I. 37% to 69%) (Table 2).

Based on these findings, the following information on the status of the WCNPO Blue Marlin stock is provided:

1. **No target or limit reference points have been established for Pacific blue marlin by the WCPFC;**
2. **Female spawning stock biomass was estimated to be 24,241 mt in 2019, or about 17% above SSB_{MSY} and 17% above $20\%SSB_0$.**
3. **Fishing mortality on the stock (average F, ages 1 to 10) averaged roughly F = 0.13 during 2016-2019, or about 40% below F_{MSY} and 28% below $F_{20\%\,SSB0}$.**
4. **Blue marlin stock status from the ensemble model indicates that relative to MSY-based reference points, overfishing was very likely not occurring (>90% probability) and Pacific blue marlin is likely not overfished (81% probability, Figure 4).**

Conservation Information

The Pacific blue marlin stock has produced annual yields of around 18,800 mt per year since 2015, or about 90% of the MSY catch. Blue marlin stock status from the ensemble model indicates that the current median spawning biomass is above SSB_{MSY} and that the current median fishing mortality is below F_{MSY}. However, uncertainty in the stock status indicates a 19% chance of Pacific blue marlin being overfished relative to SSB_{MSY}. Both the old and new growth models show evidence of spawning biomass being above SSB_{MSY} and fishing mortality being below F_{MSY} during the last 5 years. Catch biomass has been declining for the last 5 years, and therefore the stock has a low risk of experiencing overfishing or being overfished unless fishing mortality increases to above F_{MSY} based upon stock projections (Table 3, Figure 5). However, it is also important to note that retrospective analyses show that the assessment model tends to overestimate biomass and underestimate fishing mortality in recent years, in part due to rapid changes in longline CPUE.

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

1. **There is no evidence of excess fishing mortality above F_{MSY} ($F2_{016\text{-}2019}$ is 40% of F_{MSY}) or substantial depletion of spawning potential (SSB_{2019} is 17% above SSB_{MSY});**
2. **It is important to note that retrospective analyses show that the assessment model appears to overestimate spawning stock biomass in recent years; and**
3. **The results show that projected female spawning biomass is expected to increase under the $F_{status\ quo}$ and $F_{30\%}$ harvest scenarios and decline to SSB_{MSY} under the High F and F_{MSY} harvest scenarios. The probability that the stock is overfished or overfishing occurring by 2029 under each harvest scenario is low.**

<u>Special Comments</u>

1. **Uncertainty regarding the choice of BUM growth curve led to the ensemble model approach for this assessment.** The BILLWG recognized that there is considerable uncertainty in input CPUE data in the recent years and life history parameters, especially growth. The BILLWG considered an extensive suite of model formulations and associated diagnostics for developing the assessment models. Overall, the BILLWG found issues with both the new growth and old growth model diagnostics and sensitivity runs that are consistent with the presence of data conflicts, but none of the model diagnostics show that the results of either model were invalid. It is recommended model development work to reduce data conflicts and modeling uncertainties continue and that input assessment data be reevaluated to improve the time series.
2. **It is recommended that biological sampling to improve life history parameter estimates continue to be collected and ISC countries participate in the BILLWG International Biological Sampling program to improve those estimates.**

Table 1. Reported catch (tonnes, mt) used in the stock assessment along with annual model-averaged estimates of female spawning biomass (tonnes, mt), relative female spawning biomass (*SSB/SSB_{MSY}*), recruitment (thousands of age-0 fish), fishing mortality (average F, ages 1 – 10), relative fishing mortality (*F/F_{MSY}*), and spawning potential ratio (SPR) of Pacific blue marlin..

Year	2013	2014	2015	2016	2017	2018	2019	Mean[1]	Min[1]	Max[1]
Reported Catch	22,166	23,741	21,861	22,644	14,443	18,589	16,503	18,873	10,882	26,138
Spawning Biomass	27,707	26,321	25,476	23,693	22,942	23,222	24,279	35,007	17,601	69,331
Relative Spawning Biomass	1.33	1.26	1.22	1.15	1.11	1.12	1.18	1.70	0.84	3.51
Recruitment (thousands of age 0 fish)	960	785	608	862	870	1,399	876	895	502	1,399
Fishing Mortality	0.18	0.19	0.19	0.21	0.13	0.16	0.11	0.16	0.08	0.25
Relative Fishing Mortality	0.81	0.85	0.83	0.95	0.58	0.71	0.50	0.71	0.35	1.11
Spawning Potential Ratio	0.26	0.24	0.25	0.22	0.33	0.27	0.34	0.33	0.17	0.60

[1] During 1971-2019

Table 2. Estimates of biological reference points along with estimates of fishing mortality (F), spawning stock biomass (SSB), recent average yield (C), and spawning potential ratio (SPR) of Pacific blue marlin, derived from the assessment ensemble model, where "MSY" indicates reference points based on maximum sustainable yield..

Reference Point	Estimate
F_{MSY} (age 1-10)	0.23
F_{2019} (age 1-10)	0.11
$F_{20\%SSB0}$	0.18
SSB_{MSY}	20,677 mt
SSB_{2019}	24,241 mt
$SSB_{20\%SSB0}$	20,729 mt
MSY	24,600 mt
$C_{2017-2019}$	16,512 mt
SPR_{MSY}	17%
SPR_{2019}	34%
$SPR_{20\%SSB0}$	23%

Table 3. Projected median values of Pacific blue marlin spawning stock biomass (SSB, mt) and catch (mt) under four constant fishing mortality rate (F) scenarios during 2020-2029..

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Scenario 1: F = $F_{2003-2005}$										
SSB	25,459	23,462	21,752	20,498	19,262	18,689	18,252	17,835	17,583	17,475
Catch	33,111	30,527	28,638	27,331	26,431	25,806	25,363	25,044	24,811	24,641
Scenario 2: F = F_{MSY}										
SSB	25,318	23,351	21,583	20,255	19,216	18,405	18,186	17,809	17,513	17,466
Catch	32,875	30,436	28,662	27,439	26,606	26,037	25,645	25,370	25,177	25,039
Scenario 3: F = $F_{2016-2018}$										
SSB	26,930	28,182	28,764	28,675	28,428	28,731	28,052	28,142	27,861	28,081
Catch	23,321	23,546	23,591	23,561	23,513	23,472	23,443	23,422	23,407	23,397
Scenario 4: F = $F_{30\%}$										
SSB	27,757	30,064	30,624	30,976	31,072	31,624	31,415	31,800	31,753	32,132
Catch	20,828	21,404	21,764	22,001	22,167	22,294	22,393	22,471	22,532	22,580

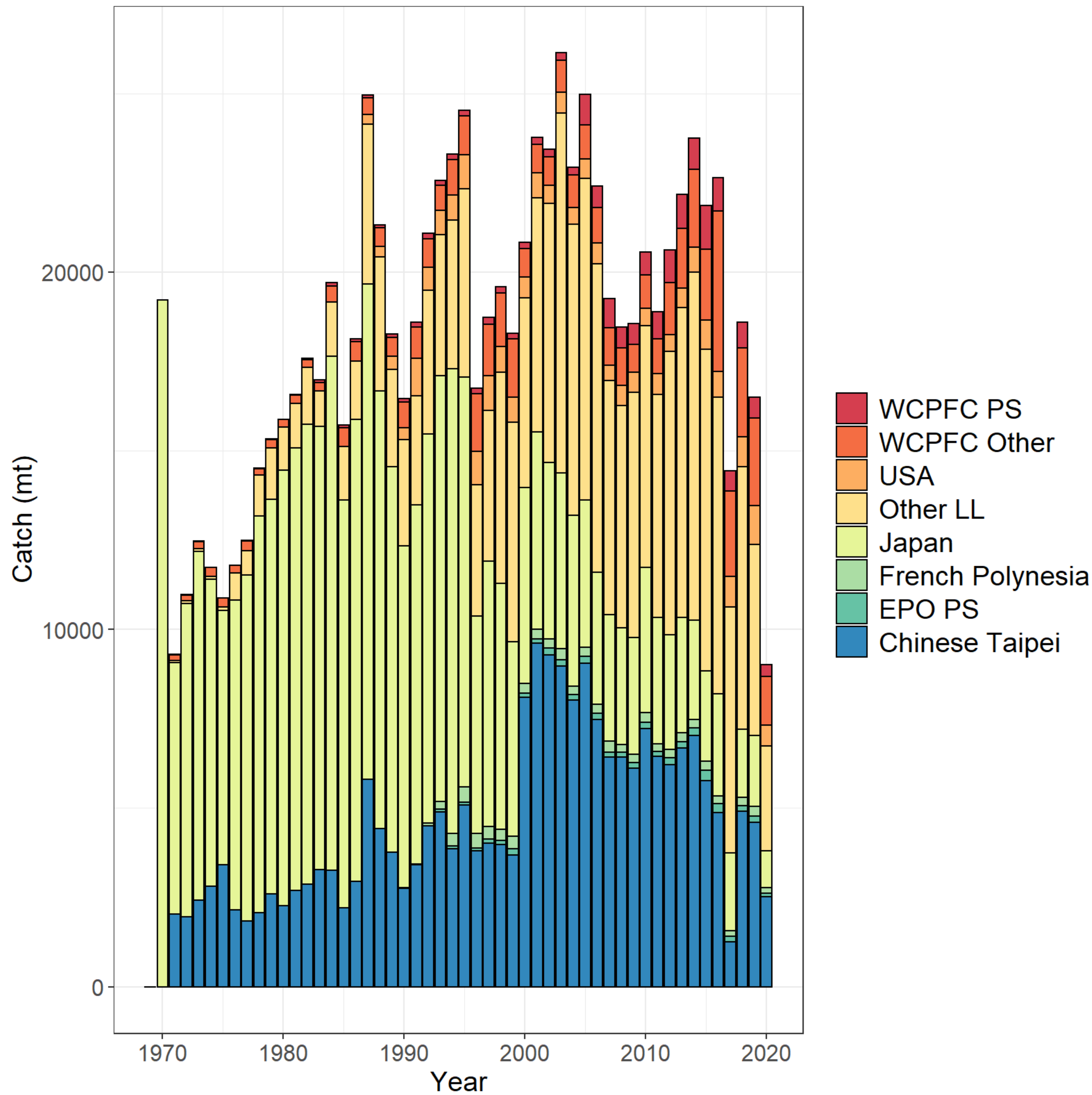


Figure 1. Annual catch biomass (tonnes, mt) of Pacific blue marlin (*Makaira nigricans*) by country for Japan, Chinese Taipei, the U.S.A., and all other countries during 1975-2019.

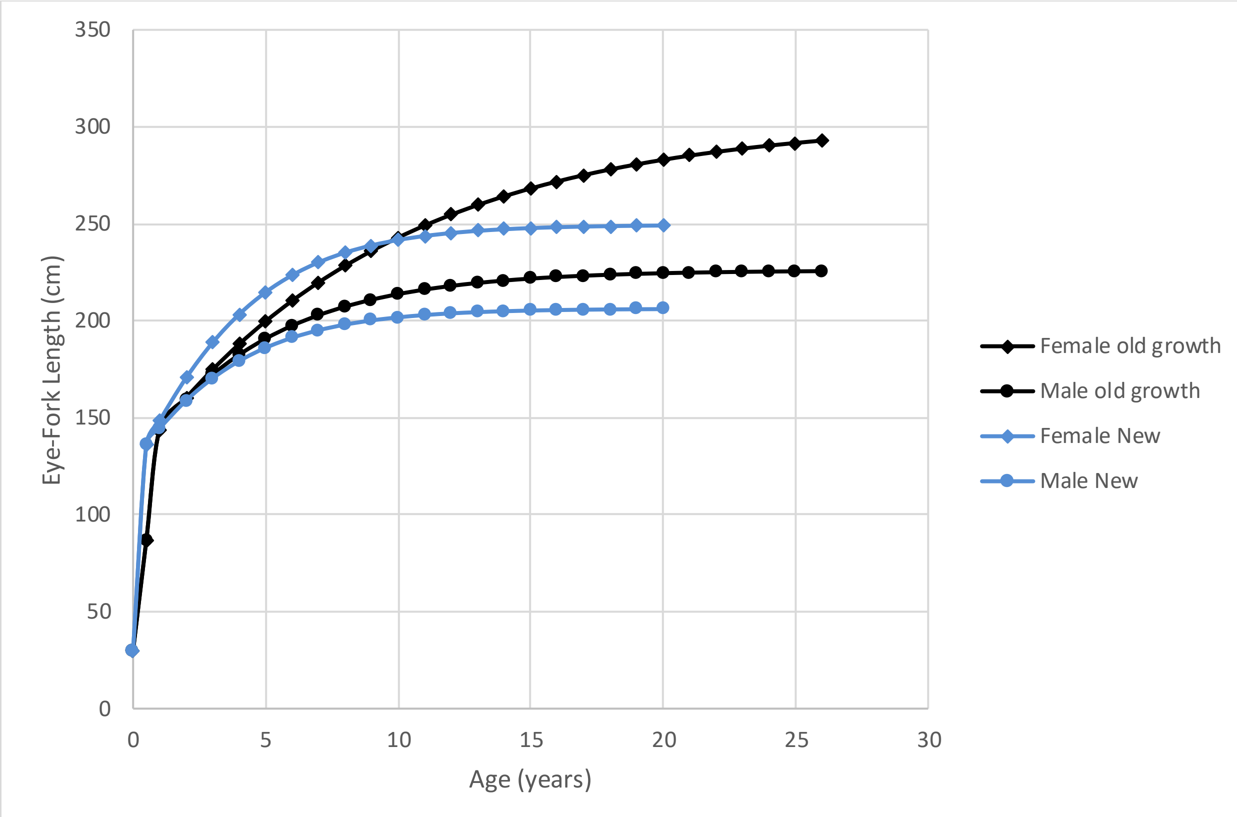


Figure 2. Length-at-age for Pacific blue marlin from the old growth model (von-Bertalanffy curve, black lines) and the new growth model (Richards curve, blue lines) by sex (females diamonds, males circles) used in the 2021 assessment..

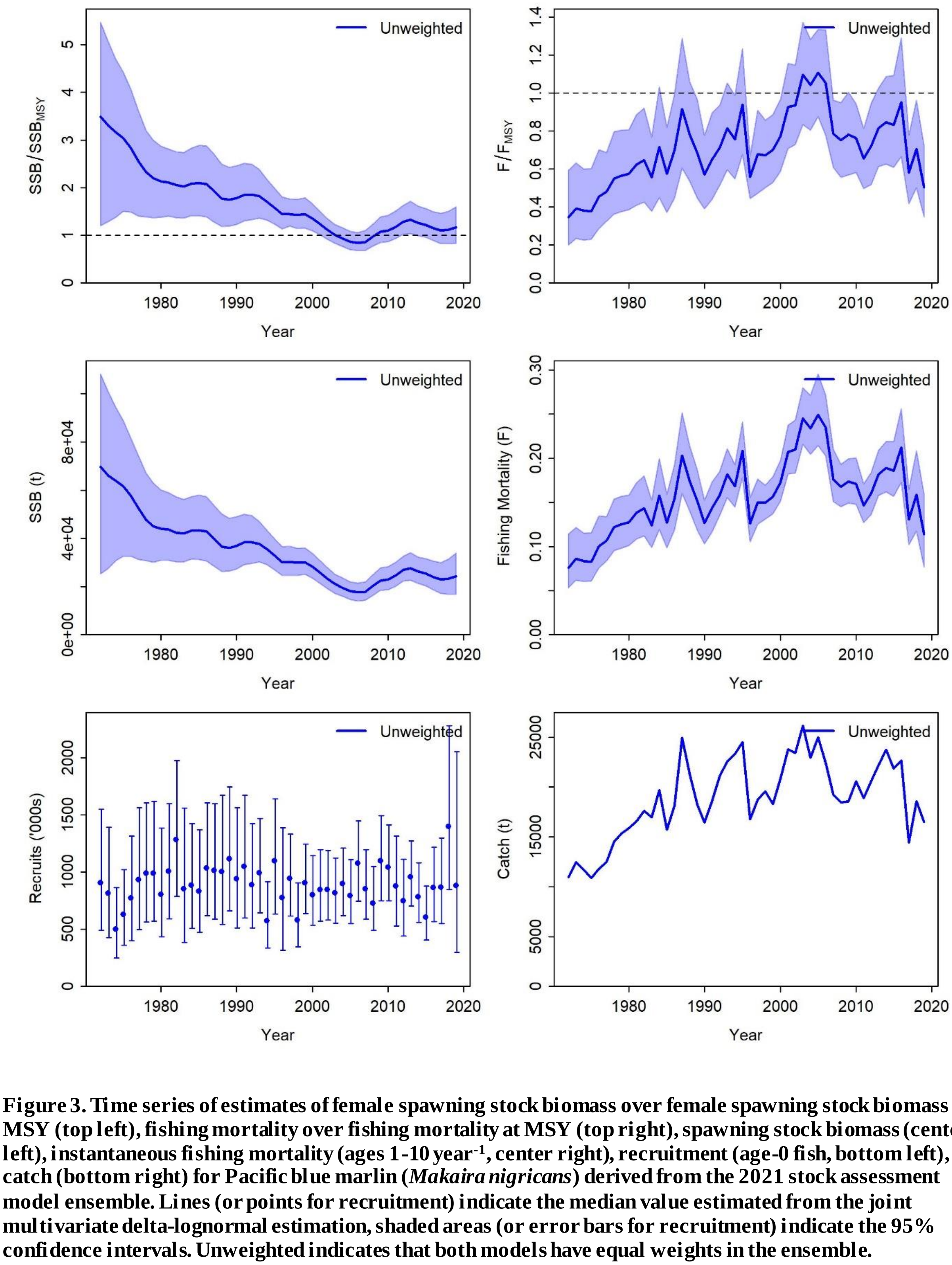


Figure 3. Time series of estimates of female spawning stock biomass over female spawning stock biomass at MSY (top left), fishing mortality over fishing mortality at MSY (top right), spawning stock biomass (center left), instantaneous fishing mortality (ages 1-10 year^{-1}, center right), recruitment (age-0 fish, bottom left), and catch (bottom right) for Pacific blue marlin (*Makaira nigricans*) derived from the 2021 stock assessment model ensemble. Lines (or points for recruitment) indicate the median value estimated from the joint multivariate delta-lognormal estimation, shaded areas (or error bars for recruitment) indicate the 95% confidence intervals. Unweighted indicates that both models have equal weights in the ensemble.

