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[DRAFT] Report of the seventeenth meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (Plenary Session)

WCPFC-NC13-2017/IP-01

ISC[1]

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

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

PLENARY SESSION

12-17 July 2017
Vancouver, British Columbia
Canada

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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	John Holmes (Canada)
BILLWG	Billfish Working Group	Jon Brodziak (U.S.A.)
PBFWG	Pacific Bluefin Working Group	Hideki Nakano (Japan)
SHARKWG	Shark Working Group	Suzanne Kohin (U.S.A.)
STATWG	Statistics Working Group	Ren-Fen Wu (Chinese Taipei)

Other Abbreviations and Acronyms 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
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

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Highlights of the ISC17 Plenary Meeting

The 17th ISC Plenary, held in Vancouver, British Columbia Canada from 12-17 July 2017 was attended by Members from Canada, Chinese Taipei, Japan, Korea, and the United States as well as the Western and Central Pacific Fisheries Management Commission. The Plenary reviewed results, conclusions, new data, and updated analyses of the Billfish, Albacore, Shark and Pacific Bluefin tuna working groups.

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 Groups (WGs) 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. In 2016, the catch of priority species monitored by ISC Member countries was 53,543 t of North Pacific albacore tuna (NPALB, *Thunnus alalunga*), 13,167 t of Pacific bluefin tuna (PBF, *T. orientalis*), 8,867 t of North Pacific swordfish (SWO, *Xiphias gladius*), 2,034 t of North Pacific striped marlin (MLS, *Kajikia audax*), 7,157 t of Pacific blue marlin (BUM, *Makaira nigicans*), 346 t of shortfin mako shark (SMA, *Isurus oxyrinchus*) and 22,642 t of North Pacific blue shark (BSH, *Prionace glauca*). [1] The total estimated catch of these seven species is 107,746 t, or approximately 91% of the 2015 total estimated catch of 118,994 t. Annual catches of priority stocks throughout their ranges are shown in Table 15-1 through Table 15-7.

1.2 Opening of the Meeting

The Seventeenth Plenary session of the ISC (ISC17) was convened in Vancouver, British Columbia, Canada, at 0900 on 12 July 2017 by the ISC Chairman, G. DiNardo. A roll call confirmed the presence of delegates from Canada, Chinese Taipei, Japan, Republic of Korea, Mexico, and U.S.A. (*Annex 1*). A representative from the Western and Central Pacific Fisheries Commission (WCPFC) was also present. Pew Charitable Trusts, World Wildlife Fund for Nature - Japan (WWF), Monterey Bay Aquarium, Wild Oceans, Tohoku University, Waseda University, and American Fishermen's Research Foundation/American Albacore Fishing Association were present as observers.

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

ISC Member China, as well as the non-voting Members the Secretariat of the Pacific Community (SPC), the Fisheries and Agriculture Organization of the United Nations (FAO), and the Inter-American Tropical Tuna Commission (IATTC), while extended an invitation, did not attend the Plenary. The Plenary encourages future participation…

J. Holmes introduced Dr. Carmel Lowe, Regional Director Science, Pacific Region, Fisheries and Oceans Canada, who gave the welcome address for the meeting. Dr. Lowe welcomed the Members and emphasized the importance of albacore to Canada and Canada's history of fishing on the stock in the EPO, which has sustained industry and coastal communities. In addition to albacore, ISC provides sound science to manage other North Pacific tuna and tuna-like species and Canada is committed to science-based decision making. She noted that 2017 is a special year for Canada, because it marks the 150th anniversary of its sovereign independence. She encouraged meeting participants to enjoy the many cultural events associated with anniversary. She concluded by emphasizing the continued importance of the ISC's work, especially on depleted stocks such as Pacific bluefin tuna. Canada supports the ISC's ongoing work, as evidenced by its hosting of this meeting and the upcoming North Pacific albacore management strategy evaluation workshop.

2 ADOPTION OF AGENDA

The proposed agenda for the session (**ISC/17/Annex/02**) was considered and adopted. It was noted that observers would be given the opportunity at the end of each day to offer comments and seek clarification on topics discussed. C. Dahl was assigned lead rapporteur duties. A list of meeting documents is contained in **ISC/17/Annex/03**.

3 DELEGATION REPORTS ON FISHERY MONITORING, DATA COLLECTION AND RESEARCH

3.1 Canada

J. Holmes presented a summary of Category I, II, and III data from Canadian fisheries for highly migratory species in 2016 (**ISC/17/PLENARY/04**). The Canadian fleet of 152 vessels targets juvenile North Pacific ALB and operates primarily in the coastal waters of Canada and the United States, with little effort or catch outside of these areas in 2016. Preliminary estimates of effort and catch for 2016 are 5,359 vessel-days (v-d) and 2,842 t, respectively. While effort increased about 2% relative to 2015, catch declined 35% relative to 2015. Catch and effort were split primarily between Canadian waters (55% of the catch and 64% of the effort) and U.S. waters (44% of the catch and 35% of the effort). The Canadian fleet experienced the highest catch rates in June, after which catch rates were below average for the remainder of the fishing season. This early peak in catch rates is unusual for this fishery, but the below-average catch rates are consistent with lower catches – North Pacific albacore (NPALB) were difficult to find in coastal waters in 2016. The size composition data sampled from the catch (N=14,189) in 2016 exhibit a primary mode at 68-71 cm FL, with a smaller secondary mode between 79 and 83 cm FL. These modes correspond to two-year old and three-year old fish, respectively.

Discussion

There does not appear to be an explanation for the shift in the timing of the catch (more catch early in the season) in 2016 compared to previous years. Both potential environmental effects and changes in the spatial distribution of fishing effort have been ruled out. The apparent decline in catch-per-unit-of-effort (CPUE) (suggested by the simultaneous decline in catch and increase in fishery participation) cannot be explained by new entrants with limited fishing experience.

It was noted that for the past six or more years the fishing season established under the United States-Canada Albacore Treaty now ends earlier (September 15) than under past fishing access regimes. Canadian vessels fish for a few weeks in Canadian waters after access to U.S. waters closes, but fish migrate out of the Canadian EEZ by mid-October.

The number of undersize, released fish (colloquially referred to as “peanuts”) declined substantially in 2016 from a spike in 2015. The 2015 catch of undersize fish suggested the potential for a spike in recruitment in later years, which apparently has not materialized yet. It was noted that there is a spatial component to the size distribution of catch; when Canadian vessels fish farther south (e.g., off of California) in the past they have encountered more undersize fish. However, in 2015 small fish were also caught and released in the Canadian EEZ, consistent with a northern shift in the stock.

3.2 Chinese-Taipei

W. Wang presented the Chinese-Taipei National Report (**ISC/17/PLENARY/05**). There are two principal tuna fisheries of Chinese-Taipei operating in the North Pacific Ocean, namely the tuna longline fishery and the distant water purse seine fishery; other offshore and coastal fisheries include the harpoon, setnet and gillnet fisheries, and account for a small proportion of overall tuna and tuna-like species catch. The catches of longline and purse seine fisheries account for 99% of the total tuna and tuna-like species catches in the North Pacific Ocean by Chinese-Taipei. Longline fisheries are composed of the large-scale tuna longline (LTLL, vessels larger than 100 gross registered tons, GRT) and small-scale tuna longline (STLL, vessels less than 100 GRT) fleets. The total catch of tunas and billfish (including SWO, MLS, BUM, BLA, and SFA) for the longline fishery (including the catch of LTLL and STLL) in the North Pacific Ocean was 23,771 t for 2016 with 79 active LTLL vessels and 1,303 STLL vessels. For the purse seine fishery, the total catch was 185,692 t caught by 34 authorized vessels in the Pacific Ocean for 2016.

For the LTLL fishery, the sources of Category I data include weekly catch reports and commercial data from individual fishing vessels. Category II and III data are all compiled from logbook data. Fishermen are required to measure the length of the first 30 fish caught in each set. For the STLL fishery, the sources of Category I data include landings and auction records of local fish markets, reports of market sales, and monthly catch reports from individual fishing vessels. For the purse seine fishery, Category I, II, and III data are obtained from logbooks.

In March 2010, a catch documentation scheme (CDS) was established and implemented for vessels fishing for PBF. In addition to prior authorization, fishing vessels targeting PBF are required to notify the relevant authority and attach a tag to every PBF caught by them. Moreover, port samplers are dispatched to measure length and weight of each PBF. In addition, Chinese-Taipei has already collected 1,408 PBF tissue samples in 2016 under the close-kin mark recapture project.

An observer program for the LTLL fleet was implemented in the Pacific Ocean in 2002. The program has gradually expanded in recent years and hence the number of observers has increased. The program was further expanded to the STLL fleet in 2012. Thirty observers were deployed on longline vessels in 2016 in total, including 10 observers for LTLL vessels and 20 observers for STLL vessels.

Discussion

The change in overall fishing effort in longline fisheries was discussed. The number of registered STLL vessels has remained stable.. But the number of active vessels has likely declined in recent years due to various economic and operational factors, so STLL catch decreased.

3.3 Japan

H. Okamoto presented the Japan National Report (***ISC/17/PLENARY/06***). Japanese tuna fisheries consist of the three major fisheries (i.e., longline, purse seine, pole-and-line) and other miscellaneous fisheries like troll, driftnet, and setnet fisheries. The number of vessels has shown a decreasing trend in the longline and pole-and-line fisheries and has been stable in the purse seine fishery in this decade. The total catch of tunas (excluding SKJ) caught by Japanese fisheries in the North Pacific Ocean was 111,115 t in 2015 and 94,884 t in 2016. The total catch of tunas (including SKJ) caught by Japanese fisheries in the North Pacific Ocean was 300,652 metric t in 2015 and 247,425 t in 2016. Preliminary catch of PBF and ALB in 2016 was 8,302 t and 35,582 t, respectively. Size of ALB caught by pole-and-line ranged from 60 to 90 cm FL in 2016 and fewer individuals smaller than 60 cm were caught compared to 2015. The total catch of SWO and MLS in 2016 was 4,885 t and 1,320 t, respectively. In addition to this fisheries information, three research topics initiated in the Pacific Ocean in 2016 were noted: a PBF egg/larvae research cruise, recruitment monitoring on juvenile PBF, and a tagging research cruise on shark.

Discussion

It was pointed out that PBF catch in purse seine fisheries appears to have increased since 2013, possibly exceeding quotas established pursuant to the WCPFC Conservation and Management Measure (CMM). It was clarified that in Japan some quotas set at the prefectural level have been exceeded but the total catch with respect to the catch limit will be reported to WCPFC.

The catch of small PBF can be quite variable from year to year due to the availability of fish in the target year classes (age 0 and 1) and Japan’s recruitment monitoring program has documented this variability in recruitment. The next stock assessment for PBF will undoubtedly provide more information on recruitment and fishing mortality.

Catch of ALB declined in 2016; a change in fishing area has been ruled out as a reason but it was noted that the northward movement of pole-and-line fishing grounds occurred later than in previous years.

3.4 Republic of Korea

D. Kim presented the Korea National Report (***ISC/17/PLENARY/07***). The Korean distant water fishery uses two types of fishing gears, purse seine and longline, that engage in fishing for tuna and tuna-like species in the North Pacific. The total number of active longline vessels showed a stable pattern, ranging from 122 vessels in 2010 to 125 in 2013; however, the number decreased to 96 in 2016. The total number of active purse seine vessels showed a constant trend during 2010-2014 but decreased slightly in 2015 and 2016 to 25 vessels. Total catch of tuna and tuna-like species caught by Korean distant water fisheries in the North Pacific Ocean was 84,586 t in 2016. Total catch by the longline fishery was 10,593 t, which is 53.4 % of the historical highest catch in 2004. Catch by the purse seine fishery was 73,993 t, which corresponds to 73.5% of the historical highest catch in 2003. As for the catch composition of the longline fishery, dominant species were BET, which is over 65% of the total catch, and YFT and BUM comprising 15% and 10%, respectively. In the purse seine fishery, SKJ, YFT, and BET comprised 85%, 13%, and 1%, of the catch respectively. The offshore large purse seine fishery caught 1,029 t of PBF in the Korean EEZ in 2016. This catch was mainly distributed in the South Sea around Jeju Island throughout the year with the highest catches in March. Large PBF (≥30kg) were 46% of the total PBF catch and most of the large PBF were caught during only two days in March. For close-kin analysis 1,045 PBF tissue samples were collected in 2016 and 348 samples were collected in 2017.

<u>Discussion</u>

Korea provided additional information about its fishery monitoring program. It has an electronic monitoring system with reporting in real time through satellite transmission. Fishermen have up to 72 hours to correct the reported information on catch and effort, if necessary. Potential inaccuracies in logbook reporting were questioned due to fishermen being less able to identify non-target bycatch species. Educating fishermen on species identification is warranted. However, logbook formats do allow reporting of all data required by RFMOs including length frequency data. It was noted that coastal fishery participants have remarked on the utility of the data they report through the electronic monitoring program. This may provide an incentive for accurate self-reporting. The coastal fishery does not have at-sea fishery observers but shoreside observers are used to document landings.

It was noted that the purse seine fishery exhibited a marked eastward shift in the distribution of fishing effort in 2015. This effort shift is likely attributable to the strong El Niño occurring in that year.

The increase in PBF landings by weight in 2016 may be attributable in part to an increase in the average weight of the fish caught. More fish ≥ 30 kg were caught in 2016 compared to 2015. Catch of larger fish may have contributed to Korea exceeding its PBF quota in 2016 but Korea will adjust quotas downward in future years in compensation so that catch over the five-year period 2017-2021 is consistent with the WCPFC CMM.

3.5 Mexico

M. Dreyfus presented the Mexico National Report (***ISC/17/PLENARY/08***).

Billfishes except SWO have been reserved for the sport fishery since 1980s. Most of the sport fishing activities are located in areas near the southern tip of the Baja California Peninsula. It is a catch and release activity where most of the catch is dolphin fish and about 20% are billfishes, dominated by MLS.

Pacific shark fisheries have traditionally reported catch in two groups (big and small shark individuals). A logbook and requirement, under which fishermen provide species composition of the catch, was introduced in 2007. As a conservation measure, in 2012 Mexico implemented a three-month closure covering the period of reproduction of many of the species found in Mexican waters. Since 2007 there also has been an observer program, which covers both longline and artisanal fleets at different coverage rates. Mexican scientists have been cooperating with the ISC SHARKWG; they have been providing time series of catch estimates for SMA and BSH and size composition of the catch. They are also collaborating with the U.S.A. and Japan in an SMA age and growth estimation study.

In relation to tunas, Mexico has a fleet that primarily targets YFT and complements its catch with SKJ. All vessels above 400 cubic meters capacity have a scientific observer on board from the IATTC or the national program. Some of those vessels also participate in the PBF fishery each year. The catch is transferred to net pen grow out farms in northwest Baja California Peninsula. A quota for the PBF commercial fishery has been in place since 2012. In 2016 2,700 t was retained after the release of 192 t to comply with the voluntary measure Mexico adopted for that year. Since 2013 Mexico also has been providing size composition of the catch for the PBF assessment and is currently processing 2015-2017 data for that same purpose. Related to the PBF close-kin analysis project, this year sampling began from animals captured last year. This activity is expected to continue for several years with the help of the farming industry.

Discussion

Mexico noted that when collecting samples for the PBF close-kin analysis project lengths of individual animals are not always collected. However, in collaboration with the PBF net pen operations the size distribution of each harvest is accurately documented. A general indication of the size of fish sampled for close-kin analysis can be derived from this information.