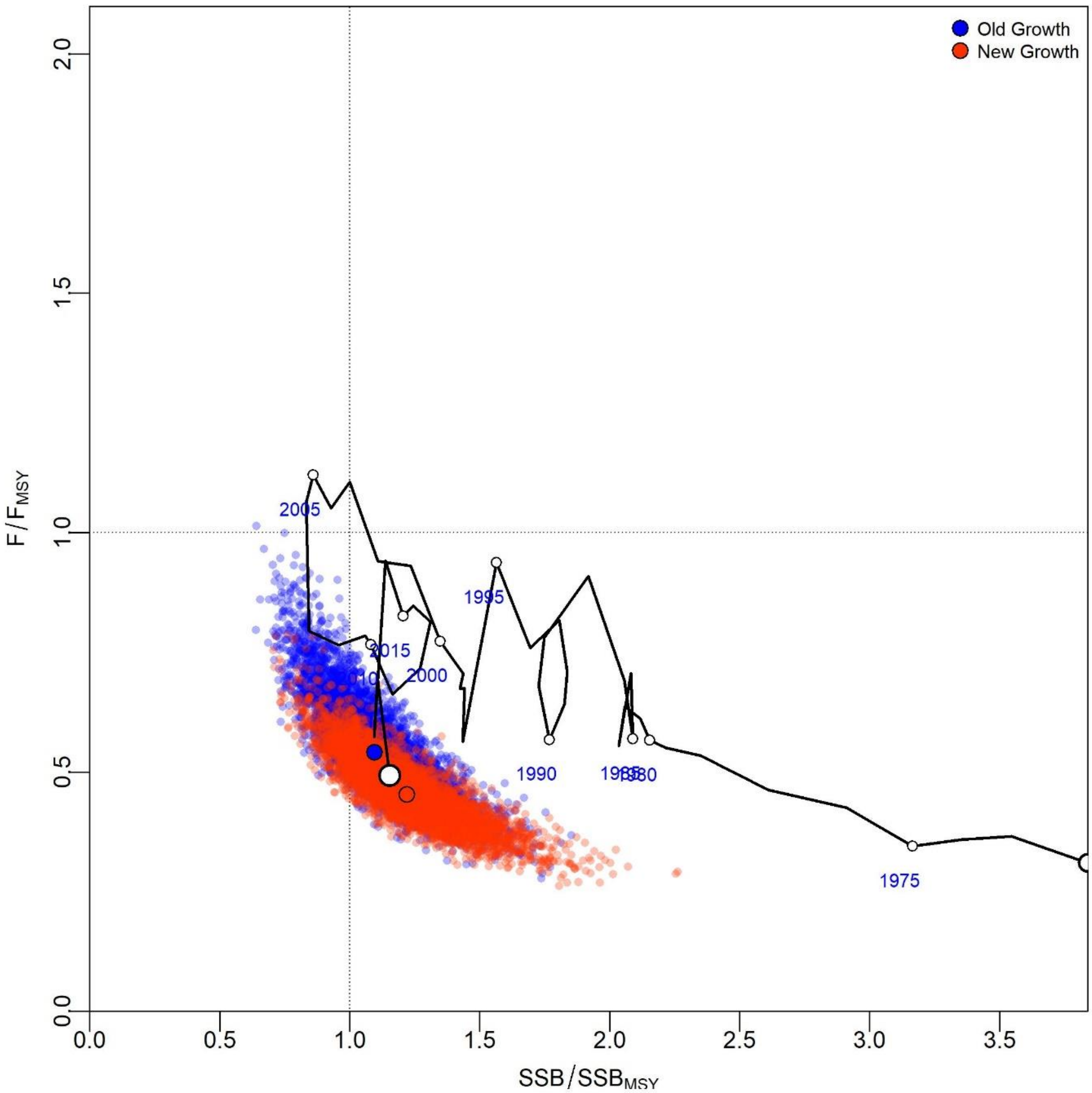


Figure 4. Kobe plot of the time series of estimates of relative fishing mortality (average of age 1-10) and relative spawning stock biomass of Pacific blue marlin (*Makaira nigricans*) during 1971-2019. The white circle denotes the delta-lognormal multivariate estimate of the ensemble model in 2019, blue dots indicate the final year stock status of the old growth model with the 10,000 multivariate draws, and red dots indicate the final year stock status of the new growth model with the 10,000 multivariate draws.

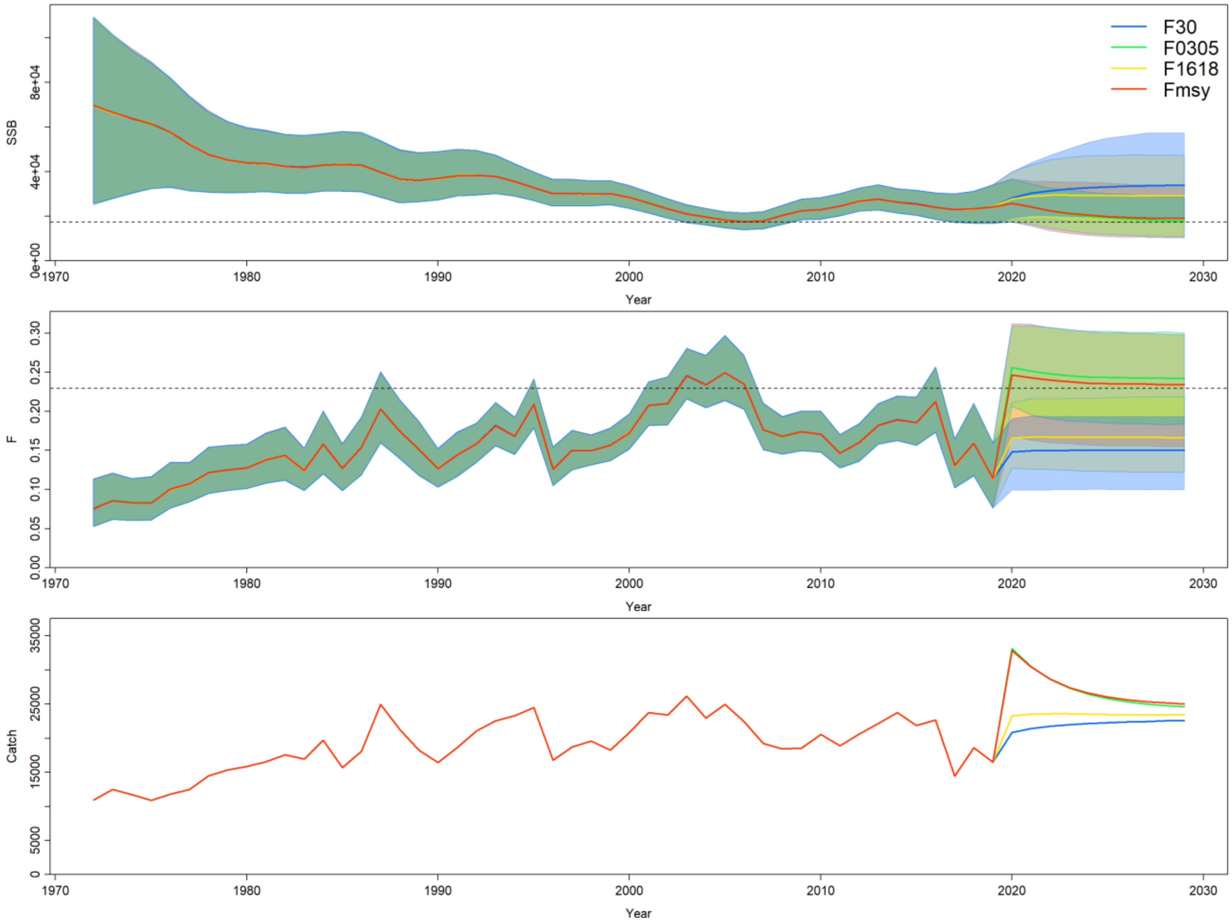


Figure 5. Historical and projected trajectories of spawning biomass and total catch from the Pacific blue marlin ensemble models based upon the four F scenarios: projected spawning biomass, dotted line indicates SSB_{MSY}, shading indicates 95% confidence intervals (top); projected instantaneous fishing mortality (ages 1-10 year^{-1}), dotted line indicates F_{MSY}, shading indicates 95% confidence intervals (center); and projected catch (tonnes, mt; bottom). Green indicates scenario 1, $F_{2003\text{-}2005}$; red indicates scenario 2, F_{MSY}; yellow indicates scenario 3, $F_{2016\text{-}2018}$; and blue indicates scenario 4, $F_{30\%}$. The list of projection scenarios can be found in Table 3.

3.3.4 Western and Central North Pacific Swordfish Stock Status and Conservation Information

H. Ijima, the BILLWG Chair, noted that the WCNPO SWO stock was last assessed in 2018 and that the next assessment is planned for 2023.

The Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC20 (see Section 3.3.3, pp. 37-39 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables and slight clarifying modifications.

Stock Status

Estimates of total stock biomass show a relatively stable population, with a slight decline until the mid-1990s followed by a slight increase since 2000. Population biomass (age-1 and older) averaged roughly 97,919 t in 1974-1978, the first 5 years of the assessment time frame, and has declined by only 20% to 71,979 t in 2016. Female SSB was estimated to be 29,403 t in 2016, or about 90% above SSB_{MSY}. Fishing mortality on the stock (average F, ages 1 – 10) averaged roughly F = 0.08 yr^{-1} during 2013-2015, or about 45% below F_{MSY}. The estimated SPR (the predicted spawning output at the current F as a fraction of unfished spawning output) is currently SPR_{2016}= 45%. Annual recruitment averaged about 717,000 fish during 2012-2016, and no long-term trend in recruitment was apparent. Overall, the time series of spawning stock biomass and recruitment estimates show a stable spawning stock biomass and a fluctuating pattern without trend for recruitment. The Kobe plot depicts the stock status relative to MSY-based reference points for the base case model and shows that spawning stock biomass declined to almost the MSY level in the mid-1990s, but SSB has remained above SSB_{MSY} throughout the time series.

Biomass status is based on female SSB in the 2018 benchmark assessment, whereas in the 2014 update assessment biomass status was based on exploitable biomass (effectively age-2+ biomass). It is also important to note that there are no currently agreed upon reference points for the WCNPO SWO stock and that retrospective analyses show that the assessment model appears to underestimate spawning stock biomass in recent years.

Based on these findings, the following information on the status of the WCNPO SWO stock is provided:

1. **The WCNPO SWO stock has produced annual yields of around 10,200 t per year since 2012, or about two-thirds of the MSY catch amount;**
2. **There is no evidence of excess fishing mortality above F_{MSY} ($F_{2013-2015}$ is 45% of F_{MSY}) or substantial depletion of spawning potential (SSB_{2016} is 87% above SSB_{MSY});**
3. **Overall, the WCNPO SWO stock is not likely overfished and is not likely experiencing overfishing relative to MSY-based or 20% of unfished spawning biomass-based reference points.**

Conservation Information

Stock projections were conducted using a two-gender projection model. The five stock projection scenarios were: (1) F status quo, (2) F_{MSY}, (3) F at 0.2*$SSB_{F=0}$, (4) $F_{20\%}$, and (5) $F_{50\%}$. These projection scenarios were applied to the base case model results to evaluate the impact of alternative levels of fishing intensity on future spawning biomass and yield for SWO in the WCNPO. The projected recruitment pattern was generated by stochastically sampling the estimated stock-recruitment model from the base case model. The projection calculations employed model estimates for the multi-fleet, multi- season, size- and age-selectivity, and structural complexity in the assessment model to produce consistent results.

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

1. **The results show that projected female spawning biomass is expected to increase under all of the harvest scenarios, with greater increases expected under lower fishing mortality rates; and**
2. **Similarly, projected catch is expected to increase under each of the five harvest scenarios, with greater increases expected under higher fishing mortality rates.**

3.3.5 Eastern Pacific Swordfish Stock Status and Conservation Information

H. Ijima, the BILLWG Chair, noted that the EPO SWO stock was last assessed in 2018 and that the IATTC is planning an assessment based on new boundaries in 2022.

Discussion

The Plenary discussed the proposed change in stock boundaries for swordfish at length. It was noted that IATTC is planning to conduct an assessment for the EPO stock south of 10˚N latitude and east of 150˚W longitude. The BILLWG has proposed conducting a WCNPO SWO assessment including the EPO area southeast of the current stock boundary to the Americas as a separate area. The BILLWG Chair explained that the proposed change to the stock boundaries is based on new movement information from tagging studies (Sepulveda et al. 2020[4] ; BILLWG discussion summarized in **ISC/21/ANNEX/08**). It was also noted that there may be some stock mixing between WCNPO and EPO SWO in the roughly triangular area defined by the current stock boundary, 10˚N latitude, and the coast of the Americas.

It was also noted that SPC-OFP is planning an assessment of the SWO stock in the South Pacific west of 150˚W longitude for the WCPFC. The BILLWG noted that a more detailed analysis would need to be undertaken to incorporate fully the newest data on swordfish stock boundaries in order to produce a scientifically supported new stock boundary. The Plenary recommended that the BILLWG, IATTC scientific staff, and SPC-OFP staff closely coordinate on defining stock boundaries in preparation for assessments to ensure a consistent approach and scientifically defensible boundaries.

The Plenary noted that the current stock status and conservation advice for EPO SWO, carried forward from ISC20 is based on the pre-existing stock boundary and is inconsistent with stock boundaries proposed for future assessments in the north and south EPO.

Stock Status and Conservation Information

The Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC20 (see Section 3.3.4, pp. 39-40 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables.

[4] Sepulveda, C.A,, Wang, .M, Aalbers, S.A., and Alvarado-Bremer, J.R., 2020. Insights into the horizontal movements, migration patterns, and stock affiliation of California swordfish. Fisheries Oceanography 29:152-168.

Stock Status

Exploitable biomass (age 2+) of the EPO SWO stock decreased during the 1969-1995 period and increased from 31,000 t in 1995 to over 60,000 t by 2010, generally remaining above B_{MSY}. Harvest rates were initially low, have had a long-term increasing trend, and likely exceeded H_{MSY} in 1998, 2002, 2003, as well as in 2012, the terminal year of the last stock assessment.

Based on these findings, the following information on the status of the EPO SWO stock is provided:

1. **No target or limit reference points have been established for the EPO SWO stock under the auspices of the IATTC. Stock status is assessed relative to MSY-based reference points;**
2. **The Kobe plot shows that overfishing likely occurred (>50%) relative to potential MSY-based reference points in the late 1990s and early 2000s and from 2010 to 2012;**
3. **There was a 55% probability that overfishing occurred in 2012, but there was less than a 1% probability that the stock was overfished relative to MSY-based reference points.**

Conservation Information

Stochastic projections for the EPO SWO stock show that exploitable biomass will likely have a decreasing trajectory during 2014-2016 under the eight harvest scenarios examined. Under the high harvest rate scenarios (status quo catch, maximum observed harvest rate, 150% of H_{MSY}), exploitable biomass was projected to decline to 31,170 t (B_{MSY}) by 2016 with corresponding harvest rates above H_{MSY}. In comparison, under the status quo harvest rate scenario, exploitable biomass was projected to decline to 40,000 t by 2016, well above the B_{MSY} level. Overall, the projections showed that if recent high catch levels (9,700 t) persist, then exploitable biomass will decrease and a moderate risk (50%) of overfishing will continue to occur.

The risk analyses for harvesting a constant catch of EPO SWO during 2014-2016 showed that the probabilities of overfishing and becoming overfished increased as projected catch increased in the future. Maintaining the current (2010-2012) catch of EPO SWO of approximately 9,700 t would lead to a 50% probability of overfishing in 2016 and a less than 1% probability of the stock being overfished in 2016.

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

1. **For the EPO SWO stock, overfishing may have occurred (<50%) from 2010 to 2012, and the average yield of roughly 10,000 t in those years, or almost two times higher than the estimated MSY, is not likely to be sustainable in the long term;**
2. **While biomass of the EPO stock appears to be nearly twice B_{MSY}, any increases in catch above recent (3-year average 2010-2012) levels should consider the uncertainty in stock structure and unreported catch.**

3.3.6 Pacific Striped Marlin Stock Status and Conservation Information

H. Ijima, Chair of the BILLWG, noted that WCNPO MLS was last assessed in 2019.

Stock Status and Conservation Information

The Plenary reviewed and agreed to forward the same stock status information that was adopted by ISC20 (see Section 3.3.2, pp. 33-37 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables and slight clarifying modifications. Furthermore, the Plenary agreed to an addition to the conservation information adopted by ISC20 in light of questions and clarifications regarding the rebuilding plan (see Section 3.3.1 of this report) initiated by the WCPFC. The ISC Plenary also reiterates the concerns expressed by the BILLWG in their special comments about the stock assessment (**ISC/19/ANNEX/11**) that are reproduced below.

Stock Status

Biomass (age 1 and older) for the WCNPO MLS stock decreased from 17,000 t in 1975 to 6,000 t in 2017. Estimated fishing mortality averaged F=0.97 yr^{-1} during the 1975-1994 period with a range of 0.60 to 1.59 yr^{-1}, peaked at F=1.71 yr^{-1} in 2001, and declined sharply to F=0.64 yr^{-1} in the most recent years (2015-2017). Fishing mortality has fluctuated around F_{MSY} since 2013. Compared to MSY-based reference points, the current spawning biomass (average for 2015-2017) was 76% below SSB_{MSY} and the current fishing mortality (average for ages 3 – 12 in 2015-2017) was 7% above F_{MSY} .

Based on these findings, the following information on the status of the WCNPO MLS stock is provided:

1. **There are no established reference points for WCNPO MLS;**
2. **Results from the base case assessment model show that under current conditions the WCNPO MLS stock is overfished and is subject to overfishing relative to MSY-based reference points.**

Conservation Information

The status of the WCNPO MLS stock shows evidence of substantial depletion of spawning potential (SSB_{2017} is 62% below SSB_{MSY}), however fishing mortality has fluctuated around F_{MSY} in the last four years. The WCNPO MLS stock has produced average annual yields of around 2,100 t per year since 2012, or about 40% of the MSY catch amount. However, the majority of the catch are likely immature fish. All the projections show an increasing trend in spawning stock biomass during the 2018-2020 period, with the exception of the high F scenario under the short-term recruitment scenario. This increasing trend in SSB is due to the 2017 year class, which is estimated from the stock-recruitment curve and is more than twice as large as recent average recruitment.

Based on these findings and the ISC conclusion on recruitment scenarios, the following conservation information is provided:

1. **In response to a request from NC15, both long-term and short-term recruitment scenarios were evaluated. The ISC concluded that the short-term recruitment model was the most appropriate model to use for conducting stochastic stock projections for WCNPO MLS because the time trend in the recruitment is not captured by the long term recruitment scenario;**
2. **If the stock continues to experience recruitment consistent with the short term recruitment scenario (2012-2016), then catches must be reduced to 60% of the WCPFC catch quota from CMM 2010-01 (3,397 t) to 1,359 t in order to achieve a 60% probability of rebuilding to 20%SSB_0=3,610 t by 2022. This change in catch corresponds to a reduction of roughly 37% from the recent average yield of 2,151 t.**
3. **The Interim Rebuilding Plan for North Pacific Striped Marlin (Attachment L, WCPFC16 Summary Report) was adopted by WCPFC16 in 2019. The ISC responded to several technical questions during ISC21 and based on these responses (see Section 3.3.1 and ISC/21/ANNEX/08) recommends that the next WCNPO MLS stock assessment be completed in 2022 followed by updating of the rebuilding plan using the latest scientific information. Further, the ISC seeks clarification prior to the assessment on whether or not the rebuilding target, 20%$SSB_{F=0}$, is based on dynamic biomass. If the rebuilding target is based on dynamic biomass, then a target rebuilding date will be needed for the projections to support the rebuilding plan.**

It was also noted that retrospective analyses (**ISC/19/ANNEX/11**) show that the assessment model appears to overestimate spawning potential in recent years, which may mean the projection results are ecologically optimistic.

Special Comments

The WG achieved a base-case model using the best available data and biological information. However, the WG recognized uncertainty in some assessment inputs including drift gillnet catches and initial catch amounts, life history parameters such as maturation and growth, and stock structure.

Overall, the base case model diagnostics and sensitivity runs show that there are some conflicts in the data (**ISC/19/ANNEX/11**). When developing a conservation and management measure to rebuild the resource, it is recommended that these issues be recognized and carefully considered, because they affect the perceived stock status and the probabilities and time frame for rebuilding of the WCNPO MLS stock.

Research Needs

To improve the stock assessment, the WG recommends continuing model development work, to reduce data conflicts and modeling uncertainties, and reevaluating and improving input assessment data.

3.4 Sharks

3.4.1 SHARKWG Report and Review of Assignments

M. Kai, SHARKWG Chair, provided a summary of SHARKWG activities over the past year (**ISC/21/ANNEX/04**). The focus of the SHARKWG was mainly on SMA with the goal of completing an indicator-based analysis by the ISC21 Plenary. This indicator-based analysis was requested in response to the ISC20 Plenary approving a change in the schedule for benchmark stock assessments of BSH and SMA from 3 to 5 years. The SHARKWG met virtually 22-26 February 2021, to conduct the SMA indicator-based analysis in addition to the discussing administrative matters and planning future SHARKWG activities. The SHARKWG also held an online meeting before the full meeting (17 September 2020) to (1) discuss which indicators should be used for SMA and (2) to discuss how an indicator approach should be presented. The WG decided to use annual catch and standardized CPUE up to 2019 as key indicators, supplemented by size-frequency data. The purpose of the analysis was to detect major changes in abundance and fishing pressure as triggers for a new assessment rather than updating stock status and conservation information based on the results.

The WG Chair briefly presented highlights of the WG meetings to the Plenary; **ISC/21/ANNEX/04** contains the report of the 22-26 February 2021 SHARKWG meeting and the 17 September 2020 intersessional meeting. The WG Chair expressed appreciation to all participants in the SHARKWG meeting for their hard work at the meetings and during the intersessional webinar, on the SMA indicator-based analysis (**ISC/21/ANNEX/05**).

In conclusion, there were no obvious signs of major shifts in the tracked indicators that would necessitate a revision to the current stock assessment schedule for SMA. The SHARKWG therefore plans to conduct the next benchmark stock assessment for SMA in 2024, as scheduled.

The WG proposed the following tentative meeting schedule to accomplish its future work.

Potential Timing	Location	Purpose
Oct.-Dec. 2021	Japan or Chinese Taipei (depending on COVID-19 situation)	BSH data preparatory for stock assessment
Dec. 2021-Feb 2022	online	BSH pre-stock assessment meeting
Mar,-May 2022	TBD	BSH stock assessment meeting

Discussion

The SHARKWG described two issues in the previous BSH stock assessment that will be addressed in the upcoming assessment scheduled for 2022. First, species-specific catch data are unavailable for most of the Japanese fleet prior to 1994 and catch data from the Japan high seas driftnet fishery are particularly uncertain. Second, the stock-recruit relationship was poorly specified in the previous assessment. The low fecundity of BSH has made it difficult to specify the appropriate relationship. The WG will update the growth curve, age-at-maturity, and the age-specific mortality schedule to improve the estimate of the stock-recruit relationship.

The Plenary approved the SHARKWG workplan for 2021-22.

3.4.2 Shortfin Mako Shark Indicator Analysis

M. Kai, SHARKWG Chair, presented the results of the indicator-based analysis of SMA in the NPO conducted in 2021 (**ISC/21/ANNEX/05**). A benchmark stock assessment was completed in 2018 with the next full benchmark scheduled for 2024. In the interim, an indicator-based analysis was conducted to monitor key indicators for signs of potential changes in the stock abundance or fisheries dynamics that could warrant a shift in the schedule for the next benchmark assessment. For the present analysis, annual trends in all available catch data (F1-F19) from 1957 to 2019 and seven abundance indices (S1-S7) from 1992-2019 were visually inspected. Length frequency data were also used alongside the catch and the abundance indices as supplemental information for the indicator-based analysis.

Catch was estimated for multiple fleets and nations based on the best available information. Catch estimates for each fishery were made based on fishing effort, knowledge of the species composition of the catch, estimated CPUE, and scientific knowledge of the operations and catch history. Species-specific SMA catch was available for all major fisheries since 1993; however, catch for the early period, from 1957 up to 1993, is highly uncertain. The highest catches came from Taiwan (F7-9), Japan (F10-14), and Mexico (F15-16) (Figure 6). After 2016, the last year of data in the 2018 benchmark stock assessment, the catch amount in 2019 reached its second highest value during the last decade. Recent increases in annual catches from 2017 to 2019 may be a sign of an increase in population size; however, this increase also could be explained by an increase in fishing pressure. The uncertainty surrounding this uptick in recent catch makes current catch data alone insufficient for describing the stock status of SMA in the NPO.

The four major abundance indices (S1: US Hawaii longline shallow-set; S3: Taiwan longline large-scale; S5: Japan research and training vessels; and S7: Mexico observer for longline) used in the base case benchmark stock assessment in 2018 were also used in this analysis as key indicators to determine whether the next benchmark stock assessment, scheduled for 2024, should be expedited. The scaled CPUEs showed a stable and slightly increasing trend in the four major fleets (Figure 7). A five-year moving average of CPUE, an approach used to reduce the effect of large fluctuations in CPUEs from year to year, was also used to examine trends in the abundance indices. The moving average of CPUE (Figure 8) reflected the trends of annual CPUEs with more smoothing (Figure 7). The moving average of CPUE for three surveys (S1, S3, and S5) showed an increasing trend throughout the period for which data were available. In contrast, the moving average of the S7 CPUE index showed a slight decrease up until 2018, followed by a large increase in 2019.

Percent changes in the moving average of annual CPUE over the long-term (the whole period for which CPUE data was available) and over the short term (the most recent 5 years) were used to evaluate historical and recent changes in the indices of relative abundance for the four major fleets. The percent change in the moving average of CPUE in the long-term series for four major fleets indicated positive values while the percent change in the short-term series indicated slightly negative values for S3 and S7 (Table 4). These results showed that the indices of relative abundance of SMA in the NPO exhibited no signals of population decline since the 1990s.

In conclusion, based on updated data for the abundance indices and length frequencies used in the base case benchmark assessment of SMA in 2018, no signs of shifts in stock abundance or fishery dynamics were apparent. As such, the SHARKWG concluded that there was no reason to shift the schedule for the next benchmark stock assessment of SMA, currently scheduled for 2024.

As a research need, threshold values of key indicators (i.e., indices of relative abundance) should be explored to help in determining when shifts may be needed in the benchmark stock assessments schedule.

<u>**Discussion**</u>

The Plenary discussed the conditions under which indicator analyses like the just completed SMA analysis, should be carried out. This discussion of included workload considerations relative to the usefulness of the information derived for determining a need to expedite a benchmark assessment for a stock. The history of the use of indicator analyses by the ISC was reviewed. Generally, the rationale for conducting these analyses relates to the shift from a three-year to a five-year assessment cycle for selected stocks. The shift in the assessment cycle for these stocks is premised on information indicating the stocks are healthy and trends in status are stable.

The Plenary agreed that a specified set of rules and procedures should be adopted to decide the timing and frequency of these indicator analyses. One option discussed is to develop a set of criteria to determine whether the results of the most recent benchmark stock assessment indicate the need to conduct an interim indicator analysis. Another option is to simply default to conducting an indicator analysis at the midpoint of a five-year assessment cycle. This latter option would be premised on a methodology that does not demand substantial work that would impinge on other workload priorities.

The Plenary tasked the WG to develop recommendations on a decision framework and process for conducting indicator analyses.

Table 4. Percent change of moving average of CPUE for four major fleets (S1, S3, S5 and S7) used in the benchmark stock assessment in 2018. Moving averages were calculated using the mean value of CPUE for five years. The percentage indicates the positive and negative change in the moving average of CPUE between the start and end years from long term (all years with data) and short term (the most recent 5 years). The last year of S5 was removed from the calculation due to data from 2020 being preliminary. S1_US_SS (US Hawaii longline shallow-set), S3_TW_LALL (Taiwan longline large-scale), S5_JP_RTV (Japan research and training vessels), and S7_MX_OBS (Mexico observer for longline)..

Period	**S1**	**S3**	**S5**	**S7**
Long term (all years with data)	16%	39%	93%	10%
Short term (the most recent 5 years)	23%	-13%	47%	-5%

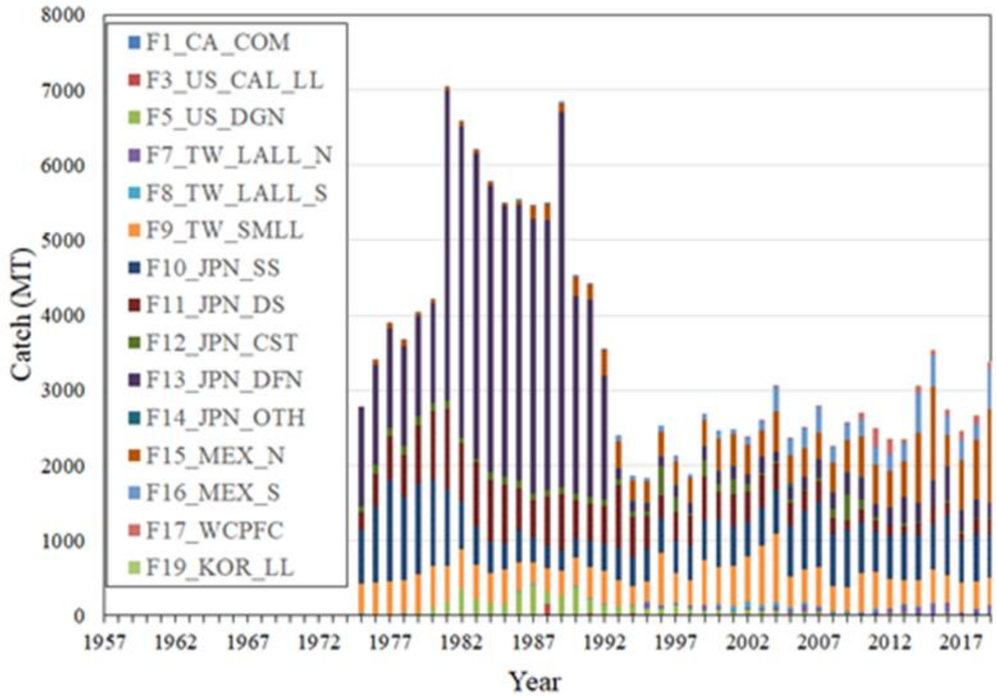


Figure 6. Annual catch (tonnes, MT) of shortfin mako in the North Pacific Ocean by fishery (fleet) from 1954 to 2019. Catch of some fleets are removed from this figure due to different units of catch.

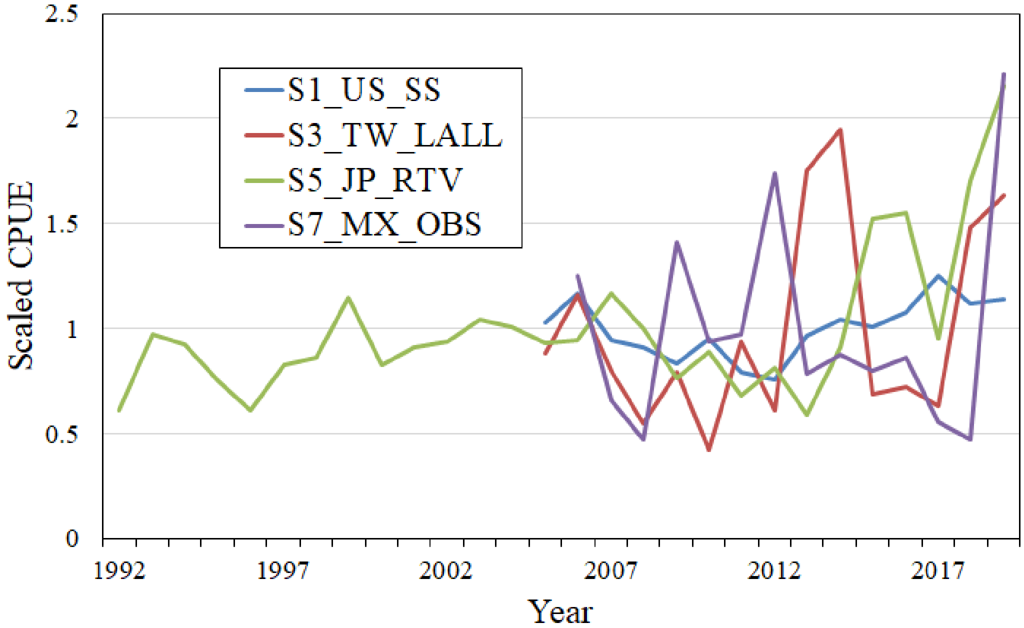


Figure 7. Annual indices of relative abundance of shortfin mako in the North Pacific Ocean from 1992 to 2019 (CPUE of each year relative to average CPUE) for four major fleets (S1, S3, S5 and S7) used in the previous benchmark stock assessment in 2018. S1_US_SS (US Hawaii longline shallow-set), S3_TW_LALL (Taiwan longline large-scale), S5_JP_RTV (Japan research and training vessels), and S7_MX_OBS (Mexico observer for longline).

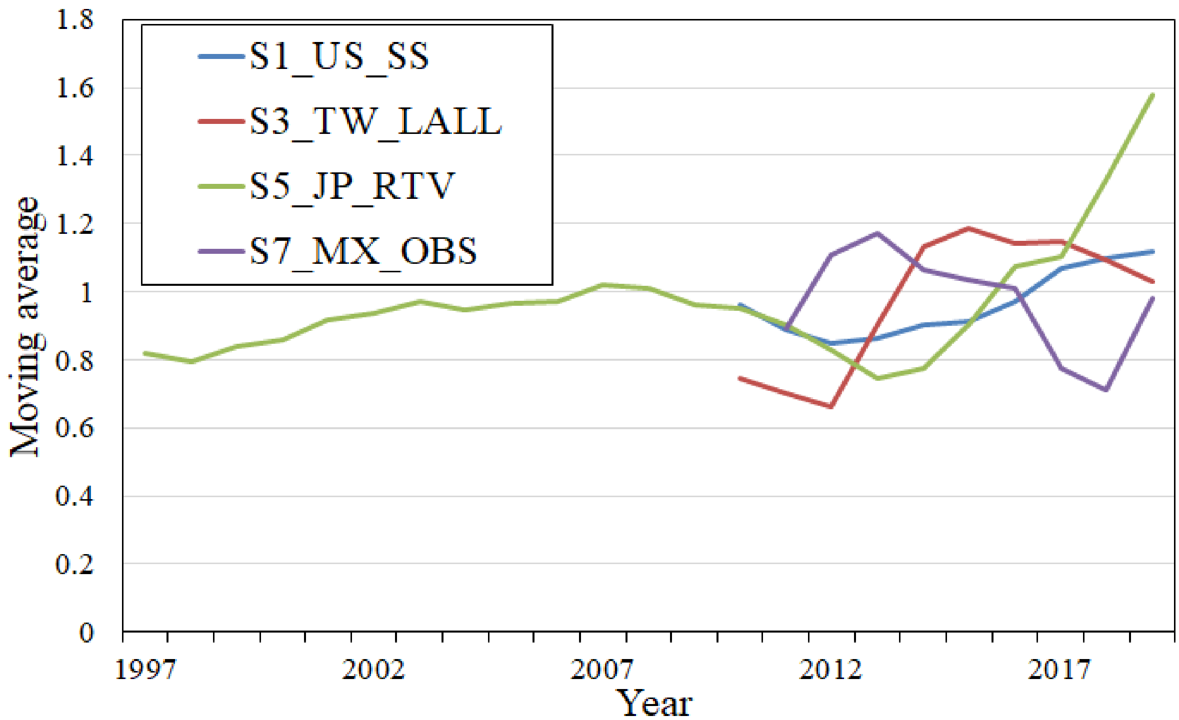


Figure 8. Annual 5-year moving average of CPUE for major fleets (S1, S3, S5 and S7) used in the previous benchmark stock assessment in 2018. S1_US_SS (US Hawaii longline shallow-set), S3_TW_LALL (Taiwan longline large-scale), S5_JP_RTV (Japan research and training vessels), and S7_MX_OBS (Mexico observer for longline).