Variability in the catch of MLS and SFA was discussed. Mexico asserted that recent inter-annual variability is not outside the historical range.

3.6 U.S.A.

M. Seki presented the United States National Report to the Plenary (**ISC/17/PLENARY/09**). The Pacific Ocean produces about 71% of the global tuna catch. And in the Pacific Ocean, about 79% of the tuna catch is from the Western Pacific. Purse seine gear accounts for 66.8% of the tuna catch, followed by longline (9.6%) and pole-and-line (8.1%). In 2016, there were 571 vessels in the U.S.A. albacore troll fishery in the North Pacific, the fewest since 2008 when there were 525 vessels. The 2016 albacore troll catch was 10,686 t. For the U.S.A. purse-seine fishery, the number of vessels fishing in the North Pacific Ocean decreased to 42 in 2016, compared to 46 in 2015. Total U.S.A. purse-seine catch in the North Pacific Ocean was 61,300 t in 2016, an increase from 53,822 t in 2015. The catch consisted of 86% skipjack and 11% yellowfin tuna.

The 2013-2016 catches are considered preliminary since the species composition of juvenile YFT and BET have not been accounted for and has not been adjusted. U.S.A. longline fishing activity for BET and SWO has remained stable since 2008. In 2016, 141 longline vessels landed 12,088 t. Of this, 5,848 t were BET, and 1049 t were SWO. Research updates were provided on the impact of oceanic fronts on ALB foraging efficiency, possible signs of increased PBF in the Southern California Bight in spring 2017, PBF foraging ecology, PBF close-kin sample collection and a workshop planned for 2017, BUM age estimation, and shark post-release survival in longline fisheries. With respect to bycatch, research on the effect of hook attachment rings on catch and bycatch and passive acoustic studies on false killer whale encounters and depredation with longline gear was presented. Additionally, studies concerning the impact of climate change on North Pacific carrying capacity, development of a recruitment index for BET to forecast catch, ongoing efforts to improve modeling for stock assessments, and economic performance of pelagic longline fishing in Hawaii were highlighted.

<u>Discussion</u>

It was explained that the age validation study of a very large BUM specimen using bomb radiocarbon dating noted in the U.S.A. report was a one-time activity and enabled by the availability of the specimen. Future work is dependent on acquiring specimens. [The chair insert the age of the animal]

In response to a question, the Chair detailed progress on the ISC PBF close-kin analysis project. ISC Members have been required to collect tissue samples since 2015 but questions have arisen about processing the samples. The U.S.A. is planning to hold a workshop for ISC Members to review and standardize processing methods. The Chair noted that Japan has already made considerable progress in sample processing and genetic analysis; their expertise should be a starting point for determining standard processing techniques at the workshop. He also noted that the cost of sample processing and genetic analysis varies widely among countries; in general it is much cheaper in the U.S.A., so it may make sense for countries to send their samples to firms in the U.S.A. for processing. Japan is also developing the simulation model that will be necessary to test estimating the stock abundance from close-kin analysis results.

4 REPORT OF THE CHAIRMAN

G. DiNardo, ISC Chair presented the following report to the Plenary.

The ISC had another busy year since the ISC Plenary met in Sapporo, Japan in July 2016. The year was spent completing a stock assessment update for blue shark, a benchmark assessment for North Pacific albacore tuna, advancing research collaborations with PICES, and collection of biological samples to facilitate close-kin research, as well as preparing for assessments on Pacific bluefin tuna and shortfin mako shark in 2018, evaluating requested Pacific Bluefin tuna harvest strategies, and developing a process to formalize the structure/existence of the ISC. While numerous accomplishments and successes advanced the scientific integrity of ISC, we cannot afford to waiver from our scientific mission. The failure of ISC to provide best available scientific information has far-reaching implications. While international fisheries management can be political at times, politics has no place in science. As an independent scientific organization ISC must stay the course, which includes appointing leaders with proper scientific credentials.

Progress was made by improving best practices and scientific reporting procedures, compiling a catalogue and inventory of the ISC database, and advancing development of the website and data enterprise system. Seven intersessional workshops and two webinars were held to facilitate collaboration among Member scientists in implementing ISC work plans and coordinating research on the stocks. In addition, the ISC convened a Pacific Bluefin Tuna International Stakeholders Meeting in Tokyo Japan, initiated planning for the third international workshop on Management Strategy Evaluations scheduled for October 2017 in Vancouver, BC, Canada, and in November 2016 co-convened a workshop at the 2016 Annual PICES Meeting in San Diego, CA as part of the joint ISC-PICES Working Group-34 to assess the impacts of climate variability on highly migratory species. We continue to address recommendations stemming from the 2013 peer review of the ISC function. Jon Brodziak (U.S.A.) and Ren-Fen Wu (Chinese-Taipei) were reelected as Chairs of the ISC Billfish and Statistics Working Groups, respectively. Hidetada Kiyofuji (Japan) was elected as Chair of the ISC Albacore Working Group, Mikihiko Kai (Japan) as Vice Chair of the Shark Working Group and Hirotaka Ijima (Japan) as Vice Chair of the Billfish Working Group.

Managing ISC activities continued to be a challenge during the past year. As before, the challenge is an inherent consequence of the ISC framework adopted by the Members. That is, ISC relies on in-kind contributions from its Members rather than monetary contributions to support a "Secretariat" to oversee day-to-day operations of the organization. Given this framework, the Office of the Chairman takes on the role of a Secretariat, but not a full-service one at that, owing to uncertain support from the Chairman's funding source. Likewise, the working groups depend on in-kind contributions from Members who elect to participate in specific working groups. This support is uneven among the Members, and can delay progress of a working group in completing assignments. To date, the support for administration of ISC activities has been provided by the U.S. for day-to-day operations of the Office of the Chairman, and by Japan for operating the ISC website and database. Member countries with scientists serving as chairpersons of the working groups have contributed to supporting administrative services of the working groups. All of the support is appreciated and acknowledged. Efforts to formalize the ISC through a Memorandum of Understanding (MOU) are moving forward and should provide the necessary framework to address many of these concerns including support for a fulltime secretariat.

I close this report by thanking all my colleagues who have worked on ISC tasks and who have provided the support to ISC and the Office of the Chair in advancing the objectives and purpose of the organization. The service of Chi-lu Sun, Vice-Chairman, for support and insightful advice is acknowledged, as well as the services of Freddie Logan, Tarah Sullivan. A special thanks and appreciation is owed to the Chairs of the working groups, namely Ren- Fen Wu, Jon Brodziak, John Holmes, Hideki Nakano, and Suzanne Kohin, who provided unselfish leadership in guiding the work of the Working Groups. In addition, the leadership role of Hideki Nakano with respect to the Data Administrator, Izumi Yamasaki, and Webmaster, Kirara Nishikawa, is appreciated. Finally, I acknowledge the professional assistance and dedicated service of Sarah Shoffler to the ISC in completing tasks assigned to the Chairman. In that capacity, she served as point of contact for the Office of the Chairman, led in writing, editing and assembling technical information required for agenda items of meetings and for responding to inquiries, and served as advisor to me on aspects of ISC. Thanks to all of you for contributing to another successful year for ISC and for the support and service provided.

5 INTERACTIONS WITH REGIONAL ORGANIZATIONS

5.1 WCPFC

A. Beeching presented an SC12 summary of the two ISC stock assessments, PBF and BUM. SC12 showed concern regarding the poor PBF stock status with spawning stock biomass at 2.6% of the estimated unfished spawning stock biomass ($SB_{F=0}$) and low recruitment. He also detailed the issues around the need for an extraordinary meeting of the NC to satisfy some of the PBF issues raised during WCPFC13. The outputs of that meeting were accepted, and they agreed to adopt CMM 2016-04 to establish a multi-annual rebuilding plan for PBF. Finally, the ISC Plenary was briefed on the operations of the WCPFC tissue bank.

Discussion

The Chair noted that he had sent a letter to WCPFC requesting that when the WCPFC makes a request to ISC it be put in writing and submitted to the ISC formally by letter. Requests emanating from WCPFC13 were not communicated to ISC in this way. The Chair will remind WCPFC of this process.

It was noted that the PBFWG had completed some work in association with requests for the ISC to define a "drastic" recruitment drop and associated risks for PBF.

5.2 PICES

5.2.1 ICE-PICES Collaboration

G. DiNardo reported on the activities of the joint ISC-PICES Working Group (WG-34) to assess the impacts of climate variability on highly migratory species, that is being facilitated under the auspices of PICES (I**SC/17/PLENARY/10**). Understanding the impacts of climate variability on pelagic fish dynamics and spatial structure, and incorporating these processes into stock assessments to support effective fisheries management decision-making, represents the next generation of stock assessment models. The joint collaboration spans 2015-2018, with an opportunity to extend the joint collaboration for an additional year.

It was reported that WG-34 convened its first workshop (W-4) and business meeting at the 2016 PICES Annual Meeting in San Diego, CA, U.S.A. A second business meeting was convened at ISC17 to review progress and membership, as well as potential venues for an international workshop to present research findings and lessons learned stemming from WG-34. A second workshop (W-3) and third business meeting will be convened at the 2017 PICES Annual Meeting in Vladivostok, Russia.

Discussion

None.

5.2.2 2018 PICES Symposium Co-Sponsor

G. DiNardo introduced the invitation from PICES for ISC to co-sponsor an international symposium on "Understanding changes in transitional areas in the Pacific" (**ISC/17/PLENARY/10**). Given the importance of transitional areas (TA) to highly migratory species and fisheries that exploit them, and the importance of this area to the mission of ISC, inviting ISC to participate as a co-sponsor seemed logical.

The goal of the 2018 symposium is to update and expand our understanding of Pacific TAs. The symposium will focus on questions surrounding natural and anthropogenic climate variability and change in Pacific TAs, and discuss evidence of climate-driven changes in the position and physical structure of TAs and their biological communities. The symposium will also address socioeconomic questions related to the challenges of managing the highly migratory and transboundary resources in TAs. The symposium organizers will strive to publish the proceedings in a peer-reviewed journal.

Discussion

It was noted that the symposium on TAs covers more types of oceanographic features than just frontal zones (such as meso-scale eddies), and many high seas fisheries operate in these areas. Scientists from U.S.A., Japan, and Mexico are assisting in organizing the symposium.

. The ISC Chair polled Members as to whether ISC should be a co-sponsor of the symposium noting that ISC sponsorship would consist of symposium participation (oral presentations). All Members present agreed that ISC should co-sponsor the symposium, and to encourage local scientists to present relevant research at the symposium.

6 REPORT OF SPECIES WORKING GROUPS AND REVIEW OF ASSIGNMENTS

Consistencey in WG Report formats

6.1 Albacore

J. Holmes reported on the activities of the ALBWG over the past year (**ISC/17/PLENARY/ANNEX/04/09/12**). The WG held a data preparation workshop 8-14 November 2016 in Nanaimo, Canada (**ISC/17/PLENARY/ANNEX/04**), and the stock assessment workshop 11-19 April 2017 in La Jolla, U.S.A. (**ISC/17/PLENARY/ANNEX/09**). The WG also conducted a webinar in January 2017 to discuss unresolved data issues prior to the data submission deadline for the stock assessment. The data issues were resolved and the stock assessment was successfully completed. The 2017 assessment includes some important changes in model structure and assumptions relative to previous assessments (see **ISC/17/PLENARY/ANNEX/09** and Section 6a) that the WG believes are important advancements in the north Pacific albacore modeling effort:

1. New coherent definitions of fleets, especially the JPN LL and PL fleets, based on area and season that achieve constant length-selectivity; and
2. A new standardization procedure for the JPN LL index which shows that the model is able to measure changes in the albacore population due to fishing. The new standardization procedure is a zero-inflated negative binomial mixed effects model, using 5°x5° area and vessel as random effects (Ochi and Kiyofuji 2017: ISC/17/ALBWG.01).

An election was held for a new WG Chair at a half-day meeting in advance of ISC17. Hidetada Kiyofuji (Japan) was unanimously elected Chair of the ALBWG for a three-year term (2017-2020). Steve Teo (U.S.A.) was appointed Vice-Chair of the ALBWG for a three-year term (2017-2020).

The ALBWG proposed a schedule for 2017/18:

Meeting	Dates	Location	Goals
SC13	9-17 Aug 2017	Rarotonga, Cook Islands	Steve Teo to present stock assessment results and information
NC13	28 Aug-02 Sept 2017	Busan, Korea	J. Holmes to present stock assessment results and information and discuss MSE progress
MSE Managers Workshop	Proposed dates 17-19 Oct 2017	Vancouver, Canada	Input on acceptable risk, harvest control rules, operating model
Workshop	Mar-Apr 2018	TBD	WG Technical input on MSE modelling issues
1SC18	July 2018		1-day meeting – catch tables, national contacts, other administrative issues

The ALBWG noted the following ongoing issues affecting its work:

1. Clarification of ALB catches reported by China and Vanuatu to the IATTC and WCPFC (see ISC15 Plenary Report for a fuller description; and
2. Clarification of engagement with managers/stakeholders from the IATTC and WCPFC on management strategy evaluation (MSE).

Discussion

Members discussed the proposed dates for and the purpose of the third MSE workshop. Desiree Tommasi, a new hire at the NOAA Southwest Fisheries Science Center, will be coordinating development of the MSE and as such, will plan with support from the ALBWG, specific topics to be covered at the workshop. Members raised concerns about the proposed dates for the workshop (17-19 October 2017) and asked for the opportunity for more input through the ALBWG to settle on a mutually agreeable date. The new WG Chair was tasked with polling WG members for alternative dates and the purpose of the workshop to clearly define when managers and scientist in their countries could attend the workshop. At the same time, members stressed that the workshop announcement should be circulated as soon as possible so as to maximize the opportunity for managers and other stakeholders to participate.

6.2 Pacific Bluefin Tuna

H. Fukuda reported on the activities of the PBFWG over the past year (**ISC/17/ANNEX/07/11**). Since in recent years the PBFWG has conducted a stock assessment every two years, with the latest stock assessment completed in 2016, a stock assessment was not conducted this year.

Between the two consecutive assessments, the PBFWG updated abundance indices to monitor the most recent trends of spawning stock and recruitments. The updated standardized CPUEs from the Japanese and Taiwanese longline fleets, which represent the relative abundance of large spawners, showed a consistent increase and catch-at-length data from both fleets indicated new modes of smaller fish in the catch. Historically the spawning population was comprised of a single cohort of large fish ranging from 155 to 236 cm. In recent years, the spawning population is comprised of multiple cohorts ranging from 100 to 236 cm.

The updated standardized catch-per-unit-of-effort (CPUE) from the Japanese troll fleet, which represents the relative abundance of age-0 recruitment, showed a slight increase in 2015 from that of 2014, but is at a low level. The presenter also introduced the real-time recruitment monitoring program conducted by Japan, and suggested that the recruitment level in 2016 is likely to be higher than that of 2015 and 2014. The PBFWG considered this positive information for stock recovery, even though the best estimate of recruitment is only available from the assessment.