3.4.3 Blue Shark Stock Status and Conservation Information

M. Kai, SHARKWG Chair, noted that an update stock assessment was completed in 2019 and that the next benchmark stock assessment is scheduled for completion in 2022.

Stock Status and Conservation Information

The Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC20 (see Section 3.4.2, pp. 42-47 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables.

Target and limit reference points have not yet been established for pelagic sharks in the Pacific Ocean by either the WCPFC or the IATTC. Stock status is reported in relation to MSY-based reference points. The following information on the status of NP BSH is provided.

Stock Status

1. **Female spawning biomass in 2015 (SSB_{2015}) was 69% higher than at MSY and estimated to be 295,774 t;**

2. **The recent annual fishing mortality ($F_{2012-2014}$) was estimated to be well below F_{MSY} at approximately 38% of F_{MSY};**
3. **The reference run produced terminal conditions that were predominately in the lower right quadrant of the Kobe plot (not overfished and overfishing not occurring).**

Conservation Information

Future projections under different fishing mortality (F) harvest policies (status quo, +20%, -20%, F_{MSY}) show that median BSH spawning biomass in the NPO will likely remain above SSB_{MSY} in the foreseeable future. Other potential reference points were not considered in these evaluations.

The Plenary noted that the average annual catch of BSH by ISC members in 2012-2014 was 29,992 t and that the average annual catch in the 2015-2019 period was 25,742 t. As ISC member countries account for at least 90% of the overall catch, these figures are believed to provide a reliable estimator of catch in North Pacific BSH.

3.4.4 Shortfin Mako Shark Stock Status and Conservation Information

M. Kai, SHARKWG Chair, noted that SMA was last assessed in 2018 and an indicator analysis was completed in 2021.

Stock Status and Conservation Information

Based on the conclusions of the SMA indicatory analysis, the Plenary agreed to forward the stock status and conservation information adopted at ISC20 (see Section 3.4.3, pp. 47-48 in the ISC20 Plenary Report) unchanged, except for the omission of accompanying figures and tables.

Stock Status

The reproductive capacity of the North Pacific SMA stock was calculated as spawning abundance (SA; i.e., number of mature female sharks) rather than spawning biomass, because the number of pups produced is not related to female size (i.e., larger female sharks do not produce more pups). Spawning potential ratio (SPR) was used to describe the impact of fishing on this stock. The SPR of this population is the ratio of SA per recruit under fishing to the SA per recruit under virgin (or unfished) conditions. Therefore, 1-SPR is the reduction in the SA per recruit due to fishing and can be used to describe the overall impact of fishing on a fish stock.

1. **Target and limit reference points have not been established for pelagic sharks in the Pacific Ocean. Stock status is reported in relation to MSY-based reference points.**
2. **The results from the base case model and six sensitivity analyses that represent the most important sources of uncertainty in the assessment show that the NPO shortfin mako stock is likely (>50%) not in an overfished condition and overfishing is likely (>50%) not occurring relative to MSY-based abundance and fishing intensity reference points.**

Conservation Information

Stock projections of biomass and catch of NPO SMA from 2017 to 2026 were performed assuming three alternative constant fishing mortality scenarios: 1) status quo, average of 2013-2015 ($F_{2013-2015}$); 2) $F_{2013-2015}$ + 20%; and 3) $F_{2013-2015}$ - 20%.

Based on these future projections, the following conservation information is provided:

1. **In scenarios where fishing mortality remains constant at $F_{2013-15}$ or is decreased by 20%, then spawner abundance (SA – the number of mature female sharks) is expected to increase gradually;**
2. **If fishing mortality is increased by 20% relative to $F_{2013-2015}$, then SA is expected to decrease in the final years of the projection;**
3. **It should be noted that, given the uncertainty in fishery data and key biological processes within the model, especially the stock recruitment relationship, the models' ability to project into the future is highly uncertain.**

The ISC Plenary notes that the average annual catch of SMA by ISC members was 1,392 t in the 2013-2015 period and decreased to 1,180 t from 2016-2019.

3.5 Observer Comments

Several observers participated in the ISC21 Plenary Sessions and were provided with an opportunity to address the Plenary during each session. Their comments and observations over four sessions are summarized below in the same order as the agenda. These comments have been edited so that they conform to the style of this report, but their content has not been changed.

Pew welcomed the completion of the MSE of NPALB as robust and offering a wide array of harvest strategies for consideration and adoption. Pew asked whether the video presentations being prepared for the WCPFC-SC and WCPFC-NC would be made publicly available to help stakeholders learn more about the MSE.

Pew urged the ISC to move forward with a MSE of PBF. If the ISC is uncertain how to proceed or lacks information to proceed, then Pew urged the ISC to send a clear request for guidance to the IATTC-NC Joint Working Group on PBF Management this year. Pew pointed out that the WCPFC-NC and IATTC have requested that the ISC complete the MSE by 2024 – a request reiterated in 2020 by the WCPFC-NC Chair. The WCPFC harvest strategy for PBF includes a list of management objectives. In 2019, a list of candidate reference points and harvest control rules for testing in the MSE was agreed by the joint working group, as well as a terms of reference to clarify the roles and responsibilities of the ISC and joint working group. Pew expressed concern that relying on the stock assessment and projections for future management is not sufficient as PBF requires a modernized, long-term approach to management. Pew reiterated that the need for the MSE is clear.

WWF Japan welcomed the ISC's decision to discuss at a Sixth Meeting of the IATTC-WCPFC NC Joint Working Group on the lack of input from managers on management objectives and alternative management procedures for PBF, which has contributed to a lack of progress on the

MSE process for this stock. In addition, WWF Japan stressed the importance of continue to improve the accuracy of data collection through actions such as increased observer coverage and electronic monitoring.

Wild Oceans expressed concern about the proposal to move the boundary of the WCNPO SWO stock, asked whether and how recent genetic research was considered, and suggested the ISC work to align the boundaries with the other scientific bodies before the next round of SWO stock assessments.

Wild Oceans sees the expedited MLS assessment as an opportunity for the BILLWG to consider important questions about the stock and rebuilding goals. More specifically, Wild Oceans asked the ISC to consider adjusting the stock assessment and rebuilding plan to account for uncertainty in MLS catch and discards. Recent catch may be significantly above what is reported and scientists should consider including the highest possible value of mortality that includes unreported catch and discards. Additionally, Wild Oceans highlighted the need for further research analyzing how well measures such as release of live marlin, use of circle hooks and other gear modifications can reduce catch and mortality and help achieve the rebuilding goal.

4 REVIEW OF STATISTICS AND DATABASE ISSUES

4.1 STATWG Report

F. Carvalho, the Chair of the STATWG, summarized the STATWG activities since ISC20 (**ISC/21/ANNEX/14**). The STATWG meeting was held virtually on July 6 and 7, 2021 with participants from Canada, Chinese Taipei, Japan, Korea, USA, and the WCPFC. Regarding the status of the STATWG, six of the ten items in the 2020-2021 work plan were completed. The "Data share space" designed for the WGs to share files during their work processes has been activated. The ISC website was updated with scheduled Working Group meetings, working papers, stock assessments, fishery statistics, and the ISC organization chart. The uncompleted workplan items include:

1. Development of error-checking protocols to be used to post-data submission by Data Correspondents to confirm the quality of the data in the database;
2. The STATWG will pursue harmonizing the ISC data submission formats with those used by the WCPFC and the IATTC;
3. The STATWG Steering Group will hold an intersessional meeting or conference call/webinar January 2022 to conduct work to complete this workplan; and
4. The STATWG Chair, Vice-Chair and other interested parties will continue to develop a Non-Disclosure Agreement (NDA) for data sharing requests. This NDA will incorporate comments from ISC20 and will be reviewed at the next STATWG meeting. A standard operating protocol will be developed to handle data sharing.

It was noted that all ISC Members except China have submitted their Category I and II data and metadata. Discrepancies noted from cross-comparisons between the data submitted by Members and the data in their national reports will be distributed to Members for confirmation and correction. Japan revised the catch in weight data "Category 1c" of SMA for 1994-2019 in **ISC21/STATWG/WP/01**. These annual catches estimates are based on annual CPUEs and the proportion of the catches and in this case the proportion of catches attributed to SMA changed. It was noted that species WGs are requested to submit stock assessment data files by November 1 each year for archiving purposes and that this was completed for assessments conducted through 2021. It also was noted that the goal of the stock assessment archive was to increase transparency and to publish the assessment files on ISC researcher's website, which has access restricted to species WG members.

The STAWG Chair discussed the draft NDA for confidential ISC stock assessment data and modeling files. The Chair noted that the draft NDA was a template for a contract between the two parties that outlines confidential data that the parties wish to share for a specified scientific purpose but that the ISC is restricting access. The Chair emphasized that the template would need to be modified for specific applications.

The STATWG discussed the function of the working group. The STATWG members agreed that the STATWG was needed on an ongoing basis in order to (1) maintain the ISC database and the quality of data submitted by members, (2) maintain the proper function of ISC website, and (3) coordinate internal data sharing and develop protocols for answering external data requests, the STATWG is responsible for overseeing these functions in cooperation with WG chairs and members, providing a link to the ISC Plenary, and recommending appropriate actions when needed. Based on discussion at the July 6 and 7th meeting, the STATWG developed a work plan with 9 items as reported in section 6.1 of **ISC/21/ANNEX/14**. The STATWG recommended the following workplan for 2021-22 to the ISC21 Plenary:

1. The DA will continue to distribute the ISC data inventory for Category I, II, and III to ISC Data Correspondents for review by September 30, 2021. The DA will then distribute the ISC data inventory to Chairs of the species WG by October 15, and publish on the ISC website by October 31, 2021.
2. The DA will continue to archive stock assessment files from all 2020-2021 ISC assessments, which are required to be submitted by Chairs of species WG by November 1, 2021.
3. After the Data Correspondents have reviewed and updated their metadata prior to the ISC21 Plenary, this metadata will be published on the ISC researcher's website by August 31, 2021. For 2021-2022, the DA will continue to distribute the WG member's new metadata by March 30, 2022. The Data Correspondents will review and update their new metadata by July 1, 2022 prior to the ISC22 Plenary, and this new metadata will be published on the ISC researcher's website by August 31, 2022.
4. The DA will revise and update the User's Guide for Online Data Submission with the rules for using the data share space on the ISC collaborative research project database and research website. This revised information will be distributed to the Data Correspondents and WG Chairs by December 31, 2021. The DA will conduct training as necessary.
5. The DA and the Chair of the STATWG will annually review the responsibilities, duties and deliverables of the DA to ensure that they are accurate and practical, and revise them as necessary.
6. The DA and Chair of the STATWG will develop error-checking protocols to be used to post-data submission by Data Correspondents to confirm the quality of the data in the

database. This protocol will be reviewed by the STATWG at ISC22.

7. The STATWG will pursue harmonizing the ISC data submission formats with those used by the WCPFC and the IATTC.
8. The STATWG Steering Group will hold an intersessional meeting or conference call/webinar January 2022 to conduct work to complete this work plan.
9. The STATWG Chair, Vice-Chair and other interested parties will continue to develop a NDA for data sharing requests. This NDA will incorporate comments from ISC21 and will be reviewed at the next STATWG meeting. A standard operating protocol will be developed to handle data sharing requests, which will include ISC point of contact information.

Discussion

The Plenary thanked Jon Brodziak for his service as interim Chair of the STATWG, Sung-Il Lee for serving as Vice Chair, and Felipe Carvalho for assuming the role of Chair for the current term.

An interest in harmonizing the data submission formats with those used by WCPFC and IATTC was noted. The Plenary requested the STATWG report back at ISC22 on the use of Category II and III data, including the nature of data requests and usage by both ISC working groups and external parties. In the coming year, the STATWG Chair will formally assess data use.

With reference to the NDA for sharing stock assessment data files (discussed further under agenda item 6.2), currently in development, the Plenary confirmed that in the interim WG chairs who field requests for stock assessment data will consult with the ISC Chair on such decisions.

The Plenary endorsed the STATWG's proposed workplan and the data revision to SMA catches provided by Japan.

4.2 Total catch tables

K. Nishikawa, the Database Administrator, presented the annual catch tables for ISC Member countries for 2019-2020. The catch tables were prepared for the following ISC species of interest: albacore, Pacific Bluefin tuna, swordfish, striped marlin, blue marlin, blue shark, and shortfin mako shark. The catch tables were generated from the ISC database, and are based on Category I data (retained catch and released catch, when available) submitted by Data Correspondents for the major fisheries in the North Pacific Ocean of the member countries. Graphs of the historical catch by country were also presented for each species. Statistics for mean, minimum and maximum catch were also presented for each species for the latest five years. The complete catch tables are included in the ISC Plenary Report in Section 9 and serve as the official ISC catch tables.

5 REVIEW OF MEETING SCHEDULE

5.1 Time and Place of ISC22

The U.S.A. offered to host ISC22, 12-18 July 2022, as an in-person meeting in Kona, Hawaii. Associated WG meetings would be held beginning 8 July. The U.S.A. is exploring the possibility of accommodating a hybrid meeting format (where some Members could join remotely) to address any continuing travel restrictions on Members.

5.2 Time and Place of Working Group Intersessional Meetings

A draft schedule of proposed intersessional meetings was reviewed and amended. Proposed ISC WG and RFMO meetings are shown in the table below. Although some WG meetings are proposed to be in person, they may be switched to an online format due to continuing travel restrictions related to the COVID-19 pandemic. WG Chairs were asked to confirm with the ISC Chair the dates for their proposed meetings as soon as possible so the information can be posted on the ISC website.

	Month	ALBWG	BILLWG	PBFWG	SHARKWG	STATWG	PLENARY	WCPFC	IATTC
2021	**July**							JWG PBF July 26-28 (EPO) July 27-29 (WPO) Online	
	Aug							SC17 Aug 11-19 Online	98th Meeting, Aug 23-27 Managua, Nicaragua
	Sept								
	Oct							NC17 5-7 Oct Japan	
	Nov			PBF Data Prep WKSHP Webinar/Dates TBD	BSH Data Prep WKSHP Webinar/Dates TBD				
	Dec		MLS Data Prep WKSHP Webinar/Date TBD					WCPFC18 Online	

	Month	ALBWG	BILLWG	PBFWG	SHARKWG	STATWG	PLENARY	WCPFC	IATTC
2022	**Jan**					Steering Comm Location/Dates TBD			
	Feb			PBF Assessment WKSHP Location/Date TBD	BSH Pre-assessment WKSHP Webinar/Dates TBD				
	Mar	Assessment Improvements Meeting Date/Location TBD	MLS Stock Assessment WKSHP Location/Date TBD						
	Apr		MLS Rebuilding Plan WKSHP Location/Date TBD		BSH Assessment WKSHP La Jolla/Dates TBD				
	May								13^{th} SAC Meeting Dates TBD
	June								
	July					July 1.5 d in advance of Plenary	July 12-18 July 11 (HOD + Chairs)		

6 ADMINISTRATIVE MATTERS

6.1 ISC Stock Assessment Review Proposal

The U.S.A. presented information on their proposal for advancing additional peer reviews of ISC stock assessments.

In the 2013 review of ISC's function, additional independent reviews of stock assessments were recommended. In 2018 the review of ISC's assessment review process provided recommendations for an additional review process. The purpose of this would be to increase transparency and improve the science. It was noted that the USA supports rigorous peer reviews and values external perspectives to improve science. ISC stock assessments are conducted by groups of highly trained, quantitative scientists. An additional level of independent review would serve to validate methods and approaches the Working Groups have taken, and occasionally identify additional issues of importance.

At ISC19, the Plenary agreed that alternative ways to integrate peer reviews into the stock assessment process and that associated costs should be identified. Following that meeting, the USA worked with the ALBWG Chair and Vice-Chair and the ISC Chair to develop a terms of reference for the review of the ALB assessment prior to ISC20, but the challenges of timing and structuring the review quickly became apparent and a review could not be organized prior to ISC20, given the timing of the albacore assessment.

The U.S.A. proposal identified those challenges, and the pros/cons of two approaches that were considered in the process. It was noted that the current review of ISC assessments is similar to the review processes used by other organizations who assess HMS stocks. Two scenarios presented for review, which have different purposes and differing timing. Scenario 1 was to conduct an additional review after an assessment is complete and prior to Plenary and would provide information on the quality of the assessment before it is considered by management. Scenario 2 is to conduct an additional review after an assessment is complete and following ISC Plenary and would provide information on how to improve the assessment in the future.

Not all assessments would be reviewed. It was noted that ISC could selectively choose which assessments to have reviewed based on a variety of factors, including time lapses since the last review, potential for science to result in new or significant management changes, economic impact, controversy, potential for precedent, and new or innovative research.

The U.S. concluded the presentation by posing several questions to Plenary: Do the 'pros' of an additional review process outweigh the 'cons'? If yes, which scenario would ISC members prefer?

<u>Discussion</u>

The ISC Chair noted that the two scenarios described in the U.S. proposal have different objectives. Scenario 1 is intended to certify a stock assessment as the best available scientific information before consideration for management while Scenario 2 would identify improvements in the methodology that could be incorporated into a future stock assessment.

The Plenary discussed the two approaches but did not reach clear consensus on a preferred process, although the balance of the discussion favored the second scenario where peer review would occur after the Plenary meeting.

The Plenary clarified that the process for selecting a review panel would entail voting on candidates within the slates put forward by each Member funding a panel member rather than across all candidates. This approach is more feasible given the barriers to Member governments funding non-resident personnel.