The presenter also showed the results of projections requested by the joint meeting between WCPFC-NC and IATTC, which have already been forwarded to the WCPFC-NC and IATTC (**ISC/17/ANNEX/11**). Stochastic projections of PBF were conducted for 19 harvesting scenarios, which were evaluated by six candidate rebuilding targets under three recruitment assumptions. Performance measures were examined for all scenarios, such as probabilities of achieving candidate rebuilding targets and expected annual yield by flag or area. Trajectories of spawning stock biomass and total yield during 2015-2035 were shown, which were comparable in each scenario, as well as a table of performance measures, providing material for further discussion towards the next CMMs. The results were presented to the ISC PBF stakeholder meeting in April 2017. (See Section 6.2.1.)

[Chair to add language on frequency of assessments, no need for emergency rule.] Finally, the presenter summarized the PBFWG's discussion of the request from WCPFC 13 to define a "drastic" drop in recruitment, which the PBFWG found difficult to do. Instead, the WG provided a possible framework to evaluate how recruitment in the most recent one or two years would affect the probability of the stock rebuilding to the rebuilding target within the specified time period (Figure 6-1).

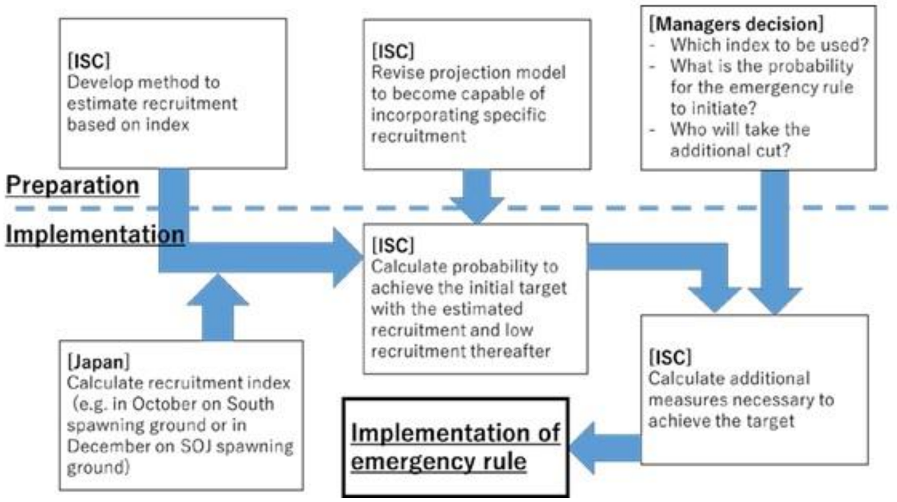

Figure 6-1. An example of flowchart of development and implementation of an emergency rule based on recruitment index. (Source: ISC/17/ANNEX/07, p. 15)

The development of a framework would require a certain amount of time, because it would entail properly evaluating the ability of the new Japanese recruitment/troll index to predict the recruitment level, developing a procedure to convert the index to recruitment (relative or absolute), and revising the projection model so it would be capable of the calculation suggested here.

[Insert future PBFWG meetings?]

Discussion

[Chair to revise.]

[It was noted that the request from the WCPFPC for emergency rule is not necessary given the frequency of assessments.] Plenary accepted the PBFWG's proposed framework for implementation of an emergency rule process when a drastic drop in recruitment is detected as shown in Figure 6-1.

It was emphasized that assessment-based projections will take recruitment variability into account.

While the PBFWG was unable to come up with criteria for identifying a "drastic drop" in recruitment, it was suggested that they look at the patterns of recruitment variability of other teleost stocks instead for defining the meaning of a "drastic drop." [This was not stated. Need to get the actual language.]

6.2.1 PBF Stakeholders' Meeting

G. DiNardo provided an overview of the PBF International Stakeholders Meeting (ANNEX 14). The International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) hosted the First Pacific Bluefin Tuna International Stakeholders Meeting at the Mita

Conference Hall (Mita Kaigisho) in Tokyo, Japan from 25-27 April 2017. The Objective of the meeting was to discuss the expected performance of 37 harvest scenarios relative to six candidate rebuilding targets and 9 performance metrics, under a range of assumptions regarding future recruitment conditions (low, average and combined low to average), to facilitate discussion on the selection of the next interim Pacific bluefin tuna (PBF) rebuilding target scheduled for decision at the August 2017 WCPFC-Northern Committee Meeting. Dr. Gerard DiNardo, Fisheries Resources Division Director at NOAA Fisheries, Southwest Fisheries Science Center and Chairman of the ISC, along with Mr. Masanori Miyahara, Japan Fisheries Research and Education Agency President and Chairman of the WCPFC-Northern Committee (NC), co-chaired the event.

As this was a public meeting, stakeholders were urged to candidly express their perceptions regarding the status of PBF, as well as perspectives on future rebuilding targets and potential rebuilding strategies to achieve the targets. Stakeholders were also reminded that at the 2016 WCPFC Commission Meeting the NC was requested to take due account of two specific suggestions: rebuilding PBF SSB to 20% [of what? Virgin biomass, current SSB0?] by 2034 and development of emergency rules concerning drastic drops in recruitment and associated risks. While no final decisions were expected at this meeting, the discussions will inform decisions on an interim rebuilding strategy and target at the 2nd Joint IATTC-NC Meeting scheduled for August 2017.

Approximately 150 stakeholders participated in the event, including resource managers, scientists, industry (fisherman, farmers, retailers, and processors), representatives from Pacific Ocean tuna RFMOs, environmental organizations, and other stakeholders interested in PBF. Dr. H. Fukuda (NRIFSF) made a presentation entitled Pacific bluefin tuna (PBF) stock assessment and related information. Dr. Gerard DiNardo presented the additional PBF projections completed by Akita et al. (2017), and reviewed during the February 2017 PBFWG Workshop, as well as a summary of the findings.

While all participants were committed to rebuilding PBF as soon as feasibly possible, the need to restructure fishing activities was also recognized. However, despite a full day of presentation materials on the critically low status of the PBF stock, many stakeholders either believed that the stock was already rebuilding, or that changing environmental conditions was the reason for low stocks. Large-scale industry stakeholders urged the ISC and the Government of Japan not to implement harsh measures, as fishery economic conditions in Japan are dire. Projection results [from 2015] constitute new information relative to PBF conservation advice and these are the conclusions [of the report]:

- Different recruitment scenarios forecast entirely different levels of SSB in the future;
- Under average recruitment conditions, all harvest scenarios achieve the initial rebuilding target of $SSB_{MED1952-2014}$ by 2024;
- Under all recruitment conditions with zero removals (no fishing), SSB trajectories achieved all rebuilding targets by approximately 2020 and the initial rebuilding target, $SSB_{MED1952-2014}$, within 2-3 years;
- Achieving 20%SSB0 during the projection period was not possible in most of the low recruitment scenarios;

- The probability of SSB falling below the historical lowest level at any time during the projection period is low (< 2%) in all projections;
- Scenarios that do not have catch limits for large fish in the EPO and WPO, or has a higher catch limit for large fish in WPO, do not achieve the initial rebuilding target, $SSB_{MED1952-2014}$, by 2024 under low recruitment conditions; and
- Reducing the catch of small fish results in positive impacts on SSB trajectories, even with increases in the catch of large fish in the WPO.

Discussion

It was recommended that the workshop report (**ISC/17/PLENARY/ANNEX/14**) be titled the ISC Chair's report and noted that the report will be presented by the outgoing ISC Chair to NC13.

6.3 Billfish

J. Brodziak provided the BILLWG Report (**ISC/17/PLENARY/ANNEX/10**). The BILLWG conducts all of its work in accord with the scientific method which includes empirical testing, open debate, documentation and reproducibility, reporting uncertainty, and peer review. The BILLWG focuses on an ongoing consistent application of this method to produce the best available scientific information for the assessment of billfish stocks in the Pacific Ocean.

The BILLWG held one intersessional meeting during the ISC17 work cycle for providing assessment information and conservation advice to the ISC17 Plenary.

BILLWG June 2017 Workshop

1. BILLWG Assessment Research Workshop was held in Keelung, Taiwan, at National Taiwan Ocean University during 1-7 June 2017 with participants from Japan, Taiwan, and U.S.A.
2. The primary goals of this workshop were (1) to review and update the standardization of Japanese longline CPUE for swordfish and (2) to review and finalize North Pacific swordfish population structure for the 2018 assessment.
3. Secondary goals of this workshop were to:
   a. Review and update billfish biological and fishery information for ISC BILLWG webpage;
   b. Analyze and describe the spatiotemporal distributions of juvenile and adult swordfish; and
   c. Identify and prioritize uncertainties in billfish stock assessments for management strategy evaluation.

All of the ISC16 BILLWG goals and associated work assignments were addressed at the June 2017 workshop. Six working papers were presented and reviewed by the BILLWG to this end.

In addition, one research presentation on swordfish genetic structure was considered. This was "Bayesian analyses of Pacific swordfish (*Xiphias gladius*) genetic differentiation using multilocus single nucleotide polymorphism data" by Ching-Ping Lu based on Lu, et al. (2016. *Journal of Experimental Marine Biology and Ecology*. 482:1-17). [consistency in citation format]

The BILLWG noted that the key findings of Lu's new research on swordfish genetics were:

- Overall the new research suggested that there were two major swordfish genetic clusters in the Pacific Ocean and these were so-called tropical and temperate genetic patterns.
- The genetic model in Lu, et al. (2016) shows that swordfish exhibit complex genetic population structure in the Pacific.

In addition, the BILLWG noted that there is new information on individual swordfish movements across the southern boundary of the EPO stock area at 20ºS latitude, which was provided by the tagging data in the study of Abascal, et al. (2010. Horizontal and vertical movements of swordfish in the Southeast Pacific. *ICES Journal of Marine Science*, 67: 466–474). This paper showed a consistent migratory pattern with fish moving northwest across the stock boundary at 20d S latitude by autumn and presumably returning south by early spring.

Based on the new information on swordfish genetic and movement patterns along with the existing status quo treatment of North Pacific stock structure, the BILLWG agreed to proceed with the 2018 benchmark assessment and account for some stock structure uncertainty by assessing:

1. The WCNPO stock (boundary same as used in 2014) as a benchmark assessment, attempting to use Stock Synthesis or similar structured model, and
2. The single North Pacific swordfish management unit north of the Equator as a supplementary assessment scenario.

Given this decision on how to treat the 2018 swordfish stock assessment, the BILLWG developed a work plan for 2017-2018 with the following resolution.

Resolution of BILLWG Work Plan for 2017-2018

Secondary tasks for the ISC18 work plan were:

- Ongoing development of management strategy evaluation algorithms for ISC BILLWG stocks
- Continue to evaluate stock structure uncertainty for North Pacific billfish stocks
- Complete the update of BILLWG webpage information
- Continue work on billfish population dynamics and fisheries in the North Pacific

The primary task for the ISC18 work plan is to conduct a benchmark assessment for North Pacific swordfish accounting for some stock structure uncertainty, as described above.

Proposed Dates and Locations of BILLWG Intercessional Meetings 2017-2018

- 2017 Swordfish Data Preparation and Modeling Webinar/Teleconference Meetings: September (SS3 version), November (Data Plan), December (Data Progress)

- Swordfish Data Preparation Meeting in Honolulu: 17-23 January 2018
- Swordfish Assessment Modeling Meeting in location to be determined: Tentative dates in Spring 2018 to be determined

The BILLWG also identified assessment scientists to work on the 2018 benchmark North Pacific swordfish stock assessment. These were Dr. Hirotaka Ijima, Japan; Dr. Michelle Sculley, U.S.A.; and Dr. Yi-Jay Chang, Taiwan.

The BILLWG also identified the need to have a data manager for the BILLWG, noting that Darryl Tagami successfully served for 2010-2016 and that there is no current data manager for the BILLWG.

Last the BILLWG resolved the need for a new Chair and Vice Chair by holding elections with

- Jon Brodziak was elected as Chair for one year
- Hirotaka Ijima was elected as Vice Chair for three years

Discussion

The first use of a structured model for the SWO assessment was discussed. It was difficult to achieve SS2 model (ver. XX) convergence in a previous attempt for the EPO stock, in part because of uncertainty about the growth curve. The WCNPO stock did not have the same convergence issues in the previous attempt. The BILLWG Chair also reviewed oceanographic and other information used to determine the current stock boundary. Recent genetic work is reasonably consistent with this stock boundary.

The ISC Chair recommended that the date and location for the proposed 2018 BILLWG assessment modeling meeting be determined soon. He also emphasized the need for the BILLWG to appoint a data manager. This appointment is the WG Chair’s responsibility.

The ISC Chair noted that as MSE research for billfish stocks advances it will be important to shift to a format that allows stakeholder engagement. The BILLWG Chair emphasized that current work is focused on resolving preliminary scientific uncertainty questions as a first step. As progress is made stakeholders will be invited to participate. It was noted that any MSE is unlikely to be conducted before 2020.

6.4 Shark

S. Kohin, SHARKWG Chair, provided a summary of SHARKWG activities over the past year (**ISC/17/ANNEX/05/08/13**). The focus of the SHARKWG was on BSH with the goal of completing a benchmark North Pacific BSH stock assessment by Plenary 17. Full meetings of the SHARKWG since ISC16 were held in Busan, Republic of Korea and La Jolla, CA, U.S.A. The SHARKWG also held two webinars between meetings to review data updates and plan for the BSH assessment. Other SHARKWG activities included a meeting of a subgroup of assessment modelers in advance of the full assessment workshop, participation in the STATWG Steering Committee meeting, a webinar involving the subgroup of shark age and growth specialists, and a short meeting in advance of ISC17 to conduct administrative business and plan for the coming year. Canada, China, Chinese Taipei, Japan, Korea, Mexico, U.S.A., IATTC and the WCPFC all actively participated in at least one SHARKWG meeting or webinar. Although BSH was the focus of the Working Group over the past year, some information on SMA fishery data and biology was also discussed as the Working Group prepares for the SMA full assessment in 2018.

Highlights of the meetings and webinars were briefly presented; Annexes 5 and 8 contain the reports of the full Working Group meetings. The SHARKWG Chair expressed appreciation to Korea for hosting the BSH data preparatory meeting and to U.S.A. for hosting the assessment workshop. Through the hard work of WG members at the meetings and during the intercessional webinars, the SHARKWG completed a very thorough and rigorous, fully-integrated BSH benchmark assessment that is based on the most complete fishery and biological data compiled for a pelagic shark species to date.

The SHARKWG proposed a work plan for the coming year to complete the first full assessment of North Pacific SMA before ISC18. The SHARKWG recognizes the difficulty in estimating shark catch and discards and the challenges presented by spatial segregation of pelagic sharks by size and sex. In addition, life history parameters for pelagic sharks are still rather uncertain. Work leading up to ISC18 will focus on improving catch and CPUE time series for SMA and advancing research on SMA growth. SHARKWG age and growth specialists are working to corroborate age readings across labs and will convene a workshop in November 2017 to conduct meta-analyses of SMA vertebrae band pair readings and produce consensus growth curves for the SMA assessment.

Suzanne Kohin has completed her final term as SHARKWG Chair. Mikihiko Kai of Japan was elected Vice Chair of the SHARKWG and will act as interim Chair until the SHARKWG meets in November 2017 when it will hold an election for Chair.

The SHARKWG established the following tentative meeting schedule:

Late Sept/Early Oct, 2017	Mako ageing webinar
Oct 19 - 24, 2017, Shizuoka, Japan	Mako ageing workshop
Early Nov, 2017	Mako data prep webinar
Nov 27 - Dec 1, 2017, Shizuoka, Japan	Mako data prep meeting
Jan/Feb, 2018	Mako data prep webinar
March/April 2018, La Jolla, CA USA	Mako assessment meeting

Discussion

The availability of catch estimate time series data was reviewed; these data are necessary to conduct a fully structured SMA assessment. Most catch is attributable to Chinese Taipei, Japan, Mexico, and the U.S.A. and these Members have committed to provide the necessary data.

A new Chair needs to be elected since the current Chair’s term is ending. There is also a need to identify the team lead for the SMA assessment and a data manager. In general, it is better if WGs address the election of officers at longer, regular meetings when more members are in attendance, rather than the short meetings that precede the Plenary. This gives members more time to consult on who can fulfill those roles.

It was noted that both spatial differences and sexual dimorphism in growth have been observed for BSH and SMA. Sexual dimorphism in growth will be addressed in the upcoming SMA growth and age workshop.

The SHARKWG Chair reached out to SPC about collaborating on the 2017 BSH stock assessment but they were not able to contribute.

There have been difficulties in obtaining needed data from the WCPFC and IATTC. For example, for the BSH assessment, public data from the RFMOs were used to update China fisheries time series but some data were excluded under data confidentiality rules. One of the first tasks of the new ISC Chair will be to engage with these organizations to resolve data provision problems. Related to data issues, the Chair emphasized the importance of the species WGs engaging with the STATWG when assistance is needed on external data requests.

7 STOCK STATUS AND CONSERVATION INFORMATION

7.1 Albacore

J. Holmes, ALBWG Chair, summarized results of the benchmark ALB stock assessment (**ISC/17/ANNEX/12**). There were three major changes to the 2017 base case model relative to the 2014 assessment. First, the model time frame was shortened to 1993-2015 (1966-2012 in the previous assessment) to eliminate the influence of poorly fit size composition data in the 1975-1992 period, and a conflict between these size composition data and the primary adult albacore index. Second, a new procedure was used to standardize the Japanese longline abundance index (1996 – 2015) used to indicate trends in adult albacore abundance and the results represent a substantial improvement relative to 2014 and earlier assessments. This new index had good contrast and was informative on both population trend and scale, and was the only index fitted in the 2017 base case model. Third, sex-specific M-at-age vectors were developed from a meta-analysis, with a sex-combined M that scaled with size for ages 0-2, and sex-specific natural mortality (M) fixed at 0.39 and 0.48 y-1 for age-3+ males and females, respectively, because support for the previous assumption (M fixed at 0.3 y-1 for both sexes at all ages) is poor in the scientific literature.

All available fishery data for north Pacific albacore for the 1993 to 2015 period were used in the stock assessment and it was assumed that there is instantaneous mixing of albacore on a quarterly basis. Catches during the modeling period (1993-2015) reached a peak of 119,300 t in 1999 and then declined in the early 2000s, followed by a recovery in later years with catches fluctuating between 68,900 and 93,100 t in recent years (2010-2015). Surface gears (troll, pole-and-line), which primarily harvest juvenile albacore, have accounted for approximately two-thirds of the reported albacore catch and longline gear the remaining third.

Catch and size composition data from ISC countries (Canada, Chinese Taipei, Japan, Korea, and U.S.A.) and catch data from some IATTC and WCPFC member countries, including China, were obtained for the assessment and assigned to 29 fisheries defined for this assessment (based on flag, gear, area, and season). Thirteen indices of abundance (standardized catch-per-unit-effort) were provided by Japan, U.S.A., Canada, and Chinese Taipei but only the index for the Japan LL in Area 2 was fitted in the base case model. A sensitivity run fitting to the Japan pole-and-line (PL) index was also conducted. Size composition data were available from 18 fisheries.

The North Pacific albacore tuna stock was assessed using a length-based, age-, and sex-structured Stock Synthesis (SS Version 3.24AB) model over the 1993-2015 period. Sex-specific growth curves from the 2014 assessment were used because of evidence of sexually dimorphic growth, with adult males attaining a larger size-at-age than females after maturity. Sex-specific M-at-age vectors were developed from a meta-analysis, with a sex-combined M that scaled with size for ages 0-2, and sex-specific M fixed at 0.48 and 0.39 y-1 for age-3+ females and males, respectively. The steepness of the Beverton-Holt stock-recruitment relationship was assumed to be 0.9, based on two prior analyses. The assessment model was fitted to the Japan LL index (1996-2015; Area 2) and all representative size composition data in a likelihood-based statistical framework. All fleets were assumed to have dome-shaped length selectivity, and age-based selectivity for ages 1-5 was also estimated for surface fleets (troll and pole-and-line) to address age-based changes in juvenile albacore availability and movement. Selectivity was assumed to vary over time for fleets with important changes in fishing operations. Maximum likelihood estimates of model parameters, derived outputs, and their variances were used to characterize stock status. Several sensitivity analyses were conducted to evaluate changes in model performance or the range of uncertainty resulting from changes in model parameters, including natural mortality, stock-recruitment steepness, starting year, selectivity estimation, variability of size-at-age and weighting of size composition data.

An age-structured production model diagnostic analysis showed that the estimated catch-at-age and fixed productivity parameters (growth, mortality and stock-recruitment relationship without annual recruitment deviates) were able to explain trends in the Japan longline index. Based on these findings, the ALBWG concluded that the base case model was able to estimate the stock production function and the effect of fishing on the abundance of the NPALB stock. The link between catch-at-age and the Japan longline index adds confidence to the data used, and represents a major improvement in the 2017 assessment of the north Pacific albacore stock. Due to the moderate exploitation levels relative to the productivity, the production function was weakly informative about NPALB stock size, resulting in asymmetric uncertainty in the absolute scale of the stock, with more uncertainty in the upper limit of the spawning stock biomass than the lower limit of spawning stock biomass. It is important to note that the primary aim of estimating the female spawning biomass (SSB) in this assessment was to determine if the estimated SSB was lower than the limit reference point (i.e., determine whether the stock is in an overfished condition). Since the lower bound is better defined, it adds confidence to the ALBWG's evaluation of stock condition relative to the limit reference point.

Discussion

With regard to the benchmark stock assessment, ongoing uncertainty about growth parameters was discussed. Growth parameters appear to vary both spatio-temporally as well as by sex. The ALBWG tried looking at regional growth models in the past but they did not perform well in the sensitivity runs. There is a need for Pacific-wide data collection to address this uncertainty. The use of a sex-specific genetic marker for albacore is in development and may be available in the next year or so. There will then be a need to design and implement a sampling program to gather samples and do the analysis.

There was confusion over the use of the term "fishing intensity" and how this differs from the more familiar term fishing mortality. Generally, it was agreed that the term should be clearly defined when used in presenting stock status information. While including the supporting tables and figures from the stock assessment report (ISC/17/ANNEX/11) in the Plenary Report is useful, presenting a concise, clear statement to fishery managers is paramount.

The difference between the projections of stock status under a constant fishing intensity scenario versus a constant catch scenario was discussed at length. It was noted that constant fishing intensity is probably a closer approximation of the current effort-based management measure adopted by both Pacific RFMOs. However, it may be necessary to provide a straightforward explanation of why stock biomass is projected to decline more under a constant catch scenario based on recent catch levels.Recent recruitment has supported higher catches under recent fishing intensity levels.

The Plenary endorsed the NPALB stock assessment and considers it to be the best available scientific information. The following represents the stock status and conservation information agreed upon by the Plenary:

Stock Status and Conservation Information

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 (Figure 7-1A). Estimated female SSB exhibits a similar population trend, with an initial decline until 2003 followed by fluctuations without a clear trend through 2015 (Figure 7-1B). The estimated SPR (spawners per recruit relative to the unfished population) in 2015 is 0.53, which corresponds to a moderate fishing intensity (i.e., 1-SPR = 0.47). 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 13 (Figure 7-2). Juvenile albacore aged 2 to 4 years comprised, on average, 70% of the annual catch between 1993 and 2015 (Figure 7-3) as reflected by the larger impact of the surface fisheries (primarily troll, pole-and-line) which remove juvenile fish, relative to longline fisheries, which primarily remove adult fish (Figure 7-4).

The WCPFC adopted a limit reference point (LRP) for the spawning stock biomass of 20% of the spawning stock biomass when F=0 (20%$SSB_{current,\ F=0}$) (https://www.wcpfc.int/harvest-strategy). The 20%$SSB_{current,\ F=0}$ LRP is based on dynamic biomass and fluctuates depending on changes in recruitment. However, there are no adopted F-based limit reference points.

Stock status is depicted in relation to the limit reference point (LRP; 20%$SSB_{current,\ F=0}$) for the stock and the equivalent fishing intensity ($F_{20\%}$; calculated as 1-$SPR_{20\%}$) (Figure 7-5A). 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.

The Kobe plot shows that the estimated female SSB has never fallen below the LRP since 1993, albeit with large uncertainty in the terminal year (2015) estimates (Figure 7-5A). Even when alternative hypotheses about key model uncertainties such as natural mortality and growth were evaluated, the point estimate of female SSB in 2015 (SSB_{2015}) did not fall below the LRP, although the risk increases with these more extreme assumptions (Figure 7-5B). The SSB_{2015} was estimated to be 80,618 t and was 2.47 times greater than the LRP threshold of 32,614 t (Table

7-1). Current fishing intensity, $F_{2012\text{-}2014}$ (calculated as 1- $SPR_{2012\text{-}2014}$), was lower than potential F-based reference points identified for the north Pacific albacore stock, except $F_{50\%}$ (calculated as 1-$SPR_{50\%}$) (Table 7-1).

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 ($F_{2012\text{-}2014}$) is below six of the seven potential reference points (see ratios in** Table 7-1**), except $F_{50\%}$.**

Conservation Information

Two harvest scenarios were projected to evaluate impacts on future female SSB: F at the 2012-2014 rate over 10 years ($F_{2012\text{-}2014}$) and constant catch[2] (average of 2010-2014 = 82,432 t) over 10 years. Median female SSB is expected to decline to 63,483 t (95% CI: 36,046 - 90,921 t) by 2025, with a 0.2 and <0.01 % probability of being below the LRP by 2020 and 2025, respectively, if fishing intensity remains at the 2012-2014 level[3] (Figure 7-6). In contrast, employing the constant catch harvest scenario is expected to reduce female SSB to 47,591 t (95% CI: 5,223 - 89,958 t) by 2025 and increases the probability that female SSB will be below the LRP to about 3.5 and 30 % in 2020 and 2025, respectively (Figure 7-7). In addition, as biomass declines during the projection period the fishing intensity approximately doubles by 2025. The probabilities of declining below the LRP in both harvest scenarios are likely higher in the future because projection results did not capture the full envelope of uncertainty. . The ALBWG notes that the lack of sex-specific size data, uncertainty in growth and natural mortality, and the simplified treatment of the spatial structure of north Pacific albacore population dynamics are important sources of uncertainty in the assessment.

Based on these findings, the following information is provided:

1. **If a constant fishing intensity ($F_{2012\text{-}2014}$) is applied to the stock, then median female spawning biomass is expected to undergo a moderate decline, with a < 0.01% probability of falling below the limit reference point established by the WCPFC by 2025. However, expected catches in this scenario will be below the recent average catch level for this stock.[2]**

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[2] It should be noted that the constant catch scenario is inconsistent with current management approaches for NPALB adopted by the IATTC and the WCPFC.

[3] Median future catch for the constant F scenario is expected to be below the average catch level for 2010-2014 (82,432 t – red line in Figure 7-6). This result is likely due to low estimated recruitment in 2011, which is expected to reduce female SSB beginning in 2015, the first year of the projection period.

2. **If a constant average catch ($C_{2010-2014}$ = 82,432 t) is removed from the stock in the future, then the decline in median female spawning biomass will be greater than in the constant F intensity scenario and the probability that SSB falls below the LRP will be greater by 2025 (30%). Additionally, the estimated fishing intensity will double relative to the current level ($F_{2012-2014}$) by 2025 as spawning biomass declines.**

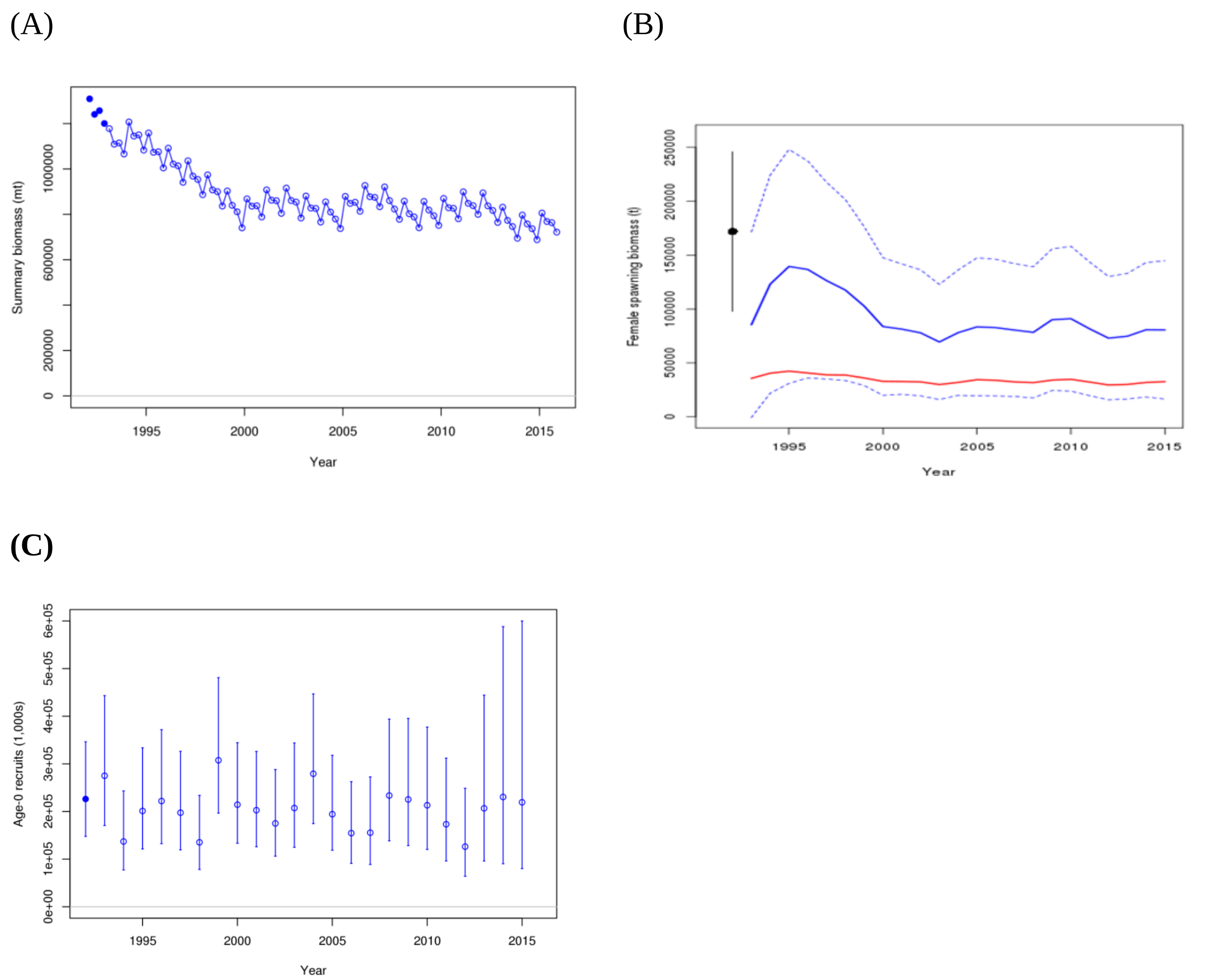

Figure 7-1. Maximum likelihood estimates of (A) total age-1+ biomass (open circles) (B), female spawning biomass (SSB) (solid blue line), and (C) age-0 recruitment (open circles) of north Pacific albacore tuna (*Thunnus alalunga*). Dashed lines (B) and vertical bars (C) indicate 95% confidence intervals of the female SSB and recruitment estimates respectively. Red line indicates the 20%$SSB_{current, F=0}$ limit reference point, which is based on dynamic SSB_0. Closed black circle and error bars in (B) are the maximum likelihood estimate and 95% confidence intervals of unfished female spawning biomass, SSB_0. Since the assessment model represents time on a quarterly basis, there are four estimates of total biomass (A) for each year, but only one annual estimate of female SSB (B) and recruitment (C).