The Plenary agreed that Members should continue to review the U.S. proposal and consider how to integrate stock assessment peer reviews into the ISC process. Members may further discuss a potential process administratively by email intersessionally. Over the next year the ISC Chair, in consultation with the U.S.A., will further develop the details of the Scenario 2 process, given stronger support for that approach in discussion. The Plenary will resume the discussion at ISC22 with the aim of agreeing on a preferred process.

6.2 Data Sharing Agreement

It was noted that the Plenary discussed this topic at ISC20 without reaching a resolution. A full draft of an NDA and related description of the process for determining access to stock assessment data was not available for review at ISC21 so a Plenary decision was deferred to ISC22. The Chair encouraged members to further consider the issue intersessionally so that substantial progress can be made at ISC22.

The STATWG Chair will investigate procedures used in other RFMOs along with further developing a draft NDA and report back at ISC22.

It was noted that an NDA is usually only required for access to confidential data. The presence of confidential data in stock assessment data files should be confirmed as part of further development of the NDA.

It was also noted that the ISC Operations Manual does not specify a process for sharing confidential stock assessment data and files. The ISC Chair indicated that he would be reviewing the Operations Manual and would bring forward a proposed process at ISC22.

6.3 Working Group Election results

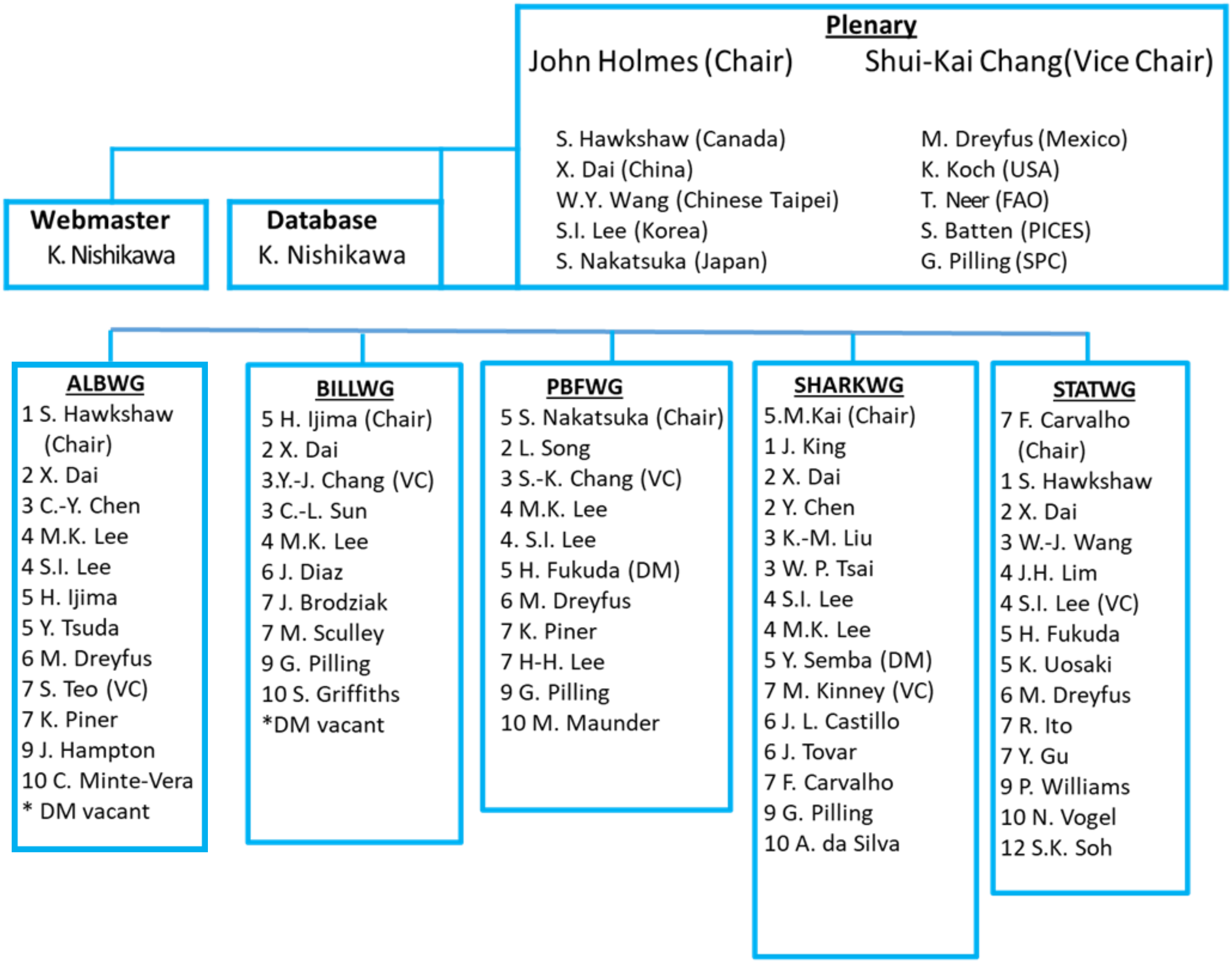
The Plenary reviewed the current WG chair and Vice Chair terms as shown below. It was noted that Sarah Hawkshaw was elected Chair of the ALBWG and Felipe Carvalho was elected STATWG Chair. Mikihiko Kai was elected to a second term as SHARKWG Chair and Michael Kinney to a second term as Vice Chair.

Title	Name	First Election Date	First Term	Second Election Date	Second Term
ISC Chair	John Holmes	Jul-17	2017-2020	Jul-20	2020-2023
ISC Vice Chair	Shui-Kai Chang	Jul-17	2017-2020	Jul-20	2020-2023
ALBWG Chair	Sarah Hawkshaw	May-21	2021-2024		
ALBWG Vice-Chair	Steve Teo	Jul-17	2017-2020	Apr-20	2020-2023
BILLWG Chair	Hirotaka Ijima	Jul-19	2019-2022		
BILLWG Vice-Chair	Yi-Jay Chang	Jul-19	2019-2022		
PBFWG Chair	Shuya Nakatsuka	Mar-19	2019-2022		
PBFWG Vice-Chair	SK Chang	Nov-19	2020-2023		
SHARKWG Chair	Mikihiko Kai	Apr-18	2018-2021	Jul-20	2021-2024
SHARKWG Vice-Chair	Michael Kinney	Apr-18	2018-2021	Jul-20	2021-2024
STATWG Chair	Felipe Carvalho	Jun-21	2021-2024		
STATWG Vice-Chair	Sung Il Lee	Jul-20	2020-2023		

6.4 ISC Organizational Chart

The Plenary reviewed the organizational chart shown below and updated personnel as needed.

ISC Organizational Chart (July 2021)



Working Group Key:

1 Canada 2 China 3 Chinese-Taipei 4 Korea 5 Japan 6 Mexico 7 USA 8 PICES 9 SPC 10 IATTC 11 FAO 12 WCPFC

VC Vice Chair DM Database Manager

This is not a comprehensive list but the main points of contact.

6.5 Other Matters

The ISC Chair thanked the WG Chairs and Vice-Chairs for their leadership and diligent work in advancing the goals of the ISC since ISC20. The quality of the work and science information and advice forwarded to the IATTC and WCPFC-NC by the ISC remains high. It is clear that the WGs have adapted to new methods of working virtually since none have requested sessions in advance of ISC22.

The ISC Chair also noted that he will be focusing on initiatives to move the ISC forward as an organization in 2021-22, including a review of the ISC Operations Manual to improve transparency and accountability, further development of the non-disclosure agreement for confidential stock assessment data and files, and developing more detailed proposals for the external review of ISC stock assessments. All of these proposals will be brought to ISC22 where they will be the subject of vigorous debate.

7 ADOPTION OF REPORT

The Report of the Meeting was adopted.

8 CLOSE OF MEETING

The meeting was closed at 8:30 PM PDT 19 July 2021.

9 CATCH TABLES

Table 5. North Pacific albacore (*Thunnus alalunga*) catches (in metric tons) by ISC member fisheries, 1952-2018. "0"; Fishing effort was reported but no catch. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	CAN		JPN								KOR		MEX		
		Troll	CAN Total	Set-net	Drift gill-net	Longline	Pole and line	Troll	Others	Purse seine	JPN Total	Longline	KOR Total	Others	Purse seine	MEX Total
Retain	1936															
	1937															
	1938															
	1939	129	129													
	1940	2	2													
	1941	35	35													
	1942															
	1943	13	13													
	1944	210	210													
	1945	648	648													
	1946	196	196													
	1947	36	36													
	1948	984	984													
	1949	1,012	1,012													
	1950	961	961													
	1951	86	86													
	1952	71	71	55	-	26,687	41,787	-	237	154	68,920			-	-	-
	1953	5	5	88	-	27,777	32,921	-	132	38	60,956			-	-	-
	1954			6	-	20,958	28,069	-	38	23	49,094			-	-	-
	1955			28	-	16,277	24,236	-	136	8	40,685			-	-	-
	1956	170	170	23	-	14,341	42,810	-	57	0	57,231			-	-	-
	1957	80	80	13	-	21,053	49,500	-	151	83	70,800			-	-	-
	1958	17	17	38	-	18,432	22,175	-	124	8	40,777			-	-	-
	1959	8	8	48	-	15,802	14,252	-	67	0	30,169			-	-	-
	1960	74	74	23	-	17,369	25,156	-	76	0	42,624			-	-	-
	1961	212	212	111	-	17,437	18,639	-	268	7	36,462			39	2	41
	1962	141	141	20	-	15,764	8,729	-	191	53	24,757			0	0	0
	1963	4	4	4	-	13,464	26,420	-	218	59	40,165			0	31	31
	1964	1	1	50	-	15,458	23,858	-	319	128	39,813			-	0	-
	1965	5	5	70	-	13,701	41,491	-	121	11	55,394			-	0	-
	1966	3	3	64	-	25,050	22,830	-	585	111	48,640			-	0	-
	1967	15	15	43	-	28,869	30,481	-	520	89	60,002			-	-	-
	1968	44	44	58	-	23,961	16,597	-	1,109	267	41,992			-	-	-
	1969	161	161	34	-	18,006	31,912	-	925	521	51,398			-	0	-
	1970	1,028	1,028	19	-	16,222	24,263	-	498	317	41,319			-	0	-
	1971	1,365	1,365	5	-	11,473	52,957	-	354	902	65,691	0	0	-	0	-
	1972	390	390	6	1	13,022	60,569	-	638	277	74,513	0	0	0	100	100
	1973	1,746	1,746	44	39	16,760	68,767	-	486	1,353	87,449	4	4	-	0	-
	1974	3,921	3,921	13	224	13,384	73,564	-	891	161	88,237	91	91	0	1	1
	1975	1,400	1,400	13	166	10,303	52,152	-	230	159	63,023	7,050	7,050	0	1	1
	1976	1,331	1,331	15	1,070	15,812	85,336	-	270	1,109	103,612	2,212	2,212	5	36	41
	1977	111	111	5	688	15,681	31,934	-	365	669	49,342	500	500	0	3	3
	1978	278	278	21	4,029	13,007	59,877	-	2,073	1,115	80,122	669	669	0	1	1
	1979	53	53	16	2,856	14,186	44,662	-	1,139	125	62,984	0	0	0	1	1
	1980	23	23	10	2,986	14,681	46,742	-	1,177	329	65,925	592	592	0	31	31
	1981	521	521	8	10,348	17,878	27,426	-	699	252	56,611	0	0	0	8	8
	1982	212	212	11	12,511	16,714	29,614	-	482	561	59,893	4,874	4,874	0	0	0
	1983	200	200	22	6,852	15,094	21,098	-	99	350	43,515	366	366	0	0	0
	1984	104	104	24	8,988	15,053	26,013	-	494	3,380	53,952	1,925	1,925	6	107	113
	1985	225	225	68	11,204	14,249	20,714	-	339	1,533	48,107	2,789	2,789	35	14	49
	1986	50	50	15	7,813	12,899	16,096	-	640	1,542	39,005	3,833	3,833	0	3	3
	1987	56	56	16	6,698	14,668	19,082	-	173	1,205	41,842	1,624	1,624	0	7	7
	1988	30	30	7	9,074	14,688	6,216	-	170	1,208	31,363	799	799	0	15	15
	1989	104	104	33	7,437	13,031	8,629	-	433	2,521	32,084	561	561	0	2	2
	1990	155	155	5	6,064	15,785	8,532	-	248	1,995	32,629	29	29	0	2	2
	1991	140	140	4	3,401	6,664	7,103	-	395	2,652	20,219	4	4	0	2	2
	1992	302	302	12	2,721	19,042	13,888	-	1,522	4,104	41,289	1	1	0	10	10
	1993	139	139	3	287	29,933	12,797	-	897	2,889	46,806	2	2	0	11	11
	1994	1,998	1,998	11	263	29,565	26,389	-	823	2,026	59,077	2	2	0	6	6
	1995	1,761	1,761	28	282	29,050	20,981	856	78	1,177	52,452	13	13	0	5	5
	1996	3,321	3,321	43	116	32,440	20,272	815	127	581	54,394	157	157	0	21	21
	1997	2,166	2,166	40	359	38,899	32,238	1,585	135	1,068	74,324	404	404	0	53	53
	1998	4,177	4,177	41	206	35,755	22,926	1,190	104	1,554	61,776	225	225	0	8	8
	1999	2,734	2,734	90	289	33,339	50,369	891	62	6,872	91,912	98	98	57	0	57
	2000	4,531	4,531	136	67	29,995	21,550	645	86	2,408	54,887	15	15	33	70	103
	2001	5,248	5,248	78	117	28,801	29,430	416	35	974	59,851	63	63	18	0	18
	2002	5,379	5,379	109	332	23,585	48,454	787	85	3,303	76,655	111	111	0	28	28
	2003	6,847	6,847	69	126	20,907	36,114	922	85	627	58,850	146	146	0	29	29
	2004	7,857	7,857	30	61	17,341	32,255	772	54	7,200	57,713	77	77	0	104	104
	2005	4,829	4,829	97	154	20,465	16,133	665	234	850	38,598	419	419	0	0	0
	2006	5,833	5,833	55	221	21,168	15,400	460	42	364	37,710	134	134	0	109	109
	2007	6,040	6,040	30	226	22,381	37,768	519	44	5,682	66,650	136	136	0	40	40
	2008	5,464	5,464	101	1,531	19,092	19,060	549	34	825	41,192	400	400	-	10	10
	2009	5,693	5,693	33	149	21,995	31,172	410	43	2,076	55,878	95	95	-	17	17
	2010	6,527	6,527	42	24	21,167	19,561	588	37	330	41,749	107	107	-	25	25
	2011	5,385	5,385	50	12	20,956	25,704	443	78	480	47,723	78	78	-	0	-
	2012	2,484	2,484	48	26	22,828	33,742	610	129	4,193	61,576	156	156	0	0	0
	2013	5,088	5,088	36	14	19,839	33,568	302	211	1,988	55,958	173	173		0	0
	2014	4,780	4,780	24	11	19,973	29,433	197	197	2,009	51,844	116	116		0	0
	2015	4,391	4,391	17	138	21,013	21,294	239	167	1,072	43,940	38	38		0	0
	2016	2,842	2,842	28	19	16,549	14,435	148	128	3,679	34,986	56	56		0	0
	2017	1,831	1,831	48	40	17,308	20,891	107	119	1,250	39,763	202	202		0	0
	2018	2,717	2,717	13	35	13,191	17,875	78	70	3,039	34,301	101	101			
	2019	2,402	2,402	13	35	13,365	17,889	78	70	3,039	34,489	65	65			
	2020	2,356	2,356	27	9	11,998	8,532	543	95	1,045	22,249	56	56			
Retain catch total		133,888	133,888	2,508	110,319	1,333,600	2,023,329	14,815	23,358	91,979	3,599,908	31,568	31,568	193	913	1,106
Release	2013	1	1													
	2014	7	7													
	2015	14	14													
	2016	2	2													
	2017	2	2													
	2018	18	18									+	+			
	2019	13	13													
	2020	2	2													
Release total		59	59									+	+			
Total		133,947	133,947	2,508	110,319	1,333,600	2,023,329	14,815	23,358	91,979	3,599,908	31,568	31,568	193	913	1,106

Table 5. Continued.