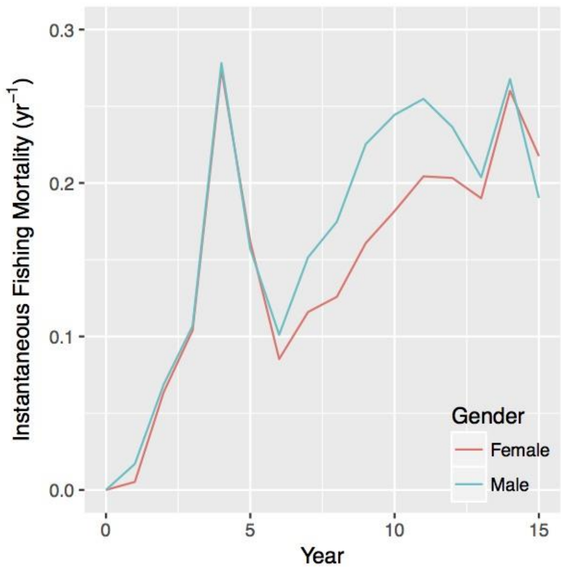

Figure 7-2 Estimated sex-specific instantaneous fishing mortality-at-age (F-at-age) for the 2017 base case model, averaged across 2012-2014.

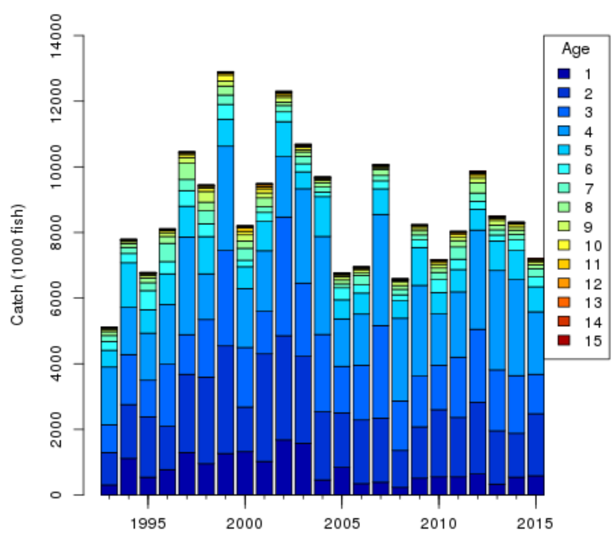

Figure 7-3. Historical catch-at-age of north Pacific albacore (*Thunnus alalunga*) estimated by the 2017 base case model.

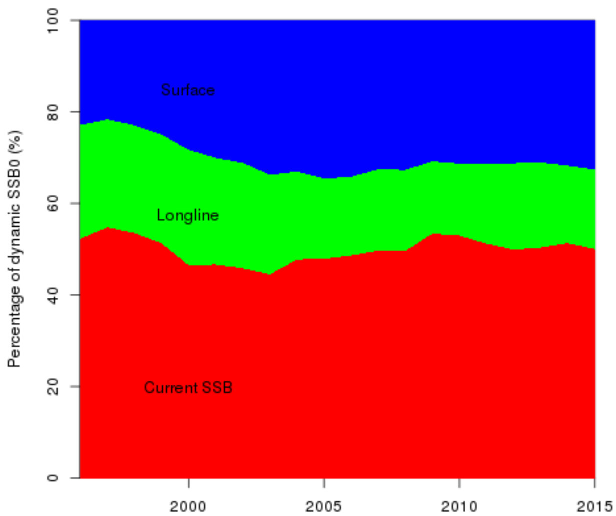

Figure 7-4. Fishery impact analysis on north Pacific albacore (*Thunnus alalunga*) showing female spawning biomass (SSB) (red) estimated by the 2017 base case model as a percentage of dynamic unfished female SSB (SSB_0). Colored areas show the relative proportion of fishing impact attributed to longline (USA, Japan, Chinese-Taipei, Korea and others) (green) and surface (USA, Canada, and Japan) (blue) fisheries (primarily troll and pole-and-line gear, but including all other gears except longline).

Table 7-1. Estimates of maximum sustainable yield (MSY), female spawning biomass (SSB) quantities, and fishing intensity (F) based reference point ratios for north Pacific albacore tuna for the base case assessment and important sensitivity analyses. SSB_0 and SSB_{MSY} are the unfished biomass of mature female fish and at MSY, respectively. The Fs in this table are not based on instantaneous fishing mortality. Instead, the Fs are indicators of fishing intensity based on SPR and calculated as 1-SPR so that the Fs reflects changes in fishing mortality. SPR is the equilibrium SSB per recruit that would result from the current year's pattern and intensity of fishing mortality. Current fishing intensity is based on the average fishing intensity during 2012-2014 ($F_{2012-2014}$).

Quantity	Base Case	$M = 0.3\ y^{-1}$	Growth CV = 0.06 for L_{inf}
MSY (t) [A]	132,072	92,027	118,836
SSB_{MSY} (t) [B]	24,770	42,098	22,351
SSB_0 (t) [B]	171,869	270,879	156,336
SSB_{2015} (t) [B]	80,618	68,169	63,719
$SSB_{2015}/20\%SSB_{current, F=0}$ [B]	2.47	1.31	2.15
$F_{2012-2014}$	0.51	0.74	0.57
$F_{2012-2014}/F_{MSY}$	0.61	0.89	0.68
$F_{2012-2014}/F_{0.1}$	0.58	0.90	0.65
$F_{2012-2014}/F_{10\%}$	0.56	0.81	0.63
$F_{2012-2014}/F_{20\%}$	0.63	0.91	0.71
$F_{2012-2014}/F_{30\%}$	0.72	1.04	0.81
$F_{2012-2014}/F_{40\%}$	0.85	1.21	0.96
$F_{2012-2014}/F_{50\%}$	1.01	1.47	1.16

A – MSY includes male and female juvenile and adult fish

B – Spawning stock biomass (SSB) in this assessment refers to mature female biomass only.

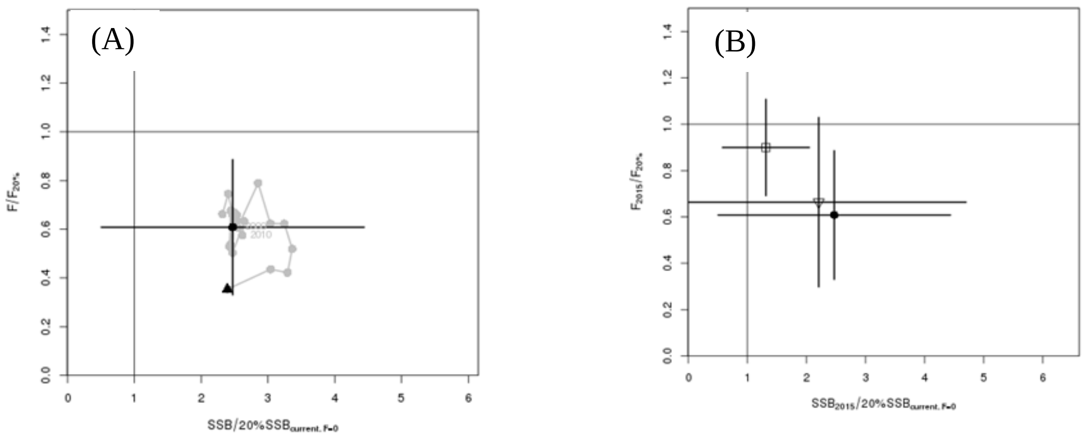

Figure 7-5. (A) Kobe plot showing the status of the north Pacific albacore (*Thunnus alalunga*) stock relative to the 20%SSBcurrent, F=0 biomass-based limit reference point (WCPFC), and equivalent fishing intensity (F20%; calculated as 1-SPR20%) over the base case modeling period (1993-2015). Note that no F-based reference point is established for north Pacific albacore by either the IATTC or WCPFC. F20% was chosen for this plot as a convenient analogue to the limit reference point but it should not be inferred that it represents advice on the choice of an F-based reference point on this stock. Black triangle indicates the start year (1993) and black circle with 95% confidence intervals indicates the terminal year (2015). (B) Kobe plot showing stock status and 95% confidence intervals in the terminal year (2015) of the base case model (black; closed circle) and important sensitivity runs with M = 0.3 y-1 for both sexes (pen square), and CV = 0.06 for L_{inf} in the growth model (white; open triangle). Fs in this figure are not based on instantaneous fishing mortality. Instead, the Fs are indicators of fishing intensity based on SPR and calculated as 1-SPR so that the Fs reflects changes in fishing mortality. SPR is the equilibrium SSB per recruit that would result from the current year's pattern and intensity of fishing mortality.

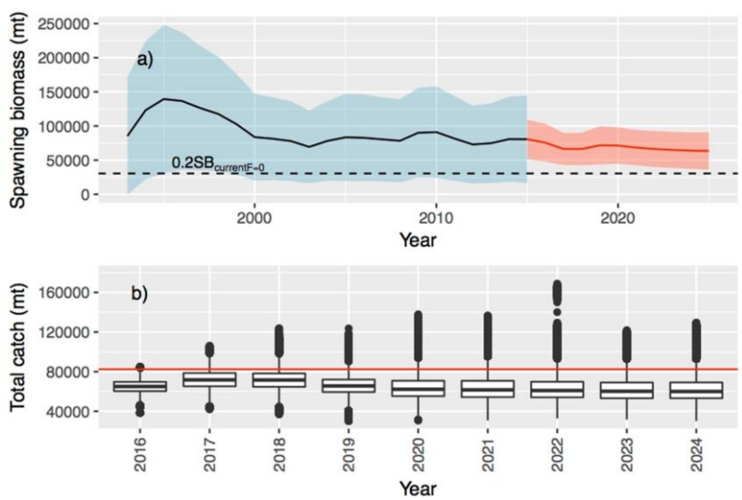

Figure 7-6. (A) Historical and future trajectory of north Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) under a constant fishing intensity ($F_{2012-2014}$) harvest scenario. Future recruitment was based on the expected recruitment variability and autocorrelation. Black line and blue area indicates maximum likelihood estimates and 95% confidence intervals (CI), respectively, of historical female SSB, which includes parameter uncertainty. Red line and red area indicates mean value and 95% CI of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year. (B) Expected annual catch under a constant fishing intensity ($F_{2012-2014}$) harvest scenario (2016-2025). The red line is the current average catch (2010-2014 = 82,432 t).

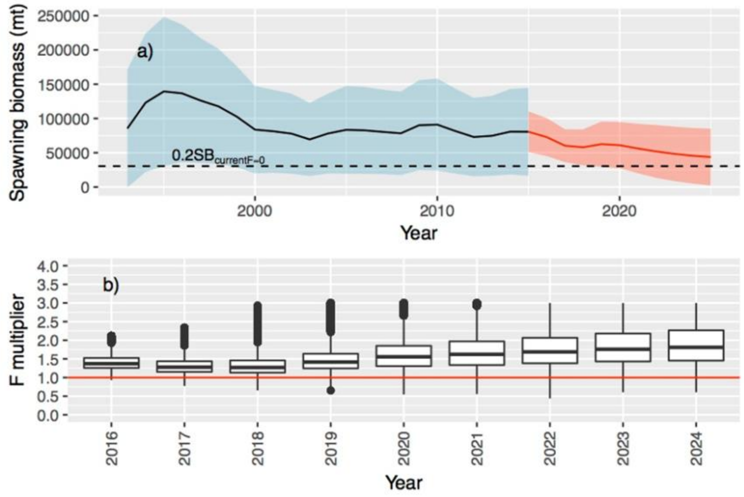

Figure 7-7. (A) Historical and future trajectory of north Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) under a constant catch (average 2010-2014 = 82,432 t) harvest scenario. Future recruitment was based on the expected recruitment variability and autocorrelation. Dashed line indictaes the average limit reference point threshold for 2012-2014. Black line and blue area indicates maximum likelihood estimates and 95% confidence intervals (CI), respectively, of historical female SSB, which includes parameter uncertainty. Red line and red area indicates mean value and 95% CI of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year. (B) Projected fishing intensity relative to the current fishing inetnsity (2012-2014) (red line) under a constant catch scenario (average 2010-2014).

7.2 Blue shark

S. Kohin, Chair of the SHARKWG Chair, summarized the results of the 2017 benchmark North Pacific BSH assessment (**ISC/17/ANNEX/13**). The assessment was conducted using a fully-integrated population dynamics model with sex-specific Stock Synthesis model (SS version 3.24f) over the 1971 to 2015 period. The SHARKWG also conducted a second assessment using a Bayesian state-space production model (BSSPM) in order to provide continuity with the 2014 ISC BSH assessment.

Data for the assessment were compiled for 18 fishing fleets and included catch time series from 1971 to 2015, six abundance indices, and sex-specific size data. A two-sex base case model that included all the size and catch data, abundance indices from the Japanese Kinkai shallow-set longline fishery, and a low fecundity stock recruitment relationship (LFSR) was developed using an iterative process. Model fits to the data and selection of the base case parameterization was based on a full suite of diagnostics. Additional models were run to explore uncertainty in biological and fishery data, and model performance.

<u>Discussion</u>

Variation in BSH CPUE across fleets was discussed in relation to potential spatial differences. It appears that trends in CPUE are different in the EPO compared to the WCPO. There may be a relationship between BSH CPUE and temperature; the EPO has been relatively warmer in the last few years and this may partially explain the recent lower CPUE.

The assessment team focused on improving model fit by modifying model structure instead of down-weighting data. Even with this approach some minor down-weighting was done. [SHARKWG Chair to provide clarifying language on process as necessary.]

The Plenary endorsed the BSH stock assessment and considers it to be the best available scientific information. The following represents the stock status and conservation information agreed upon by the Plenary:

Stock Status and Conservation Information

Stock Status

The assessment uses a fully integrated, sex-specific Stock Synthesis (SS) model. Model inputs have been greatly improved since the previous assessment. The main differences between the present assessment and the 2014 assessment are: 1) use of SS with a thorough examination of the size composition data, and the relative weighting of CPUE and composition data; 2) improved life history information, such as growth and reproductive biology, and their contribution to productivity assumptions; 3) an improved understanding and parametrization of the low fecundity stock-recruit relationship (LFSR); 4) catch, CPUE, and size time series updated through 2015; 5) a suite of model diagnostics including implementation of an Age Structured Production Model implemented in SS. There remain some uncertainties in the time series based on the quality (observer versus logbook) and timespans of catch and relative abundance indices, limited size composition data for several fisheries, potential under-reporting of catch, and life history parameters.