Catch disposition	Year	TWN Set-net	TWN Gill-net (not specified)	TWN Longline	TWN Others	TWN Purse seine	TWN Total	USA Drift gill-net	USA Handline	USA Longline	USA Pole and line	USA Troll	USA Others	USA Purse seine	USA Sport	USA Total	Total
Retain	1936											442				442	442
	1937											1,681				1,681	1,681
	1938											8,594				8,594	8,594
	1939											8,586				8,586	8,715
	1940											6,603				6,603	6,605
	1941											5,412				5,412	5,447
	1942											10,678				10,678	10,678
	1943											17,071				17,071	17,084
	1944											23,957				23,957	24,167
	1945											17,886				17,886	18,534
	1946											10,955				10,955	11,151
	1947											12,235				12,235	12,271
	1948									45		22,457				22,502	23,486
	1949									33		24,901				24,934	25,946
	1950									27		32,746				32,773	33,734
	1951									24		15,629				15,653	15,739
	1952									46		23,843			1,373	25,262	94,253
	1953									23		15,740			171	15,934	76,895
	1954									13		12,246			147	12,406	61,500
	1955									9		13,264			577	13,850	54,535
	1956									6		18,751			482	19,239	76,640
	1957									4		21,165			304	21,473	92,353
	1958									7		14,855			48	14,910	55,704
	1959									5		20,990			+	20,995	51,172
	1960									4		20,100			557	20,661	63,359
	1961									5	2,837	12,055	1		1,355	16,253	52,968
	1962									7	1,085	19,752	1		1,681	22,526	47,424
	1963									7	2,432	25,140			1,161	28,740	68,940
	1964									4	3,411	18,388			824	22,627	62,441
	1965									3	417	16,542	1		731	17,694	73,093
	1966									8	1,600	15,333			588	17,529	66,172
	1967	-	-	330	189		519			12	4,113	17,814			707	22,646	83,182
	1968	-	-	216	283		499			11	4,906	20,434			951	26,302	68,837
	1969	-	-	65	423		488			14	2,996	18,827			358	22,195	74,242
	1970	-	-	34	59		93			9	4,416	21,032			822	26,279	68,719
	1971	-	-	20	52		72			11	2,071	20,526			1,175	23,783	90,911
	1972	-	-	187	-		187			8	3,750	23,600			637	27,995	103,185
	1973	-	-	-	-		-			14	2,236	15,653			84	17,987	107,186
	1974	-	-	486	-		486			9	4,777	20,178			94	25,058	117,794
	1975	-	-	1,240	-		1,240			33	3,243	18,932	10		640	22,858	95,572
	1976	-	-	686	-		686			23	2,700	15,905	4		713	19,345	127,227
	1977	-	-	572	-		572			37	1,497	9,969			537	12,040	62,568
	1978	-	-	6	-		6			54	950	16,613	15		810	18,442	99,518
	1979	-	-	81	-		81				303	6,781			74	7,158	70,277
	1980	-	1	249	20		270				382	7,556			168	8,106	74,947
	1981	1	-	143	12		156			25	748	12,637			195	13,605	70,901
	1982	-	-	38	9		47			105	425	6,609	21		257	7,417	72,443
	1983	-	-	8	1		9			6	607	9,359			87	10,059	54,149
	1984	-	1	-	-		1			2	1,030	9,304		3,728	1,427	15,491	71,586
	1985	1	-	-	2		3	2				6,422	118	26	1,176	7,744	58,917
	1986	-	-	-	-		-	3				4,713	66	47	196	5,025	47,916
	1987	2	2,514	-	-		2,516	5		150		2,772	139	1	74	3,141	49,186
	1988	6	7,389	-	-		7,395	15		307		4,221	76	17	64	4,700	44,302
	1989	-	8,350	40	-		8,390	4		248		1,896	10	1	160	2,319	43,460
	1990	-	16,701	4	39		16,744	29		177		2,733	20	71	24	3,054	52,613
	1991	-	3,398	12	-		3,410	17		312		1,917	20		6	2,272	26,047
	1992	-	7,866	-	-		7,866			334		4,626	40		2	5,002	54,470
	1993	-	-	5	-		5			438		6,325	194		25	6,982	53,945
	1994	-	-	83	-		83	38		544		11,068	66		106	11,822	72,988
	1995	-	-	4,280	-		4,280	52		882		8,302	4		102	9,342	67,853
	1996	-	-	7,596	-	-	7,596	83		1,185		17,150	10	11	88	18,527	84,016
	1997	-	-	9,456	-	-	9,456	60		1,653		14,458	12	2	1,018	17,203	103,606
	1998	-	-	8,810	-	-	8,810	80		1,120		14,577	15	33	1,208	17,033	92,029
	1999	-	-	8,393	-	-	8,393	149		1,542		10,451	61	48	3,621	15,872	119,066
	2000	-	-	8,842	-	-	8,842	55		940		9,834	24	4	1,798	12,655	81,033
	2001	-	1	8,684	+	-	8,685	94		1,295		11,543	39	51	1,635	14,657	88,522
	2002	-	-	7,965	-	-	7,965	30		525		11,003	13	4	2,357	13,932	104,070
	2003	-	-	7,166	-	-	7,166	16		524		14,246	8	44	2,214	17,052	90,090
	2004	-	-	4,988	-	-	4,988	12		361		13,630	3	1	1,506	15,513	86,252
	2005	-	-	4,472	-	-	4,472	20		296		8,654	1		1,719	10,690	59,008
	2006	-	-	4,317	-	-	4,317	3		270		12,642	+		385	13,300	61,403
	2007	-	+	2,916	-	-	2,916	4	94	250		11,911	+	77	461	12,797	88,579
	2008	-	-	3,069	-	-	3,069	1	28	354		11,762	+		418	12,563	62,698
	2009	-	-	2,378	-	-	2,378	4	97	203		12,343	+	31	944	13,622	77,683
	2010	+	-	2,818	-	-	2,818	5	53	421		11,691	0		862	13,032	64,258
	2011	+	1	3,434	2	-	3,437	5	84	708		10,147	0		421	11,365	67,988
	2012	2	2	2,643	-	-	2,647	8	253	660		14,152	2		1,212	16,287	83,150
	2013	1	+	4,427	-	-	4,428	5	46	317		12,312	0		839	13,519	79,166
	2014	1	1	2,617	+	-	2,619	0	49	209		13,401			1,042	14,701	74,060
	2015	1	2	3,020	4	-	3,027	1	62	227		11,597	2		932	12,820	64,216
	2016	+	+	3,406	-	-	3,406	1	24	248		10,759	0		675	11,708	52,998
	2017	-	5	4,333	-	-	4,338	0	35	95		7,432	14		372	7,947	54,082
	2018	-	-	4,514	+	-	4,514		20	87		7,729			381	8,218	49,850
	2019	-	5	5,454	+	1	5,460		10	104		7,767	4		1,364	9,249	51,665
	2020	-	5	3,809	+	-	3,814		3	163		7,317	9		260	7,751	36,226
Retain catch total		15	46,242	138,312	1,095	1	185,665	801	859	17,801	52,932	1,103,229	1,023	4,197	49,401	1,230,241	5,182,377
Release	2013																1
	2014																7
	2015																14
	2016																2
	2017																2
	2018																18
	2019																13
	2020																2
Release total																	59
Total		15	46,242	138,312	1,095	1	185,665	801	859	17,801	52,932	1,103,229	1,023	4,197	49,401	1,230,241	5,182,436

Table 6. Pacific bluefin tuna (*Thunnus orientialis*) catches (in metric tons) by ISC member fisheries, 1952-2018. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN							KOR						MEX		
		Set-net	Longline	Pole and line	Troll[1]	Others	Purse seine	JPN Total	Set-net	Longline	Purse seine	Trawl	Troll	KOR Total[2]	Others	Purse seine	MEX Total
Retain	1952	2,145	2,694	2,198	667	1,700	7,680	17,084							-	-	0
	1953	2,335	3,040	3,052	1,472	160	5,570	15,629							-	-	0
	1954	5,579	3,088	3,044	1,656	266	5,366	18,999							-	-	0
	1955	3,256	2,951	2,841	1,507	1,151	14,016	25,722							-	-	0
	1956	4,170	2,672	4,060	1,763	385	20,979	34,029							-	-	0
	1957	2,822	1,685	1,795	2,392	414	18,147	27,255							-	-	0
	1958	1,187	818	2,337	1,497	215	8,586	14,640							-	-	0
	1959	1,575	3,136	586	736	167	9,996	16,196							32	171	203
	1960	2,032	5,910	600	1,885	369	10,541	21,337							-	-	0
	1961	2,710	6,364	662	3,193	599	9,124	22,652							-	130	130
	1962	2,545	5,769	747	1,683	293	10,657	21,694							-	294	294
	1963	2,797	6,077	1,256	2,542	294	9,786	22,752							-	412	412
	1964	1,475	3,140	1,037	2,784	1,884	8,973	19,293							-	131	131
	1965	2,121	2,569	831	1,963	1,106	11,496	20,086							-	289	289
	1966	1,261	1,370	613	1,614	129	10,082	15,069							-	435	435
	1967	2,603	878	1,210	3,273	302	6,462	14,728							-	371	371
	1968	3,058	500	983	1,568	217	9,268	15,594							-	195	195
	1969	2,187	878	721	2,219	195	3,236	9,436							-	260	260
	1970	1,779	607	723	1,198	224	2,907	7,438							-	92	92
	1971	1,555	697	938	1,492	317	3,721	8,720		0				0	-	555	555
	1972	1,107	512	944	842	197	4,212	7,814		0				0	-	1,646	1,646
	1973	2,351	838	526	2,108	636	2,266	8,725		0				0	-	1,084	1,084
	1974	6,019	1,177	1,192	1,656	754	4,106	14,904		0				0	-	344	344
	1975	2,433	1,061	1,401	1,031	808	4,491	11,225		3				3	-	2,145	2,145
	1976	2,996	320	1,082	830	1,237	2,148	8,613		5				5	-	1,968	1,968
	1977	2,257	338	2,256	2,166	1,052	5,110	13,179		0				0	-	2,186	2,186
	1978	2,546	648	1,154	4,517	2,276	10,427	21,568		3				3	-	545	545
	1979	4,558	729	1,250	2,655	2,429	13,881	25,502		0				0	-	213	213
	1980	2,521	811	1,392	1,531	1,953	11,327	19,535		0				0	-	582	582
	1981	2,129	590	754	1,777	2,653	25,422	33,325		0				0	-	218	218
	1982	1,667	718	1,777	864	1,709	19,234	25,969		0	31			31	-	506	506
	1983	972	217	356	2,028	1,117	14,774	19,464		0	13			13	-	214	214
	1984	2,234	142	587	1,874	868	4,433	10,138		1	4			5	-	166	166
	1985	2,562	105	1,817	1,850	1,175	4,154	11,663		0	1			1	-	676	676
	1986	2,914	102	1,086	1,467	719	7,412	13,700		0	344			344	-	189	189
	1987	2,198	211	1,565	880	445	8,653	13,952		13	89			102	-	119	119
	1988	843	157	907	1,124	498	3,605	7,134		0	32			32	1	447	448
	1989	748	209	754	903	283	6,190	9,087		0	71			71	-	57	57
	1990	716	267	536	1,250	455	2,989	6,213		0	132			132	-	50	50
	1991	1,485	218	286	2,069	650	9,808	14,516		0	265			265	-	9	9
	1992	1,208	513	166	915	1,081	7,162	11,045		0	288			288	-	0	0
	1993	848	812	129	546	365	6,600	9,300		0	40			40	-	0	0
	1994	1,158	1,206	162	4,111	398	8,131	15,166		0	50			50	2	63	65
	1995	1,859	678	270	4,778	586	18,909	27,080		0	821			821	-	11	11
	1996	1,149	901	94	3,640	570	7,644	13,998		0	102			102	-	3,700	3,700
	1997	803	1,300	34	2,740	811	13,152	18,840		0	1,054			1,054	-	367	367
	1998	874	1,255	85	2,876	700	5,391	11,181		0	188			188	-	1	1
	1999	1,097	1,157	35	3,440	709	16,173	22,611		0	256			256	35	2,369	2,404
	2000	1,125	953	102	5,217	689	16,486	24,572		0	2,401	0		2,401	99	3,019	3,118
	2001	1,366	791	180	3,466	782	7,620	14,205		0	1,176	10		1,186	-	863	863
	2002	1,100	841	99	2,607	631	8,903	14,181		0	932	1		933	2	1,708	1,710
	2003	839	1,237	44	2,060	446	5,768	10,394		0	2,601	0		2,601	43	3,211	3,254
	2004	896	1,847	132	2,445	514	8,257	14,091		0	773	0		773	14	8,880	8,894
	2005	2,182	1,925	549	3,633	548	12,817	21,654		0	1,318	9		1,327	-	4,542	4,542
	2006	1,421	1,121	108	1,860	777	8,880	14,167		0	1,012	3		1,015	-	9,806	9,806
	2007	1,503	1,762	236	2,823	657	6,840	13,821		0	1,281	4		1,285	-	4,147	4,147
	2008	2,358	1,390	64	2,377	770	10,221	17,180		0	1,866	10		1,876	15	4,407	4,422
	2009	2,236	1,080	50	2,003	575	8,077	14,021		0	936	4		940	-	3,019	3,019
	2010	1,603	890	83	1,583	495	3,742	8,396		0	1,196	16		1,212	-	7,746	7,746
	2011	1,651	837	63	1,820	283	8,340	12,993		0	670	14	+	684	1	2,731	2,732
	2012	1,932	673	113	570	343	2,462	6,093		0	1,421	2		1,423	1	6,668	6,669
	2013	1,415	784	8	904	529	2,771	6,411	1	-	604	0	+	605		3,154	3,154
	2014	1,907	683	5	1,023	499	5,456	9,573	6		1,305	-	0	1,311		4,862	4,862
	2015	1,242	648	8	413	431	3,645	6,386	1		676		0	677		3,082	3,082
	2016	1,228	691	54	778	508	5,095	8,354	3		1,024	2	0	1,030		2,709	2,709
	2017	2,221	913	49	605	665	4,540	8,993	3		734	6		743		3,643	3,643
	2018	645	700	9	371	431	4,050	6,206	7		523	5		535		2,482	2,482
	2019	941	1,002 [3]	+	720	372	4,464	7,499	36		542	3		581		2,249	2,249
	2020	1,234	1,416	1	760	502	3,960	7,873	35		567	3		605		3,266	3,266
Retain catch total		134,489	94,219	54,787	131,609	48,969	576,790	1,040,863	93	25	27,339	92		27,548	245	109,404	109,649
Total		134,489	94,219	54,787	131,609	48,969	576,790	1,040,863	93	25	27,339	92		27,548	245	109,404	109,649

Table 6. Continued.

Catch disposition	Year	TWN							USA									Total
		Set-net	Gill-net (not specified)	Drift gill-net	Longline	Others	Purse seine	TWN Total	Drift gill-net	Longline	Pole and line	Troll	Hook and Line	Others	Purse seine	Sport	USA Total[4]	
Retain	1952														2,076	2	2,078	19,162
	1953														4,433	48	4,481	20,110
	1954														9,537	11	9,548	28,547
	1955														6,173	93	6,266	31,988
	1956														5,727	388	6,115	40,144
	1957														9,215	73	9,288	36,543
	1958														13,934	10	13,944	28,584
	1959										56				3,506	13	3,575	19,974
	1960										+				4,547	1	4,548	25,885
	1961										16				7,989	23	8,028	30,810
	1962										+				10,769	25	10,794	32,782
	1963										28				11,832	7	11,867	35,031
	1964										39				9,047	7	9,093	28,517
	1965				54			54			11	+		66	6,523	1	6,601	27,030
	1966				-			0			12				15,450	20	15,482	30,986
	1967				53			53			+				5,517	32	5,549	20,701
	1968				33			33			8				5,773	12	5,793	21,615
	1969				23			23			9				6,657	15	6,681	16,400
	1970				-			0			+				3,873	19	3,892	11,422
	1971				1			1			+				7,804	8	7,812	17,088
	1972				14			14			3			42	11,656	15	11,716	21,190
	1973				33			33			5	+		20	9,639	54	9,718	19,560
	1974				47	15		62			+	+		30	5,243	58	5,331	20,641
	1975				61	5		66			83			1	7,353	34	7,471	20,910
	1976				17	2		19			22	+		3	8,652	21	8,698	19,303
	1977				131	2		133			10			3	3,259	19	3,291	18,789
	1978				66	2		68			4			2	4,663	5	4,674	26,858
	1979				58	-		58			5			1	5,889	11	5,906	31,679
	1980				114	5		119			+			24	2,327	7	2,358	22,594
	1981				179	-		179	4		+	10		+	867	9	890	34,612
	1982			2	207	-		209	9		1			+	2,639	11	2,660	29,375
	1983			2	175	-	9	186	31		59			2	629	33	754	20,631
	1984			-	477	8	5	490	6	1	5			18	673	49	752	11,551
	1985			11	210	-	80	301	8					20	3,320	89	3,437	16,078
	1986			13	70	-	16	99	16					41	4,851	12	4,920	19,252
	1987			14	365	-	21	400	2					18	861	34	915	15,488
	1988			37	108	25	197	367	4					46	923	6	979	8,960
	1989			51	205	3	259	518	3					18	1,046	112	1,179	10,912
	1990			299	189	16	149	653	11					81	1,380	65	1,537	8,585
	1991			107	342	12	-	461	4	2				+	410	92	508	15,759
	1992			3	464	5	73	545	9	38				14	1,928	110	2,099	13,977
	1993				471	3	1	475	32	42				29	580	283	966	10,781
	1994				559	-		559	28	30				1	906	86	1,051	16,891
	1995				335	2		337	20	29				+	657	245	951	29,200
	1996	-	-		956	-	-	956	43	25		2		+	4,639	40	4,749	23,505
	1997	-	-		1,814	-	-	1,814	58	26		1		48	2,240	131	2,504	24,579
	1998	-	-		1,910	-	-	1,910	40	54		128		59	1,771	422	2,474	15,754
	1999	-	-		3,089	-	-	3,089	22	54		20		88	184	408	776	29,136
	2000	-	1		2,780	1	-	2,782	30	19		1		11	693	319	1,073	33,946
	2001	-	2		1,839	2	-	1,843	35	6		6		1	292	344	684	18,781
	2002	-	3		1,523	1	-	1,527	7	2		1		2	50	613	675	19,026
	2003	-	10		1,863	11	-	1,884	14	1				3	22	355	395	18,528
	2004	-	1		1,714	2	-	1,717	10	1				+		50	61	25,536
	2005	1	-		1,368	1	-	1,370	5	1				1	201	73	281	29,174
	2006	1	-		1,149	-	-	1,150	1	1				+		94	96	26,234
	2007	2	8		1,401	-	-	1,411	2	+				+	42	12	56	20,720
	2008	1	1		979	-	-	981	1	+				+		63	64	24,523
	2009	1	10		877	-	-	888	3	1		0		2	410	156	572	19,440
	2010	29	7		373	-	-	409	1	0				0		88	89	17,852
	2011	16	7		292	1	-	316	18	0		0		100		225	343	17,068
	2012	2	-		210	2	-	214	4	0		0		38		400	442	14,841
	2013	2	1		331	-	-	334	7	1		0		3		809	820	11,324
	2014	38	4		483	-	-	525	5	0		+	2	-	401	420	828	17,099
	2015	25	1		552	-	-	578	4	0			7	-	86	400	499	11,221
	2016	-	+		454	-	-	454	9	1		0	31	-	316	372	728	13,275
	2017	-	-		415	+	-	415	1	1		0	18	-	466	451	938	14,732
	2018	+	3		381	+	-	384	18	1		-	31	4	12	513	579	10,186
	2019	+	3		486	+	-	492	10	2		1	36	1	226	462	737	11,557
	2020	1	+		1,148	3	-	1,152	28	2		-	87	1	116	651	884	13,779
Retain catch total		121	61	539	33,448	131	810	35,110	563	340	376	170	212	843	242,901	10,138	255,543	1,468,713
Total		121	61	539	33,448	131	810	35,110	563	340	376	170	212	843	242,901	10,138	255,543	1,468,713

Numbers in paranthesis are provisional.
1) Japanese troll catch since 1998 includes catch from farming.
2) Catch statistics of Korea were derived from Japanese Import statistics for 1982-1999.
3) Catch of Japanese coastal longline in 2019 is provisional value.
4) USA in 1952-1958 contains catch from other countries - primarily Mexico. Other includes catches from gillnet, troll, pole-and-line, and longline.