Extensive model explorations showed that the reference run had the best model performance and showed fits most consistent with the data. The CPUE indices used in the reference case were considered most representative of the North Pacific blue shark stock due to their broader spatial temporal coverage in the core distribution of the stock and the statistical soundness of the standardizations. Alternate CPUE series for the latter part of the time series produced different stock trajectories depending upon the index used, but in each case, median SSB during the last three years exceeded SSB_{MSY}. Using alternate assumptions on stock productivity (i.e., form of the stock recruitment relationship) also resulted in variation in the stock trajectories; assuming stock productivity lower than supported by current biological studies, resulted in lowered spawning stock biomass relative to MSY.

Results of the reference case model showed that the spawning stock biomass was near a time-series high in the late 1970s, declined to its lowest level between 1990 to 1995, subsequently increased gradually to reach the time-series high again in 2005, and has since shown small fluctuations close to the time-series high. Recruitment has fluctuated around 37,000,000 age-0 sharks annually with no apparent trend (Figure 7-8). Stock status is reported in relation to maximum sustainable yield (MSY) based reference points.

1. **Female spawning biomass in 2015 (SSB_{2015}) was 69% higher than at MSY and estimated to be 295,774 t (Table 7-2; Figure 7-8).**
2. **The recent annual fishing mortality ($F_{2012\text{-}2014}$) was estimated to be well below F_{MSY} at approximately 38% of F_{MSY} (Table 7-2; Figure 7-8).**

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) (Figure 7-9).**

[Correct SB to SSB]

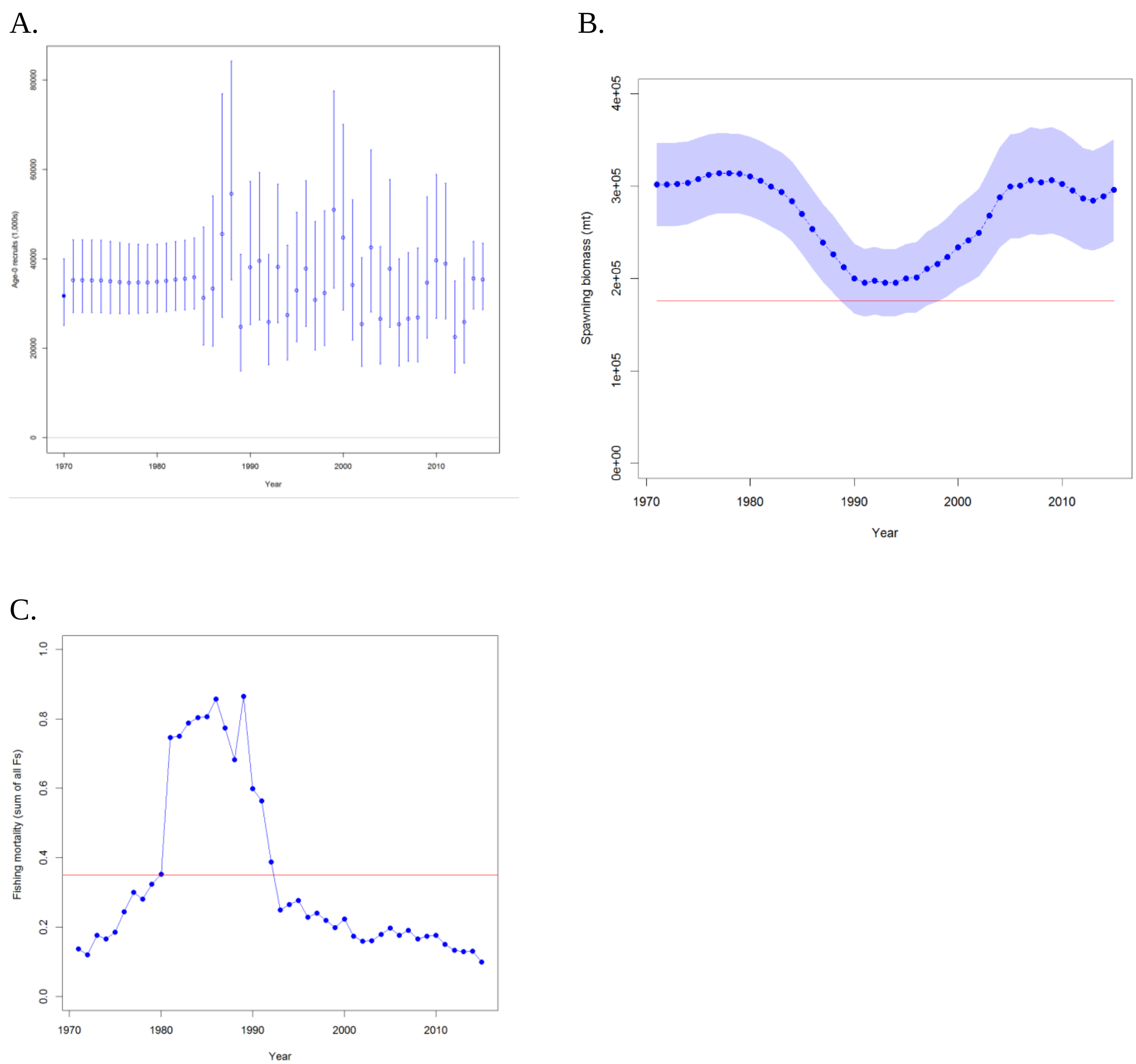

Figure 7-8. Results of the SS stock assessment reference case model for the North Pacific BSH assessment: (A) estimated age-0 recruits (circles) and 95% confidence intervals (vertical bars); (B) estimated female spawning biomass and 95% confidence intervals (blue shaded area); (C) estimated fishing mortality (sum of F's across all fishing fleets). Red solid lines indicate the estimates of SB_{MSY} and F_{MSY} in (B) and (C), respectively.

Table 7-2. Estimates of key management quantities for the North Pacific blue shark SS stock assessment reference case model and the range of values for 13 sensitivity runs.

Management Quantity	Reference Case Model	Range for Sensitivity Runs
SSB_{1971}	301,739 t	174,381 - 980,878 t
SSB_{2015}	295,774 t	140,742 - 1,082,300 t
SSB_{MSY}	175,401 t	100,984 - 482,638 t
F_{1971}	0.15	0.01 - 0.15
$F_{2012-2014}$	0.14	0.06 - 0.15
F_{MSY}	0.36	0.26 - 0.66
SSB_{2015}/SSB_{MSY}	1.69	1.39 - 2.59
$F_{2012-2014}/F_{MSY}$	0.38	0.15 - 0.50

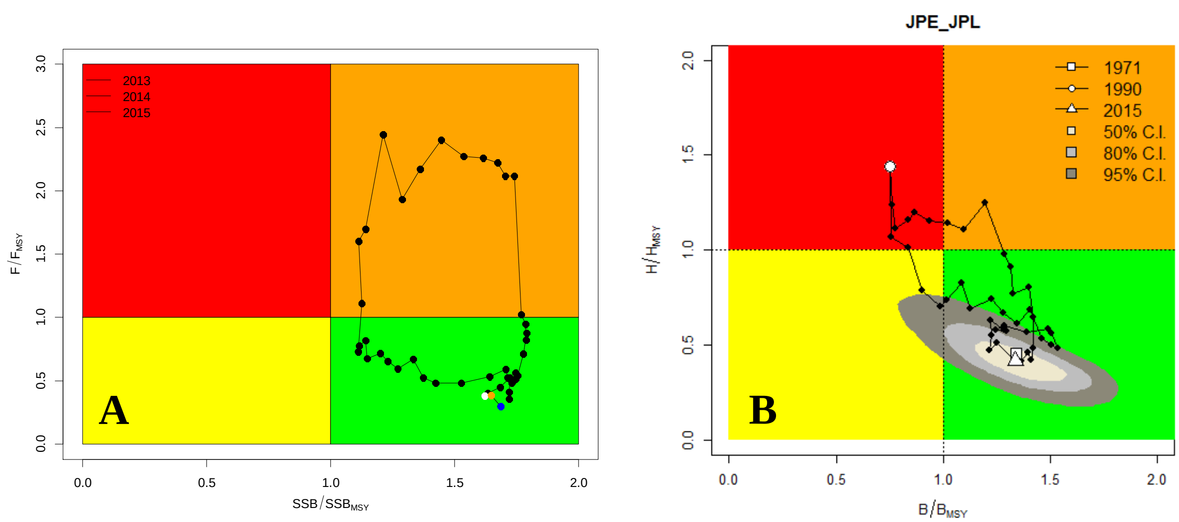

Figure 7-9. Kobe plots of the trends in estimates of relative fishing mortality and biomass of North Pacific blue shark between 1971 and 2015 for the reference case of (A) the SS stock assessment model, and (B) the BSSPM stock assessment model. [Explain CI bands in panel B.]

[Move figures and tables after conservation information section or move figures and text in albacore section.]

Conservation Information

Target and limit reference points have not yet been established for pelagic sharks by the WCPFC or the IATTC, the organizations responsible for management of pelagic sharks caught in international fisheries for tuna and tuna-like species in the Pacific Ocean.

The 2015 SB exceeds SB_{MSY} and $F_{2012-2014}$ is below F_{MSY}. Future projections under different fishing mortality (F) harvest policies (status quo, +20%, -20%, F_{MSY}) show that median BSH spawning biomass in the North Pacific will likely remain above SB_{MSY} in the foreseeable future (Table 7-3, Figure 7-10). Other potential reference points were not considered in these evaluations.

[Move to SHARKWG Report section 6.4]Continued improvements in the monitoring of BSH catches, through carefully designed observer programs and species-specific logbooks, including recording the size and sex of sharks retained and discarded for all fisheries, as well as continued research into the biology and ecology of BSH in the North Pacific are recommended.

Table 7-3. Projected trajectory of spawning biomass (in metric tons) for alternative harvest scenarios.

Year	Average F + 20%	F_{MSY}	Average F - 20%	Average F (2012-2014)
2015	295,774	295,774	295,774	295,774
2016	306,782	306,782	306,782	306,781
2017	316,169	312,081	318,183	317,173
2018	322,317	312,329	326,829	324,559
2019	324,795	310,499	332,111	328,419
2020	326,757	307,209	336,929	331,782
2021	328,323	303,909	341,210	334,675
2022	329,623	300,842	344,988	337,181
2023	330,719	298,091	348,286	339,349
2024	331,656	295,663	351,138	341,218

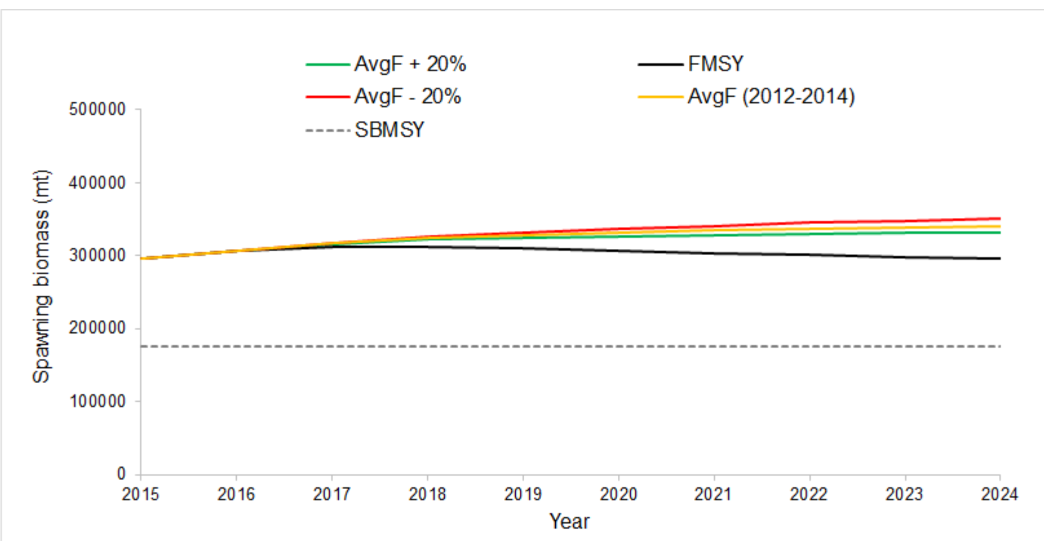

Figure 7-10. Comparison of future projected North Pacific blue shark spawning biomass under different *F* harvest policies (*status quo*, +20%, -20%, and F_{MSY}) using the SS reference case model. *Status quo* fishing mortality was based on the average from 2012-2014.

7.3 Shortfin Mako Shark

S. Kohin noted that a SMA stock assessment was not conducted by the SHARKWG (ISC/17/ANNEX/5/8) in the past year.

Discussion

The Plenary agreed to forward the stock status and conservation information statements adopted at ISC16 for SMA unchanged [with slight clarifying modifications – add to other unassessed stocks], except for the omission of accompanying figures and tables, because there are no new assessments for this stock upon which to base a change in the previous recommendations.

Stock Status and Conservation Information

SMA was last assessed in 2015 and the ISC Plenary endorsed the stock status and conservation information adopted at ISC16 (see pp. 62-63 in the ISC16 Plenary Report), which is reproduced here with slight clarifying modifications.

Stock Status

Shortfin mako is a data poor species. Recognizing that information on important fisheries is missing, the untested validity of indicators for determining stock status, and conflicts in the available data, stock status (overfishing and overfished) could not be determined. Managers should consider the undetermined stock status of SMA in the North Pacific when developing and implementing management measures.

The SHARKWG reviewed a suite of information to determine the stock status of SMA shark in the North Pacific. Of the three indices considered to have the greatest value in providing stock status information (Japan shallow-set longline, Hawaii shallow-set longline and Hawaii deep-set longline), abundance trends in two of the series appear to be stable or increasing, while the abundance trend in the Hawaii shallow-set longline fishery CPUE series appears to be declining.

Conservation Information

It is recommended that data for fisheries operating in the North Pacific for which catch estimates are not yet available be developed for use in the next stock assessment scheduled for 2018 and that available catch and CPUE data be monitored for changes in trends. It is further recommended that data collection programs be implemented or improved to provide species-specific shark catch data for fisheries in the North Pacific Ocean.

7.4 North Pacific Swordfish

J. Brodziak noted that a North Pacific SWO stock assessment was not conducted by the BILLWG in the past year.

Discussion

The Plenary agreed to forward the stock status and conservation information statements adopted at ISC16 for SWO unchanged, except for the omission of accompanying figures and tables, because there are no new assessments for this stock upon which to base a change in the previous recommendations.

Stock Status and Conservation Information for the Stock

The SWO stock was last assessed in 2014 and the ISC Plenary endorsed the stock status and conservation information adopted at ISC16 (see pp. 56-61 in the ISC16 Plenary Report), which is reproduced here with slight clarifying modifications.

Western and Central North Pacific Ocean Stock Status

Catches and harvest rates of WCNPO swordfish had a declining trend from 2007-2011, with exploitable biomass fluctuating around 70,000 t. The Kobe plot shows that the WCNPO swordfish stock did not appear to have been overfished or to have experienced overfishing relative to MSY-based reference points throughout most of the assessment time horizon of 1951-2012.

Based on these results, it is unlikely that the WCNPO swordfish population biomass was below B_{MSY} in 2012 (Pr(B2012 < B_{MSY})=14%). Similarly, it is unlikely that the swordfish population was being fished in excess of harvest rate at MSY (H_{MSY}) in 2012 (Pr(H_{2012} > H_{MSY}) < 1%).

Eastern Pacific Ocean Stock Status

For the EPO stock, exploitable biomass had a declining trend during 1969-1995 and increased from 31,000 t in 1995 to over 60,000 t in 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 stock assessment.

The Kobe plot shows that overfishing likely occurred in a few years, but may have occurred from 2010 to 2012. There was a 55% probability that overfishing occurred in 2012, but there was a less than 1% probability that the stock was overfished relative to MSY-based reference points.

Western and Central North Pacific Ocean Stock Conservation Information

Stochastic projections for the WCNPO stock were conducted using eight harvest scenarios through 2016. Results relative to MSY-based reference points show that exploitable biomass would likely remain above 60,720 t (B_{MSY}) through 2016 under the status quo catch or status quo harvest rate scenarios. For the high harvest rate scenarios (i.e., maximum observed harvest rate, 150% of H_{MSY}, 125% of H_{MSY}), exploitable biomass was projected to decline below BMSY by 2016 with harvest rates exceeding H_{MSY}. In contrast, the stock would not be expected to experience any overfishing during 2014-2016 under the status quo catch and status quo harvest rate scenarios.

The risk analyses of harvesting a constant annual catch of WCNPO SWO during 2014-2016 showed that there would be less than 1% probability of the stock being overfished or experiencing overfishing relative to MSY-based reference points in 2016 if current annual catches (2011-2012) of about 10,000 t were maintained.

The WCNPO SWO stock is healthy ($B_{2010\text{-}2012} > B_{MSY}$) and is above the level required to sustain recent harvest rates ($H_{2010\text{-}2012} < H_{MSY}$).

Eastern Pacific Ocean Stock Conservation Information

Stochastic projections for the EPO 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 only 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, 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.

For the EPO SWO stock, overfishing may have occurred 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. While biomass of the EPO stock appears to be nearly twice BMSY, any increases in catch above recent (3-year average 2010-2012) levels should consider the uncertainty in stock structure and unreported catch.

7.5 Western and Central North Pacific Striped Marlin

J. Brodziak noted that an MLS stock assessment was not conducted by the BILLWG in the past year.

Discussion

The Plenary agreed to forward the stock status and conservation information statements adopted at ISC16 for MLS unchanged, except for the omission of accompanying figures and tables, because there are no new assessments for this stock upon which to base a change in the previous recommendations.

Stock Status and Conservation Information

The most recent MLS stock assessment was conducted in 2015 and the ISC Plenary endorsed the stock status and conservation information adopted at ISC16 (see pp. 53-55 in the ISC16 Plenary Report), which is reproduced here with slight clarifying modifications.

Stock Status

Estimates of population biomass of the WCNPO MLS exhibit a long-term decline. Population biomass (age-1 and older) averaged roughly 20,513 t, or 46% of unfished biomass during 1975-1979, the first 5 years of the assessment time frame, and declined to 6,819 t, or 15% of unfished biomass in 2013. Spawning stock biomass is estimated to be 1,094 t in 2013 (39% of SSBMSY, the spawning stock biomass to produce MSY). Fishing mortality on the stock (average F on ages 3 and older) is currently high and averaged roughly F = 0.94 during 2010-2012, or 49% above FMSY. 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 SPR2010-2012 = 12% ,which is 33% below the level of SPR required to produce MSY. Recruitment averaged about 308,000 recruits during 1994-2011, which was 25% below the 1975-2013 average. No target or limit reference points have been established for the WCNPO striped marlin stock under the auspices of the WCPFC.

The WCNPO MLS stock is expected to be highly productive due to its rapid growth and high resilience to reductions in spawning potential. The status of the stock is highly dependent on the magnitude of recruitment, which has been below its long-term average since 2007, with the exception of 2010. Changes in recent size composition data in comparison to the previous assessment resulted in changes in fishery selectivity estimates and also affected recruitment estimates. These changes, in turn, affected the scaling of biomass and fishing mortality to reference levels.

When the status of MLS is evaluated relative to MSY-based reference points, the 2013 spawning stock biomass is 61% below SSBMSY (2819 t) and the 2010-2012 fishing mortality exceeds FMSY by 49%. Therefore, overfishing is occurring relative to MSY-based reference points and the WCNPO MLS stock is overfished.

Conservation Information

The stock has been experiencing overfishing since 1977, with the exception of 1982 and 1983, and fishing appears to be impeding rebuilding, especially if recent (2007-2011) low recruitment levels persist. Projection results show that fishing at FMSY could lead to median spawning biomass increases of 25%, 55%, and 95% from 2015 to 2020 under the recent recruitment, medium-term recruitment, and stock recruitment-curve scenarios. Fishing at a constant catch of 2,850 t could lead to potential increases in spawning biomass of 19% to over 191% by 2020, depending upon the recruitment scenario. In comparison, fishing at the 2010-2012 fishing mortality rate, which is 49% above FMSY, could lead to changes in spawning stock biomass of -18% to +18% by 2020, while fishing at the average 2001-2003 fishing mortality rate (F2001-2003=1.15), which is 82% above FMSY, could lead to spawning stock biomass decreases of -32% to -9% by 2020, depending upon the recruitment scenario.

7.6 Pacific Blue Marlin

J. Brodziak noted that a BUM stock assessment was not conducted by the BILLWG in the past year.

Discussion

The Plenary agreed to forward the stock status and conservation information statements adopted at ISC16 for BUM unchanged, except for the omission of accompanying figures and tables, because there are no new assessments for this stock upon which to base a change in the previous recommendations.

Stock Status and Conservation Information

The most recent BUM stock assessment was conducted in 2016 and the ISC Plenary endorsed the stock status and conservation information adopted at ISC16 (see pp. 46-52 in the ISC16 Plenary Report), which is reproduced here with slight clarifying modifications.

Stock Status

Estimates of total BUM stock biomass show a long term decline. Population biomass (age-1 and older) averaged roughly 130,965 t in 1971-1975, the first 5 years of the assessment time frame, and has declined by approximately 40% to 78,082 t in 2014. Female spawning biomass was estimated to be 24,809 t in 2014, or about 25% above SSBMSY. Fishing mortality on the stock (average F, ages 2 and older) averaged roughly F = 0.28 during 2012-2014, or about 12% below FMSY. The estimated spawning potential ratio of the stock (SPR, the predicted spawning output at the current F as a fraction of unfished spawning output) is currently SPR2012-2014 = 21%. Annual recruitment averaged about 897,000 recruits during 2008-2014, and no long-term trend in recruitment was apparent. Overall, the time series of spawning stock biomass and recruitment estimates show a long-term decline in 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 decreased to roughly the MSY level in the mid-2000s, and has increased slightly in recent years.

Based on the results of the 2016 stock assessment update, the Pacific blue marlin stock is not currently overfished and is not experiencing overfishing relative to MSY-based reference points. Because Pacific blue marlin is mainly caught as bycatch, direct control of the annual catch amount through the setting of a total allowable catch may be difficult.

Conservation Information

Since the stock is nearly full exploited, the ISC recommends that fishing mortality remain at or below current levels (2012-2014).

7.7 Pacific Bluefin Tuna

H. Nakano, PBFWG Chair, summarized the recommendations of the PBFWG (ISC/17/ANNEX/07/11/14) as it pertains to stock status and conservation advice.

Discussion

The stock assessment of PBF was not conducted in the past year. The PBFWG proposed some revisions to the stock status and conservation information narrative, which prompted considerable discussion by the Plenary. Some of the revisions were based on new information that had come forward and was discussed in the past year but has not been thoroughly documented and reviewed by the PBFWG. While the utility of this information was not disputed, concerns were raised about the lack of rigorous documentation and the potential for the endorsement of this information.

The Plenary agreed to forward the stock status and conservation information statements adopted at ISC16 with slight clarifying modifications. In addition, the Plenary agreed to incorporate the summary results from the stakeholders workshop (**ISC/17/ANNEX/11)** and recent real-time monitoring observations from the 2015 and 2016 cohorts into the conservation information statement in this Plenary Report, because it represented new information discussed by the PBFWG that will be valuable for managers to consider. Management measures by RFMOs referred to here may be succeeded by updated measures.

Stock Status and Conservation Information

Stock Status

[Insert bold format as in original.]

The PBFWG conducted a bench mark assessment (base-case model) that used the best available fisheries and biological information. The base-case model fits the data that were considered to be more reliable well and was internally consistent among most of the sources of data. The 2016 base-case model was a substantial improvement compared to the 2014 assessment and fits all reliable data well. The base-case model indicates: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2014); (2) the SSB steadily declined from 1996 to 2010; and (3) the decline appears to have ceased since 2010, although the stock remains near the historic low. The model diagnostics suggest that the estimated biomass trend for the last 30 years is robust although SSB prior to the 1980s is uncertain due to data limitations.

Using the base-case model, the 2014 (terminal year) SSB was estimated to be around 17,000 t, which is about 9,000 t below the terminal year estimated in the 2014 assessment (26,000 in 2012). This was because of improvements to the input data and refinements to the assessment model scaled down the estimated value of SSB and not because the SSB declined from 2012 to 2014.

Recruitment estimates fluctuate widely without an apparent trend. The 2014 recruitment was relatively low, and the average recruitment for the last five years may have been below the historical average level. Note that recruitments in terminal years in an assessment are highly uncertain due to limited information on the cohorts. However, two of the last three data points from the Japanese troll CPUE-based index of recruitment, which was consistent with other data in the model, are at their lowest level since the start of the index (1980). Most age-specific fishing mortalities (F) for intermediate ages (2-10 years) are substantially above $F_{2002\text{-}2004}$ while those for age 0 as well as ages 11 and above are lower.

Although no limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the F2011-2013 exceeds all calculated biological reference points except for F_{MED} and F_{LOSS} despite slight reductions to F in recent years. The ratio of SSB in 2014 relative to the theoretical unfished[4] SSB ($SSB_{2014}/SSB_{F=0}$, the depletion ratio) is 2.6%[5] and $SSB_{2012}/SSB_{F=0}$ is 2.1% indicating a slight increase from 2012 to 2014. Although the $SSB_{2014}/SSB_{F=0}$ for this assessment (2.6%) is lower than $SSB_{2012}/SSB_{F=0}$ from the 2014 assessment (4.2%), this difference is due to improvements to the input data and model structure rather than a decline in SSB from 2012 to 2014. Note that potential effects on Fs as a result of the measures of the WCPFC and IATTC that started in 2015 or by other voluntary measures were not yet reflected in the data used in this assessment.

Since reference points for PBF have yet to be identified, two examples of Kobe plots are presented. These versions of the Kobe plot represent two interpretations of stock status in an effort to prompt further discussion. In summary, if these were the reference points, overfishing would be occurring or just at the threshold in the case of F_{MED}; and the stock would be considered overfished. Plot B in ISC/16/ANNEX/XX shows that the stock has remained in an overfished and overfishing status for the vast majority of the assessment period if F20% and SSB20% are the reference points. The ISC notes that the SSB estimates before 1980 are more uncertain and that the reason why the fishing mortality is estimated to be so high right after the WWII is not well understood. The low biomass level at the beginning of the assessment period (1952) could potentially have been the result of relatively high catches prior to the assessment period.

Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleets, in particular those targeting small fish (age 0-1), have had a greater impact, and the effect of these fleets in 2014 was greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fleet has had a limited effect on the stock throughout the analysis period. This is because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish.

Conservation Information

[Should this be changed to past tense?] The steady decline in SSB from 1996 to 2010 appears to have ceased, although SSB_{2014} is near the historic low and the stock is experiencing exploitation rates above all calculated biological reference points except for F_{MED} and F_{LOSS}.

The projection results are based on the base-case model under several harvest and recruitment scenarios and time schedules. Under all examined scenarios the initial goal of WCPFC, rebuilding to SSB_{MED} by 2024 with at least 60% probability, is reached and the risk of SSB falling below SSB_{LOSS} at least once in 10 years was low.

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[4] "Unfished" refers to what SSB would be had there been no fishing.

[5] The unfished SSB is estimated based upon equilibrium assumptions of no environmental or density-dependent effects.

The projection results show that the probability of SSB recovering to the initial WCPFC target (SSB_{MED} by 2024, 41,000 t, calculated in the same manner as the previous assessment) is 61.5% or above the level prescribed in the WCPFC CMM if low recruitment scenario is assumed and WCPFC CMM 2015-04 and IATTC Resolution C-14-06 continue in force and are fully implemented (Scenario 2 with low recruitment). Scenario 2 with low recruitment has the lowest prospect of recovery among the examined harvest scenarios. The probability of achieving the WCPFC's initial target (SSB_{MED} by 2024) would increase if more conservative management measures were implemented. The projection results indicate that a 10% reduction in the catch limit for fish smaller than the weight threshold in CMM 2015-04 would have a larger effect on recovery than a 10% reduction in the catch limit for fish larger than the weight threshold. The ISC notes that the current assessment model uses a maturity ogive that assumes 20%, 50% and 100% maturity in age 3 (weight on July 1: 34kg), 4 (weight on July 1: 58kg) and 5 (weight on July 1: 85kg), respectively, while the WCPFC CMM 2015-04 specifies that catches of fish smaller than 30kg should be reduced. The weight threshold in the CMM needs to be increased to 85kg (weight of age 5) if the intent is to reduce catches on all juveniles according to the maturity ogive in the assessment.

The projections results assuming a stronger stock-recruitment relationship (where h=0.9) than in the assessment model are not necessarily more pessimistic than the low recruitment scenario.

The projection results assume that the CMMs are fully implemented and are based on certain biological or other assumptions. In particular, the ISC noted the implementation of size based management measures need to be monitored carefully. If conditions change, the projection results would be more uncertain. Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment has on stock biomass, monitoring recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

It should be noted that recent data (2016) on the abundance of large fish from Japanese and Taiwanese longline fisheries are higher than those of 2014 and 2015.

Japan reported that recent data from Japanese real-time monitoring on cohorts of 2015 and 2016 suggests that they are above that of 2014 (see ISC/17/ANNEX/07). While this information is encouraging, it needs to be vetted to assess its utility.

ISC conducted further projections on various harvest and recruitment scenarios in accordance with the requests of RFMOs and the result was presented to the ISC PBF Stakeholder Meeting in April, 2017 (ISC/17/ANNEX/11). Notable points from the additional analysis were:

- Different recruitment scenarios forecast entirely different levels of SSB in the future;
- Under average recruitment conditions, all harvest scenarios achieve the initial rebuilding target of $SSB_{MED1952\text{-}2014}$ by 2024;
- Under all recruitment conditions with zero removals (no fishing), SSB trajectories achieved all rebuilding targets by approximately 2020 and the initial rebuilding target, $SSB_{MED1952\text{-}2014}$, within 2-3 years;
- Achieving 20%SSB0 during the projection period was not possible in most of the low recruitment scenarios;

- The probability of SSB falling below the historical lowest level at any time during the projection period is low (< 2%) in all projections;
- Scenarios that do not have catch limits for large fish in the EPO and WPO, or has a higher catch limit for large fish in WPO, do not achieve the initial rebuilding target, $SSB_{MED1952-2014}$, by 2024 under low recruitment conditions;
- Reducing the catch of small fish results in positive impacts on SSB trajectories, even with increases in the catch of large fish in the WPO.

8 REVIEW OF STOCK STATUS OF SECONDARY STOCKS IN THE WESTERN PACIFIC

8.1 EPO

M. Dreyfus provided an overview of the status of Secondary stocks (YFT, BET, and SKJ) in the IATTC Convention Area (**ISC/17/INFODOC/02/03/04/08**).