Table 7. Annual catch of swordfish (*Xiphias gladius*) in metric tons for fisheries monitored by ISC member countries for assessments of North Pacific Ocean stocks, 1951-2018. "0"; Fishing effort was reported but no catch. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN						KOR		MEX			TWN							USA										Total
		Set-net	Drift gill-net	Longline	Others	Not specified	JPN Total	Longline	KOR Total	Others	Sport	MEX Total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN Total	Drift gill-net	Harpoon	Handline	Longline	Pole and line	Troll	Hook-and-line	Other	Purse-seine	USA Total	
Retain	1951	78	10	7,361	4,131	98	11,678																							11,678
	1952	68	-	9,042	2,569	12	11,691																							11,691
	1953	21	-	10,873	1,407	107	12,408									-			0											12,408
	1954	18	-	12,659	813	121	13,611									-			0											13,611
	1955	37	-	13,093	821	160	14,111									-			0											14,111
	1956	31	-	14,606	775	73	15,485									-			0											15,485
	1957	18	-	14,305	858	70	15,251									-			0											15,251
	1958	31	-	18,567	1,069	67	19,734									-			0											19,734
	1959	31	-	17,302	891	44	18,268									427			427											18,695
	1960	67	1	20,109	1,191	30	21,398									520			520											21,918
	1961	15	2	19,766	1,335	30	21,148									318			318											21,466
	1962	15	-	10,685	1,371	44	12,115									494			494											12,609
	1963	17	-	10,420	747	59	11,243									343			343											11,586
	1964	16	4	7,760	1,006	66	8,852									358			358											9,210
	1965	14	-	8,861	1,908	208	10,991									331			331											11,322
	1966	11	-	9,979	1,728	45	11,763									489			489											12,252
	1967	12	-	11,067	891	38	12,008						-	-	5	646	30		681											12,689
	1968	14	-	10,046	1,539	50	11,649						-	8	3	763	1		775											12,424
	1969	11	-	9,712	1,557	56	11,336						-	1	6	843	-		850											12,186
	1970	9	-	7,751	1,748	39	9,547						-	1	5	904	-		910		612		5						617	11,074
	1971	37	1	7,387	473	48	7,946	0	0				-	-	3	992	-		995		99		1						100	9,041
	1972	1	55	7,327	282	22	7,687	0	0				-	-	12	862	-		874		171								171	8,732
	1973	23	720	7,574	121	29	8,467	0	0				-	-	113	860	6		979		399								399	9,845
	1974	16	1,304	6,669	190	29	8,208	0	0				-	-	98	881	38		1,017		406								406	9,631
	1975	18	2,672	7,677	205	60	10,632	0	0				-	-	152	928	1		1,081		557								557	12,270
	1976	14	3,488	8,845	313	182	12,842	0	0				-	-	159	636	35		830		42								42	13,714
	1977	7	2,344	9,301	201	73	11,926	0	0				-	2	139	578	-		719		318		17						335	12,980
	1978	22	2,475	9,069	130	111	11,807	0	0				-	3	10	546	-		559		1,699		9						1,708	14,074
	1979	15	983	9,692	161	49	10,900	0	0				-	5	24	668	4		701		329		7						336	11,937
	1980	15	1,746	6,898	398	30	9,087	135	135				-	4	72	613	1		690	160	566		5						731	10,643
	1981	9	1,848	7,841	129	61	9,888	0	0				-	3	18	658	4		683	473	271		3	2					749	11,320
	1982	7	1,257	6,998	195	59	8,516	166	166				-	3	46	856	-		905	945	156		5	3	6		1		1,116	10,703
	1983	9	1,033	8,752	166	32	9,992	47	47				-	3	164	783	-		950	1,693	58		5	2	3		1	1	1,763	12,752
	1984	13	1,053	8,411	117	98	9,692	27	27				43	5	259	733	-		1,040	2,647	104		15	49				26	2,841	13,600
	1985	10	1,133	10,387	191	69	11,790	12	12				3	29	166	566	61		825	2,990	305	4	2				104		3,405	16,032
	1986	9	1,264	9,815	123	47	11,258	18	18				3	1	201	456	6		667	2,069	291	4	2				109		2,475	14,418
	1987	11	1,051	10,411	87	45	11,605	50	50				-	-	187	1,331	3		1,521	1,529	235	4	24				31		1,823	14,999
	1988	8	1,234	9,317	173	19	10,751	27	27				-	1	80	777	183		1,041	1,376	198	6	24				64		1,668	13,487
	1989	10	1,596	7,492	362	21	9,481	7	7				3	2	61	1,541	35		1,642	1,243	62	7	218				56		1,586	12,716
	1990	4	1,074	6,598	128	13	7,817	46	46		-	-	4	2	118	1,452	88		1,664	1,131	64	5	2,437				43		3,680	13,207
	1991	5	498	5,690	153	20	6,366	37	37		-	-	4	2	205	1,430	56		1,697	944	20	6	4,535				44		5,549	13,649
	1992	6	887	8,505	381	16	9,795	32	32		-	-	12	1	287	1,494	33		1,827	1,356	75	1	5,762				47		7,241	18,895
	1993	4	292	9,777	309	44	10,426	27	27		-	-	13	3	194	1,228	100		1,538	1,412	168	4	5,936				161		7,681	19,672
	1994	4	421	8,723	308	37	9,493	4	4		-	-	12	3	211	1,155	9		1,390	792	157	4	3,807				24		4,784	15,671
	1995	7	561	7,809	423	34	8,834	9	9		-	-	6	2	14	1,185	203		1,410	771	97	6	2,981				29		3,884	14,137
	1996	4	428	7,983	597	45	9,057	15	15		-	-	10	2	19	710	1	-	742	761	81	5	2,848				15		3,710	13,524
	1997	5	365	8,216	346	62	8,994	99	99		-	-	8	1	27	1,397	1	-	1,434	708	84	7	3,393				11		4,203	14,730
	1998	2	471	7,423	476	68	8,440	153	153		-	-	15	9	17	1,198	-	-	1,239	931	48	7	3,681				19		4,686	14,518
	1999	5	724	6,606	416	47	7,798	131	131		-	-	5	5	51	1,455	+	-	1,516	606	81	9	4,329				27		5,052	14,497

Table 7. Continued.

Catch disposition	Year	JPN Set-net	JPN Drift gill-net	JPN Longline	JPN Others	JPN Not specified	JPN Total	KOR Longline	KOR Total	MEX Others	MEX Sport	MEX Total	TWN Set-net	TWN Gill-net (not specified)	TWN Harpoon	TWN Longline	TWN Others	TWN Purse seine	TWN Total	USA Drift gill-net	USA Harpoon	USA Handline	USA Longline	USA Pole and line	USA Troll	USA Hook-and-line	USA Other	USA Purse-seine	USA Total	Total
Retain	2000	5	808	7,301	497	49	8,660	202	202	602	-	602	5	6	74	3,716	-	-	3,801	649	90		4,834				33		5,606	18,871
	2001	15	732	7,840	230	30	8,847	438	438	516	-	516	8	18	64	4,853	-	-	4,943	375	52		1,969				19		2,415	17,159
	2002	11	1,164	7,195	201	29	8,600	438	438	215	-	215	16	8	1	5,400	1	-	5,426	302	90		1,524				3		1,919	16,598
	2003	4	1,198	6,439	149	28	7,818	380	380	237	-	237	8	3	-	4,771	-	-	4,782	216	107	10	1,958				11		2,302	15,519
	2004	4	1,062	6,904	229	30	8,229	410	410	268	-	268	7	6	1	4,248	2	-	4,264	182	69	7	1,185				44		1,487	14,658
	2005	3	956	6,653	187	337	8,136	403	403	234	-	234	5	3	16	3,964	2	-	3,990	220	77	5	1,622				5		1,929	14,692
	2006	5	796	7,690	244	343	9,078	465	465	328	-	328	7	2	49	4,382	3	-	4,443	443	71	4	1,211				5		1,734	16,048
	2007	2	829	8,125	122	368	9,446	453	453	172	-	172	2	2	20	4,099	2	-	4,125	490	59	5	1,735		1				2,290	16,486
	2008	3	648	6,189	173	349	7,362	794	794	242	-	242	3	6	39	3,745	+	-	3,793	405	48	6	2,014				19		2,492	14,683
	2009	3	682	6,007	239	249	7,180	993	993	394	-	394	83	7	31	3,550	-	-	3,671	253	50	5	1,817		0		0		2,125	14,363
	2010	8	494	5,400	110	230	6,242	662	662	222	-	222	6	4	42	2,844	-	-	2,896	62	37	3	1,676				18		1,796	11,818
	2011	2	193	4,022	10	233	4,460	962	962	-	-	-	8	17	52	3,577	1	+	3,655	119	24	5	1,623				90		1,861	7,283
	2012	8	371	4,034	59	288	4,760	856	856	-	-	-	3	15	30	3,746	+	-	3,794	118	5	6	1,395		1		1		1,526	7,142
	2013	13	290	4,248	163	291	5,005	1,071	1,071	-	-	-	2	8	-	2,846	1	-	2,857	95	6	6	1,270		1		7		1,385	7,461
	2014	7	269	4,381	0	291	4,948	829	829	-	-	-	4	4	-	2,817	+	+	2,825	127	6	7	1,665		1	0	4		1,811	7,588
	2015	3	277	5,012	204	281	5,777	776	776		-	-	4	4	-	3,199	-	-	3,207	101	5	5	1,515		1	0	12		1,639	8,192
	2016	2	303	5,605	169	256	6,335	582	582		-	-	2	3	+	2,054	+	-	2,059	183	26	4	1,092			1	42		1,348	8,265
	2017	3	291	4,837	274	289	5,694	583	583				+	3	-	2,194	+	+	2,197	180	28	6	1,618			1	44		1,876	10,350
	2018	5	230	5,015	480	267	5,997	664	664				1	+	-	2,124	+	-	2,125	148	10	3	1,053		1	1	67		1,281	10,068
	2019	6	242	3,956	339	210	4,753	468	468				2	+	-	2,113	+	-	2,115	52	12	3	733			2	185		986	8,323
	2020	6	242	4,739	339	210	5,536	392	392				2	+	-	1,868	+	-	1,870	35	6	2	541			1	125		710	8,508
		952	45,072	602,836	40,327	7,545	696,732	13,732	13,732	3,430	-	3,430	319	220	3,545	106,515	911	-	111,510	29,290	8,630	171	74,102	56	16	5	1,521	27	113,818	939,222
	2010																											0	0	0
	2011																											0	0	0
	2018							+	+																					+
	2019							+	+																					+
	2020							+	+																					+
								+	+																			0	0	+
		952	45,072	602,836	40,327	7,545	696,732	13,732	13,732	3,430	0	3,430	319	220	3,545	106,515	911	0	111,510	29,290	8,630	171	74,102	56	16	5	1,521	27	113,818	939,223

Table 8. Annual catch of striped marlin (*Kajikia audax*) in metric tons for fisheries monitored by ISC member countries for assessments of North Pacific Ocean stocks, 1951-2018. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN						KOR			MEX	
		Set-net	Drift gill-net	Longline	Others	Not specified	JPN Total	Longline	Purse seine	KOR Total	Sport	MEX Total
Retain	1951	92	-	3,167	1,149	39	4,447					
	1952	203	-	3,623	1,321	40	5,187					
	1953	126	-	2,185	793	36	3,140					
	1954	82	-	3,120	938	67	4,207					
	1955	106	-	3,110	850	82	4,148					
	1956	133	-	3,788	1,822	41	5,784					
	1957	71	-	3,308	2,312	76	5,767					
	1958	82	3	4,383	2,704	127	7,299					
	1959	87	2	4,308	2,905	200	7,502					
	1960	161	4	3,963	1,689	87	5,904					
	1961	161	2	4,589	1,538	98	6,388					
	1962	197	8	5,849	1,607	108	7,769					
	1963	92	17	6,197	1,527	292	8,125					
	1964	81	2	14,346	2,223	41	16,693					
	1965	81	1	11,621	2,640	73	14,416					
	1966	226	2	8,531	1,313	31	10,103					
	1967	82	3	11,825	1,394	75	13,379					
	1968	71	0	16,143	914	58	17,186					
	1969	71	3	9,147	2,516	81	11,818					
	1970	55	3	13,867	824	153	14,902					
	1971	61	10	11,891	1,674	307	13,943	0		0		
	1972	72	243	7,988	827	94	9,224	0		0		
	1973	80	3,265	7,107	476	146	11,074	0		0		
	1974	90	3,112	7,076	581	104	10,963	0		0		
	1975	105	6,534	5,605	492	89	12,825	0		0		
	1976	37	3,561	5,414	441	107	9,560	0		0		
	1977	103	4,424	3,290	337	107	8,261	0		0		
	1978	93	5,593	4,227	210	243	10,366	0		0		
	1979	66	2,532	5,948	327	133	9,006	0		0		
	1980	80	3,467	6,990	397	59	10,993	73		73		
	1981	88	3,866	4,377	385	69	8,785	0		0		
	1982	52	2,351	5,666	476	128	8,673	102		102		
	1983	124	1,867	4,052	547	156	6,746	49		49		
	1984	144	2,333	3,901	398	177	6,953	39		39		
	1985	81	2,363	4,632	499	153	7,728	13		13		
	1986	131	3,584	7,336	343	103	11,497	14		14		
	1987	102	1,888	8,731	244	167	11,132	15		15		
	1988	63	2,211	7,030	400	205	9,909	16		16		
	1989	47	1,664	5,834	345	145	8,035	24		24		
	1990	65	1,945	3,496	287	193	5,986	1		1	-	-
	1991	56	1,329	4,045	320	131	5,881	7		7	-	-
	1992	71	1,204	4,212	137	95	5,719	53		53	-	-
	1993	27	828	5,200	308	373	6,736	568		568	-	-
	1994	73	1,443	4,196	218	92	6,022	556		556	-	-
	1995	58	970	5,337	139	86	6,590	307		307	-	-
	1996	39	703	3,791	25	88	4,646	429		429	-	-
	1997	34	813	3,523	61	68	4,499	1,017		1,017	-	-
	1998	34	1,092	3,761	123	147	5,157	635		635	-	-
	1999	28	1,126	3,163	66	90	4,473	433		433	-	-
	2000	41	1,062	2,269	165	91	3,628	536		536	-	-
	2001	51	1,077	2,322	150	36	3,636	253		253	-	-
	2002	80	1,264	1,565	182	28	3,119	187		187	-	-
	2003	41	1,064	1,858	135	27	3,125	205		205	-	-
	2004	23	1,339	1,701	33	34	3,130	75		75	-	-
	2005	28	1,214	1,231	35	35	2,543	136		136	-	-
	2006	30	1,190	1,162	33	32	2,447	55		55	-	-
	2007	21	970	1,171	20	38	2,220	46		46	-	-
	2008	26	1,302	1,009	43	28	2,408	29		29	-	-
	2009	17	821	809	34	39	1,720	22		22	-	-
	2010	20	913	1,061	26	36	2,056	18		18	-	-
	2011	30	347	1,306	32	26	1,741	48		48	-	-
	2012	52	597	1,336	33	34	2,052	33		33	-	-
	2013	39	336	1,496	19	34	1,924	65		65	-	-
	2014	35	173	1,155	0	22	1,385	82		82	-	-
	2015	37	287	1,441	37	27	1,829	44		44	-	-
	2016	25	308	1,056	41	32	1,462	61		61	-	-
	2017	28	241	977	23	28	1,297	81		81		
	2018	28	278	886	52	36	1,280	70		70		
	2019	29	241	1,268	61	39	1,638	48		48		
	2020	29	241	1,267	61	39	1,637	74		74		
Retain catch total		5,074	81,636	323,234	45,277	6,601	461,822	6,496		6,496	0	0
Release	2010											
	2011											
	2016								+	+		
	2018							0	2	2		
	2019											
	2020											
Release total								0	2	2		
Total		5,074	81,636	323,234	45,277	6,601	461,822	6,496	2	6,497	0	0

Numbers in paranthesus are provisional.

Table 8. Continued.

Catch disposition	Year	TWN							USA							
		Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN Total	Handline	Longline	Troll	Others	Purse seine	Sport	USA Total	Total
Retain	1951															4,447
	1952													23	23	5,210
	1953					0		0						5	5	3,145
	1954					0		0						16	16	4,223
	1955					0		0						5	5	4,153
	1956					0		0						34	34	5,818
	1957					0		0						42	42	5,809
	1958				543	387		930						59	59	8,288
	1959				391	354		745						65	65	8,312
	1960				398	350		748						30	30	6,682
	1961				306	342		648						24	24	7,060
	1962				332	211		543						5	5	8,317
	1963				560	199		759						68	68	8,952
	1964				392	175		567						58	58	17,318
	1965				355	157		512						23	23	14,951
	1966				370	180		550						36	36	10,689
	1967	-	0	141	387	63		591						49	49	14,019
	1968	-	40	134	333	34		541						51	51	17,778
	1969	-	5	159	573	28		765						30	30	12,613
	1970	-	8	175	495	6		684						18	18	15,604
	1971	-	16	101	449	18		584						17	17	14,544
	1972	-	1	124	389	1		515						21	21	9,760
	1973	-	4	115	569	20		708						9	9	11,791
	1974	-	7	53	674	58		792						55	55	11,810
	1975	-	7	86	796	3		892						27	27	13,744
	1976	-	9	61	379	70		519						31	31	10,110
	1977	-	9	207	541	3		760						41	41	9,062
	1978	-	7	70	618	1		696						37	37	11,099
	1979	2	18	104	458	0		582						36	36	9,624
	1980	-	39	92	284	1		416						33	33	11,515
	1981	-	25	70	508	0		603						60	60	9,448
	1982	-	26	112	404	0		542						41	41	9,358
	1983	-	31	144	555	39		769						39	39	7,603
	1984	-	16	314	965	0		1,295						36	36	8,323
	1985	1	6	152	513	23		695			18			42	60	8,496
	1986	-	13	119	179	16		327			19			19	38	11,876
	1987	1	2	132	414	16		565	1	272	29			28	330	12,042
	1988	7	12	70	464	80		633		504	54			30	588	11,146
	1989	-	23	124	192	10		349	+	612	24			52	688	9,096
	1990	12	16	207	139	21		395	+	538	27			23	588	6,970
	1991	-	81	173	290	32		576	+	663	41			12	716	7,180
	1992	-	11	163	220	24		418	1	459	37			25	522	6,712
	1993	3	7	132	226	0		368	1	471	67			11	550	8,222
	1994	4	5	176	138	11		334	+	326	35			17	378	7,290
	1995	4	5	67	110	6		192	+	543	52			14	609	7,698
	1996	3	8	30	188	6	-	235	1	418	53			20	492	5,802
	1997	3	9	33	351	0	-	396	1	352	37			21	411	6,323
	1998	6	16	19	304	0	-	345	+	378	26			23	427	6,564
	1999	5	8	26	197	0	-	236	1	364	27			12	404	5,546
	2000	6	18	29	315	1	-	369		200	15			10	225	4,758
	2001	5	16	30	250	0	-	301		351	44			+	395	4,585
	2002	8	15	6	477	0	-	506	+	226	30			+	256	4,068
	2003	5	27	11	922	0	-	965	+	538	29			+	567	4,862
	2004	5	10	7	522	2	-	546	2	376	31			+	409	4,160
	2005	9	9	5	783	9	-	815	+	511	20			+	531	4,025
	2006	-	30	117	741	0	-	888	+	611	21			+	632	4,022
	2007	-	29	141	301	0	-	471		276	13			+	289	3,026
	2008	-	43	168	270	2	-	483		427	14				441	3,361
	2009	-	46	92	262	0	-	400		258	10				268	2,410
	2010	-	42	131	253	3	-	429		165	19				184	2,687
	2011	1	27	95	343	4	0	470		362	16				378	2,637
	2012	-	34	114	443	1	+	592		282	11				293	2,970
	2013	+	24	197	372	+	+	593		398	8				406	2,988
	2014	+	5	64	140	+	1	210		426	12			1	439	2,116
	2015	1	4	28	228	+	-	261		493	11	0			504	2,638
	2016	-	3	21	214	+	1	239	-	390	12				402	2,165
	2017	+	7	41	389	-	-	437		406	6				413	2,227
	2018	+	5	27	330	-	+	362		465	12				477	2,189
	2019	-	8	26	373	-	+	407		545	13		1		559	2,652
	2020	-	8	26	353	-	-	387		336	10				345	2,443
Retain catch total		91	900	5,261	25,230	2,967	2	34,451	8	13,941	903	0	1	1,484	16,338	519,106
Release	2010												1		1	1
	2011												0		0	0
	2016						1	1								1
	2018						+	+								2
	2019						1	1								1
	2020						0	0								0
Release total							2	2					1		1	5
Total		91	900	5,261	25,230	2,967	4	34,453	8	13,941	903	0	2	1,484	16,339	519,111

Numbers in paranthesus are provisional.

Table 9. Retained catches (metric tons, whole weight) by ISC Member countries of blue marlin (*Makaira nigricans*) by fishery in the North Pacific Ocean, north of the equator 1953-2020. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

		JPN		KOR			MEX		TWN							USA						
Catch disposition	Year	Longline	JPN Total	Longline	Purse seine	KOR Total	Sport	MEX Total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN Total	Handline	Longline	Troll	Others	Purse seine	USA Total	Total
Retain	1953											-			-							-
	1954											-			-							-
	1955											-			-							-
	1956											-			-							-
	1957											-			-							-
	1958											887			887							887
	1959											781			781							781
	1960											948			948							948
	1961											703			703							703
	1962											628			628							628
	1963											691			691							691
	1964											934			934							934
	1965											1,016			1,016							1,016
	1966											957			957							957
	1967								-	-	317	898	167		1,382							1,382
	1968								-	30	649	1,433	120		2,232							2,232
	1969								-	58	465	1,232	103		1,858							1,858
	1970								1	21	604	1,385	70		2,081							2,081
	1971	5,461	5,461	0		0			-	13	473	1,331	118		1,935							7,396
	1972	6,772	6,772	0		0			-	14	490	1,205	50		1,759							8,531
	1973	6,453	6,453	0		0			-	12	275	1,650	265		2,202							8,655
	1974	6,545	6,545	0		0			1	6	355	2,144	146		2,652							9,197
	1975	4,374	4,374	0		0			-	3	421	2,638	207		3,269							7,643
	1976	5,018	5,018	0		0			-	9	511	1,315	162		1,997							7,015
	1977	4,780	4,780	0		0			-	11	391	1,183	110		1,695							6,475
	1978	5,900	5,900	0		0			1	15	364	1,633	7		2,020							7,920
	1979	5,949	5,949	0		0			3	19	362	1,646	164		2,194							8,143
	1980	5,613	5,613	155		155			-	35	444	1,185	170		1,834							7,602
	1981	5,518	5,518	0		0			-	35	313	1,840	69		2,257							7,775
	1982	6,051	6,051	351		351			-	7	306	2,139	120		2,572							8,974
	1983	4,796	4,796	82		82			-	26	741	2,122	127		3,016							7,894
	1984	6,248	6,248	155		155			-	22	960	1,789	111		2,882							9,285
	1985	5,164	5,164	45		45			9	11	747	1,187	43		1,997			145			145	7,351
	1986	5,922	5,922	86		86			4	90	839	1,723	107		2,763			220			220	8,991
	1987	5,370	5,370	89		89			12	9	973	4,627	1		5,622		51	261			312	11,393
	1988	5,054	5,054	133		133			20	8	658	2,822	589		4,097		102	266			368	9,652
	1989	5,117	5,117	50		50			10	14	640	2,691	9		3,364		356	326			682	9,213
	1990	4,116	4,116	44		44	-	-	3	24	427	1,749	143		2,346		378	295			673	7,179
	1991	4,094	4,094	75		75	-	-	4	50	338	2,288	152		2,832		297	346			643	7,644
	1992	3,721	3,721	60		60	-	-	25	40	432	3,786	110		4,393		347	260			607	8,781
	1993	4,600	4,600	36		36	-	-	44	41	400	4,135	82		4,702		339	311			650	9,988
	1994	5,832	5,832	2		2	-	-	12	30	206	3,007	7		3,262		362	298			660	9,756
	1995	5,907	5,907	0		0	-	-	15	36	895	3,896	5		4,847		570	315			885	11,639
	1996	3,260	3,260	10		10	-	-	13	35	270	3,337	10	-	3,665		467	409			876	7,811
	1997	3,697	3,697	145		145	-	-	5	48	194	3,683	-	-	3,930		487	378			865	8,637
	1998	3,438	3,438	335		335	-	-	8	59	91	3,624	1	-	3,783		395	242			637	8,193
	1999	3,751	3,751	164		164	-	-	21	32	135	3,417	-	-	3,605		357	293			650	8,170
	2000	3,606	3,606	96		96	-	-	24	40	186	4,131	2	-	4,383		314	235			549	8,634
	2001	3,594	3,594	166		166	-	-	18	57	229	4,733	-	-	5,037		399	291			690	9,487
	2002	2,976	2,976	152		152	-	-	13	63	32	4,448	6	-	4,562		264	225	1		490	8,180
	2003	2,836	2,836	158		158	-	-	20	107	52	7,685	4	-	7,868		363	210			573	11,435
	2004	2,977	2,977	226		226	-	-	14	93	36	6,672	9	-	6,824		283	188	5		476	10,503
	2005	2,506	2,506	303		303	-	-	8	65	48	7,630	16	-	7,767		337	187			524	11,100
	2006	2,414	2,414	217		217	-	-	12	15	30	5,729	-	-	5,786		409	160			569	8,986
	2007	2,016	2,016	120		120	-	-	3	17	20	5,117	-	-	5,157	1	262	127			390	7,683
	2008	2,096	2,096	219		219	-	-	10	16	15	5,477	1	-	5,519	1	349	198			548	8,382
	2009	1,840	1,840	224		224	-	-	9	12	9	4,638	1	-	4,669	1	360	15			376	7,109
	2010	2,457	2,457	257		257	-	-	5	27	15	4,959	1	-	5,007	2	306	148			456	8,177
	2011	2,343	2,343	684		684	-	-	3	18	17	4,625	9	2	4,674	2	373	199			574	8,275
	2012	2,019	2,019	587		587	-	-	6	13	16	4,097	+	12	4,144	2	298	141			441	7,191
	2013	2,179	2,179	963		963	-	-	2	6	16	4,607	+	9	4,640	3	406	137			546	8,328
	2014	1,903	1,903	801		801	-	-	4	11	124	4,861	5	7	5,012	4	535	159		1	699	8,415
	2015	1,622	1,622	531		531	-	-	3	14	177	4,306	+	3	4,503	3	631	196			830	7,486
	2016	1,581	1,581	1,116	-	1,116	-	-	3	23	158	3,398	3	4	3,589	2	562	163			728	7,014
	2017	1,405	1,405	1,453		1,453			-	7	138	3,977	+	6	4,128	3	687	155		3	849	7,835
	2018	1,256	1,256	1,373		1,373			-	11	108	3,501	-	10	3,630	3	664	166		2	835	7,093
	2019	1,313	1,313	981		981			-	22	99	3,359	+	4	3,484	5	901	176		3	1,085	6,863
	2020	1,131	1,131	848		848			-	22	99	1,955	+	-	2,076	3	531	111		3	648	4,703
Retain catch total		194,591	194,591	13,492	0	13,492	0	0	368	1,522	17,310	182,190	3,602	57	205,049	35	13,742	7,952	6	12	21,748	434,879
Release	2010																			1	1	1
	2011																			6	6	6
	2012																					
	2013													5	5							5
	2014																					
	2015				-	-								3	3							3
	2016				1	1								4	4							5
	2017													6	6							6
	2018			1	1	2								6	6							8
	2019			-										5	5							5
	2020			0		0								5	5							5
Release total				1	2	3								34	34					7	7	44
Total		194,591	194,591	13,078	2	13,080	0	0	368	1,522	17,310	182,190	3,602	91	205,083	35	13,742	7,952	6	19	21,755	434,509

Table 10. Retained catches (metric tons, whole weight) by ISC Member countries of blue sharks (*Prionace glauca*) by fishery in the North Pacific Ocean, north of the equator, 1985-2020. “0” - Fishing effort was reported but no catch; “+” - Below 499kg catch; “-“ - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN						KOR		MEX		TWN		USA						Total
		Set-net	Drift gill-net	Longline	Others	Not specified	JPN Total	Longline	KOR Total	Others	MEX Total	Longline	TWN Total	Drift gill-net	Longline	Troll	Others	Sport	USA Total	
Retain	1985													-			1		1	1
	1986													1			1		2	2
	1987													1			1		2	2
	1988													-			3		3	3
	1989																6		6	6
	1990													-			20		20	20
	1991													-			1		1	1
	1992													1			1		2	2
	1993													-			-		0	0
	1994	9	577	33,368	19	4	33,977							-			12		12	33,989
	1995	7	483	37,567	11	4	38,072							-			5		5	38,077
	1996	7	474	29,015	19	4	29,519							-			-		0	29,519
	1997	9	598	32,457	8	6	33,078							-			-		0	33,078
	1998	7	611	30,610	5	4	31,237							-			1		1	31,238
	1999	8	828	27,270	7	2	28,114							-			-		0	28,114
	2000	8	730	29,569	11	1	30,319							-			-		0	30,319
	2001	8	731	30,615	9	2	31,365			-	-						-		0	31,365
	2002	7	768	26,181	13	1	26,970			-	-						-		0	26,970
	2003	7	1,350	26,780	12	2	28,151			-	-			-			-		0	28,151
	2004	8	1,202	25,684	7	3	26,904			-	-						-		0	26,904
	2005	-	1,321	29,482	13	2	30,818			2,721	2,721						-		0	33,539
	2006	5	1,204	25,106	2	2	26,319			2,765	2,765						-		0	29,084
	2007	5	1,323	23,725	19	2	25,074			3,324	3,324			9	8		-		17	28,415
	2008	-	944	20,115	14	1	21,074			4,355	4,355				7				7	25,436
	2009	-	1,208	19,330	4	1	20,543			4,423	4,423	11,541	11,541	1	9		1		11	36,518
	2010	4	963	22,608	9	1	23,585			4,469	4,469	7,670	7,670	-	7		0		7	35,731
	2011	7	765	20,231	1	3	21,007			3,719	3,719	13,117	13,117		13		0		13	37,856
	2012	2	1,076	13,892	3	3	14,975			4,108	4,108	10,606	10,606		16		0		16	29,705
	2013	6	1,103	17,203	4	2	18,319	75	75	4,494	4,494	6,321	6,321		1	0	0		1	29,210
	2014	4	1,060	16,241	0	2	17,306	100	100	5,502	5,502	8,151	8,151		0	-	-	-	0	31,059
	2015	21	1,080	12,470	-	2	13,573	53	53			8,551	8,551				-	-	0	22,177
	2016	26	1,832	14,483	1	2	16,343					8,563	8,563							24,906
	2017	4	1,366	14,787	-	1	16,158	8	8			11,121	11,121				1	-	1	27,287
	2018	40	1,236	10,921	-	1	12,198	2	2			11,761	11,761				1	0	1	23,962
	2019	28	1,052	5,793	-	1	6,874	4	4			18,165	18,165		-		11	-	11	25,053
	2020	28	1,052	5,793	-	1	6,874	0	0			15,540	15,540		0		-	-	1	22,415
Retain catch total		264	26935	601294	192	61	628746	242	242	39880	39880	131107	131107	13	61	0	66	1	141	800115
Release	2015							0	0											0
	2016							8	8											8
	2017							11	11											11
	2018							58	58											58
	2019							12	12											12
	2020							22	22											22
Release catch total								112	112											112
Total		264	26,935	601,294	192	61	628,746	355	355	39,880	39,880	131,107	131,107	13	61	0	66	1	141	800,229

Table 11. Retained catches (metric tons, whole weight) by ISC Member countries of shortfin mako sharks (*Isurus oxyrhinchus*) by fishery in the North Pacific Ocean, north of the equator, 1985-2020. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN Drift gill-net	JPN Longline	JPN Others	JPN Total	KOR Longline	KOR Total	MEX Others	MEX Total	TWN Longline	TWN Purse seine	TWN Total	USA Drift gill-net	USA Harpoon	USA Handline	USA Longline	USA Troll	USA Hook and line	USA Others	USA Purse-seine	USA Sport	USA Total	Total
Retain	1985							43	43				129	1					19			149	192
	1986							84	84				250	1					59			310	394
	1987							197	197				208	3					188			399	596
	1988							248	248				106	3					214			323	571
	1989							135	135				117	1					137			255	390
	1990							288	288				229	3					141			373	661
	1991							228	228				125	1					91			217	445
	1992							376	376				118	3					19			140	516
	1993							442	442				87	1					32			120	562
	1994	123	975	21	1,119			336	336				80	1					46			127	1,582
	1995	103	958	15	1,075			333	333				79	1					14			94	1,502
	1996	101	1,149	17	1,268			413	413				85	1					9			95	1,776
	1997	127	1,044	16	1,187			401	401				118	3					11			132	1,720
	1998	130	920	13	1,063			386	386				85	1					12			98	1,547
	1999	176	1,374	14	1,564			439	439				52	0					9			61	2,064
	2000	156	1,107	15	1,278			539	539				64	+					12			76	1,893
	2001	156	1,154	15	1,325			491	491				30	1					10			41	1,857
	2002	122	964	5	1,090			488	488				69	+					12			81	1,659
	2003	229	971	6	1,205			471	471				57	+					9			66	1,742
	2004	134	927	1	1,062			865	865				38	1					13			52	1,979
	2005	155	1,022	43	1,219			609	609				25	1					8			34	1,862
	2006	178	1,062	6	1,246			641	641				38	+					7			45	1,932
	2007	244	1,187	15	1,446			689	689				37	+					6			43	2,178
	2008	212	1,017	14	1,243	-	-	609	609				27	1					5			33	1,885
	2009	294	1,231	1	1,527	-	-	653	653	78		78	21	1			0		7			29	2,287
	2010	272	981	20	1,273	-	-	760	760	54		54	10	0					10			20	2,107
	2011	163	717	11	891	-	-	758	758	208		208	8	0					8			16	1,873
	2012	229	706	2	938	-	-	715	715	74		74	9	0			0		11			20	1,747
	2013	345	743	9	1,097	8	8	711	711	107		107	16	0					12			28	1,951
	2014	263	755	3	1,021	8	8	-	-	119		119	7	0		53	+	3	6		9	78	1,218
	2015	334	847	11	1,193					322		322	7			58		1	4			71	1,585
	2016	446	987	16	1,448	+	0			220		220	12	0	1	70		1	4		0	89	1,757
	2017	271	674	10	955	+	+			187		187	13	0		71		1	5			90	1,232
	2018	223	839	28	1,090	+	+			265		265	11			60		1	5			78	1,433
	2019	195	790	2	988	+	+			273		273	7 #			47 #		1 #	21 #			75	1,336
	2020	195	790	2	988	+	+			248		248	3	1		16		1	3			23	1,259
Retain catch total		5,577	25,892	328	31,798	16	16	13,348	13,348	2,155		2,155	2,377	30	1	375	1	9	1,178	0	9	3,980	51,297
Release	2011																			0		0	0
	2012										-	-											0
	2016					1	1																1
	2018					1	1																1
	2019					1	1																1
	2020					1	1																1
Release catch total						3	3																3
Total		5,577	25,892	328	31,798	19	19	13,348	13,348	2,155		2,155	2,377	30	1	375	1	9	1,178	0	9	3,980	51,300

Numbers in paranthesus are provisional.
Sharks catch is all retained, and no discard data.
1) USA data provided mako shark data as MAK (shortfin mako and longfin mako shark).