Catches of YFT are above 200,000 t, after record catches in 2002-2003 that were associated with very high recruitment. Most of the catch is taken by the purse seine fishery, especially in sets associated with dolphins. Nevertheless, the impact is more evenly distributed within the three types of sets in the purse seine fishery (dolphin associated, free swimming schools, and log sets), because of the size composition of the catch. Fish aggregating device (FAD) sets catch the smaller individuals.

Total BET catch is around 90,000 t. Most of the catch comes from the purse seine FAD fishery. Before 1993 it was basically a longline fishery. The FAD fishery has by far the biggest impact on this stock.

For those two stocks, IATTC periodically conducts full assessments and SSB has been close to the level that produces MSY in the recent past. In addition, SKJ condition is analyzed with relative reference points and based on productivity and susceptibility criteria compared to BET; IATTC scientific staff considers the SKJ biomass to be above the B_{MSY} level.

For 2017, after three meetings, the IATTC agreed to a quota for dolphin sets and FAD sets (including natural logs) was agreed. Nevertheless, new measures must be discussed for the following years in the upcoming IATTC annual meeting. Time closures, quotas, and FAD measures are among the options considered. There is concern about increasing capacity in the EPO, so IATTC staff recommended an increase from 62 to 72 days in the purse seine closure period.

Discussion

It was explained that the IATTC has been trying to control purse seine fishing capacity since 2003; despite adopted measures active capacity has continued to increase.

8.2 WCPO

A. Beeching presented on the SC12 review of stock assessments for SKJ and South Pacific BSH (**ISC/17/INFODOC/01/05/06**). The SKJ stock is in a good state, currently considered to be in the vicinity of the interim target reference point. The South Pacific BSH assessment was considered to be preliminary and management advice was not drafted by SC12. This was partly due to the lack reference of points for this species and also the lack of quality historical data to support a stock assessment. The indicator analyses for the stocks for which stock assessments were not conducted (BET, YFT, and SPALB) were then briefly reviewed. The presentation concluded with a slide detailing upcoming WCPFC meetings.

Discussion

It was noted that a full stock assessment was conducted for the WCPO SKJ stock whereas IATTC evaluates various indicators without conducting a full assessment. It was also noted that there was a difference of opinion in the SC with respect to weighting of different data sources (CPUE versus tagging). The weighting scheme affects interpretation of stock status.

Although there is a 19% risk of SPALB falling below the LRP in 2033, the recommended catch reduction is aimed at maintaining economic viability of the fishery and is also expected reduce the risk of breaching the LRP by 2033. It was further noted that the WCPFC has not yet adopted a the risk of breaching the SPALB LRP.

It was noted that it may be difficult to conduct a stock assessment for SP BSH using a fully integrated model because of data limitations.

9 REVIEW OF STATISTICS

9.1 STATWG Report

R.-F. Wu, the STATWG Chair, provided a summary of STATWG activities since ISC15 (**ISC/17/ANNEX/06/16**). **SUMMARY of 2017 STATWG Report to the Plenary**

Ren-Fan Wu, the STATWG Chair, provided a summary of STATWG activities since ISC16 (see 2017 STATWG Report in Annex ?). The STATWG Steering Group held 1 intercessional meeting in La Jolla, California, USA, in January 18-20, 2017, and in May 30, 2013. A meeting of the entire STATWG was held in Vancouver, Canada in July 7, 2017, prior to ISC17; 2 Information Papers and 1 Working Paper were submitted for this meeting.

It was announced that Izumi Yamasaki has relinquished her role as the ISC Data Administrator (DA) after eight years of outstanding service to the ISC. Kirara Nishikawa will assume the role as the ISC DA, as well as retain her current role as the ISC Webmaster.

The STATWG also welcomed new member Zane Zhang (Canada) who will replace John Holmes as the Data Correspondent for Canada.

It was reported that 4 of 6 items of the 2016 STATWG Work Plan were completed since ISC16; the 2 outstanding items were completed by July 13 at ISC17. The 2 items were updating member metadata annually, and resolving discrepancies of the data comparison report.

At the STATWG meeting in July 7, 2017 the following topics were presented and discussed:

1. Reviewed and resolved ISC database issues presented at ISC16
2. Reviewed the ISC catch tables
3. Compiled information on member's shark data collection systems
4. Reviewed the duties and Deliverables for the Data Administrator
5. Reviewed improvements to the ISC website
6. Conducted elections for Chair and Vice Chair of the STATWG for 2017-2018

Accomplishments of the STATWG since ISC16 include:
1. Continuing with publishing of data inventories on the ISC website
2. Continuing with improvements to the online data submission system and the ISC database, including updating the User's Manual for members
3. Continuing with archiving of stock assessment files from the species Working Groups from 2014-2017
4. Provided member metadata for updating annually
5. Provided comparison report on Member's re-submitted data vs data in the ISC database
6. Provided report on discrepancies between ISC catch tables vs catch tables in National Reports of Members
7. Compiled information on member's shark data collection systems to provide available years of data by shark species
8. Drafted an updated description of the duties and deliverables of the Database Administrator
9. Continuing with improvements and updates to the ISC website

The 2017 Work Plan for the STATWG was developed, as well as recommendations to the ISC17 Plenary.
The recommendations were:
1. The STATWG recommends that the Plenary approve the publishing of ISC Category II data online as public domain data, consistent with the practices of other RFMOs.
2. The STATWG recommends that the Plenary consider revising the current data submission deadline from July 1 to June 1, in order to provide sufficient time for the DA to validate Category II data prior to publishing online on the ISC website.
3. The STATWG recommends that the Plenary formally review the ISC Operations Manual to correct inconsistent and inaccurate information.

The current national contacts list for the STATWG was also provided, as well as the 2017 Member Report Card (see 2017 STATWG Report in Annex ?). Ren-Fen Wu and Darryl Tagami were elected as Chair and Vice Chair of the STATWG, respectively, for a 1 year term. The STATWG Steering Group will schedule their next meeting in January, 2018, and requested the scheduling of a 2-day STATWG meeting prior to the ISC18 Plenary.

<u>Discussion</u>

Mexico noted that it has increased staff capacity, which will enable it to provide required data to the ISC by established deadlines.

The process for preparing and publicly disseminating Category II data was discussed at length. The STATWG has been working toward making these data available through the ISC website. It was clarified that only Category II data from high-seas fisheries (longline, purse seine, pole and line, and troll) will be published. According to the ISC Operations Manual, Category II data should be summarized for all flag states combined by 5° x 5° latitude-longitude grid for longline fisheries and 1° x 1° latitude-longitude grid for surface fisheries by month to be considered public domain data. The STATWG proposed disaggregating data by flag but this is likely to present issues with respect to confidentiality rules, which prohibit publishing data coming from any spatio-temporal stratum in which fewer than three vessels are reporting. The alternatives of excluding data or aggregating data on a case-by-case basis were discussed. As a first step, the Plenary agreed that the STATWG should endeavor to make Category II data presentable [available] by ISC18 with fishery-level data aggregated by all countries by latitude-longitude grid and by month. Japan noted it may need approval from its relevant authorities if the definition of public domain data is changed from that in the ISC Operations Manual.

The Plenary also discussed the STATWG's request to shift the data submission deadline from July 1 to June 1. The STATWG outlined the Database Administrator's workload and short time window to prepare all the data for Plenary given the current deadline. The Plenary concluded that the current July 1 deadline should stand although Members are encouraged to submit their data before the deadline if possible.

The Plenary endorsed the STATWG's proposal convene a two-day meeting prior to ISC18.

9.1 9.2 Total catch tables

K. Nishikawa, the Database Administrator, presented the annual catch tables for ISC Member countries for 2015-2016. The catch tables include the following ISC species of interest: albacore, blue shark, Pacific bluefin tuna, striped marlin, swordfish, blue marlin, and shortfin mako shark. Graphs of the historical catch by country were also presented for each species. The catch tables were generated from the ISC database, and are based on Category I data submitted by Data Correspondents for the major fisheries in the North Pacific Ocean of the member countries. These catch tables are included in the ISC Plenary Report as Table 15-1 to Table 15-7 and serve as the official ISC catch tables.

Discussion

Canada noted an error in its reported NPALB landings for the period 1968-71. (During the meeting Canada subsequently updated its Category I data for the 1939-1993 period.) Canada will work with the Database Administrator to correct this error.

Mexico noted it is working on methods to provide more accurate estimates of its shark landings. It hopes to provide more accurate data in the future.

The omission of catch data in the ISC database for the historical Korean high seas driftnet fishery was flagged. This is especially an issue for billfish. Korea agreed to provide these data.

Japan noted that the lack of pre-1971 longline catch data in the ISC database for BUM is because BUM catch was combined with BLM catch in a combined category during this period.

It was reiterated that WG input on data needs or issues is effected through WG chair membership on the STATWG.

10 REPORT OF THE SEMINAR

J. Holmes provided an overview of the ISC17 Seminar, “HMS Tagging and Lessons Learned” (**ISC/17/ANNEX/15)**. David Itano, American Fishermen’s Research Foundation, Honolulu, U.S.A., presented on “Tagging Tuna: Lessons learned, focusing on conventional large scale tuna tagging studies in the Pacific Ocean.” Chuck Farwell, Monterey Bay Aquarium, U.S.A., then made a presentation on “Tagging Approaches for Highly Migratory Fish”, which described four types of electronic tags (archival tags, acoustic tags, pop-up satellite archival tags, and SPOT tags) deployed by the aquarium as part of its research program. Finally, Dr. Erin Rechisky, Kintama Research, Nanaimo, Canada, presented on “Acoustic-tracking Juvenile Pacific Salmon in the Coastal Ocean: Results and Lessons Learned” in which she described tracking experiments of salmon smolts migrating down the Columbia and Fraser Rivers and north along the continental shelf.

Five types of tags and programs were discussed: dart tags, pop-up satellite archival tags, archival tags, acoustic tags, and acoustic tags with tracking. Each tag type provides useful information, but some (PSAT, archival) potentially provide richer datasets than others. Dart tags and archival tags are largely fisheries dependent while pop-up satellite tags, archival tags and acoustic tags with tracking are independent of fisheries for information return. When considering tagging studies/experiments, four themes emerged for future programs: (1) planning and experimental design are important to overall success as it links the project to specific assessment/management needs and develops a scientifically defensible tagging plan; (2) develop and enforce standardized tagging and release protocols to minimize differences between groups conducting tagging operations, and develop criteria for selecting fish to tag and identifying fish that should not be tagged; (3) data management is important, particularly with electronic tags since the amount of information provided by each tag is potentially large; and (4) publicize the program to the fishing industry (fishers, processors, buyers), the public, and other stakeholders before it begins and provide feedback as the program progresses to ensure ongoing support (which can be translated into funding and long-term commitment) and the return of tags as necessary.

<u>Discussion</u>

The Plenary agreed to form an ad hoc working group to explore the development of a coordinated tagging program under the auspices of the ISC. It was agreed that it would be important for appropriate scientists, such as statisticians and stock assessment scientists, to participate in the ad hoc WG, so that any products proposed would be useful for enhancing stock assessments. The first task of this working group would be to inventory and describe existing tagging programs for HMS in the Pacific with the objective of reporting this information to ISC18. Based on further guidance from ISC18, the working group would then develop a framework for a possible ISC tagging program to be reviewed at ISC19. This framework would identify the scientific objectives to be achieved for each species under consideration, the likely costs for any such program, and possibly a prioritization of the species for which tagging programs would be supported. The outgoing ISC Chair agreed to work with the new Chair to organize this working group in the near future.

11 REVIEW OF MEETING SCHEDULE

11.1 Time and Place of ISC18

It was agreed that ISC18 will be held 11-16 July 2018 in the Republic of Korea.

11.2 Time and place of Working Group intercessional meetings

A draft schedule of proposed intersessional meetings was reviewed and amended, see Table 11-1.

Table 11-1. Schedule of working group meetings.

		ISC												Others	
		ALB		PBF		BILL		SHARK		STAT		PLENARY			
2017	Aug													9-17	SC
														28-31	NC
	SEPT					SWO Data Preparation & Modeling (SS3 version)	Webinar	Mako ageing webinar						1	NC
														22-30	PICES
	OCT	MSE	Date TBD (Vancouver)					Mako ageing workshop	19-24 (Japan)					1P	PICES
	NOV					SWO Data prep &Modeling (Data Plan)	Webinar	Mako data prep webinar	Early Nov						
	Dec					SWO Data prep & Modeling (Data Process)	Webinar	Mako data prep meeting	27Nov - 1Dec (Japan)					Dec 3 8 2017	WCPFC
2018	Jan					SWO data prep	17-23 (Honolulu)	Data prep webinar	1-2 days Jan/Feb	Steering Group Meeting	Jan 23-25 (Shimizu)				
	Feb														
	Mar	(Workshop)	DATE TBD	Update Stock Assessment	5-12 (La Jolla)										
	Apr	(Workshop)	DATE TBD			(SWO Assessment Modeling workshop)	(Location TBD)	(Mako assessment meeting)	Mar/April TBD(La jolla)						
	May					(SWO Assessment Modeling workshop)	(Location TBD)							May 2018	IATTC SAC
	Jun														
	Jul	1 day - Pre Plenary		1 day - Pre Plenary		1 day - Pre Plenary			1 day - Pre Plenary		2 days Pre Plenary		Proposed Plenary Dates July 11-16 18	July 2018	IATTC

Reformat presentation of meeting schedule. ALBWG – put March April in the March box. MSE workshop not confirmed for Oct. Add footnote: pending additional input could be later. BILLWG: Dec. webinar should read data progress. April-May swo modeling workshop, only one workshop, looks like two workshops in April and May.

12 ADMINISTRATIVE MATTERS

12.1 Formalization of ISC

Plenary discussed formalization of ISC. ISC currently does not operate under a formal agreement or Memorandum of Understanding (MoU). Concern for this arrangement was noted several Plenary sessions ago. At the time, it was noted that ISC Members may be able to better participate in ISC scientific working groups if a formal agreement existed. A formal agreement may also allow the creation of a budget as well as a formal secretariat that would support ISC operations. ISC Members were asked to review a draft MoU as a model to share with the people in their governments that would be responsible for furthering a formal multi-country agreement. ISC Members were also asked to send to the ISC Chair by the end of ISC17 the name of the person in their governments that might be responsible for addressing this issue.

<u>Discussion</u>

Members agreed with the requests of the ISC Chair to provide the MoU to the appropriate contact person in their respective governments for review provide him with the names of these points of contact by the close of ISC17. Finally, he emphasized the need to conclude this process as quickly as possible. [remove duplication of above]

12.2 Peer Review of Function and Process for Stock Assessments

ISC is required to conduct a peer review of its function and process every five years. At ISC16, it was agreed to solicit a panel to recommend an independent peer-review process for ISC. Independent peer review is critical to rigorous science and a clear process is an issue faced by many science providers that provide stock assessments and other science products to tuna RFMOs. At ISC16, the U.S.A. and Japan agreed to solicit funding for one reviewer each. A Member country to support a third reviewer was not identified. Draft terms of reference (TOR) were developed and made available for review (**ISC/17/PLENARY/12**).

<u>Discussion</u>

The ToR were agreed to but it was noted that it should be updated with regard to the dates and locations of meeting that reviewers may attend. It was agreed that one reviewer would observe the benchmark SWO stock assessment and the other would observe the PBF update assessment. If a third reviewer is available, then the SMA benchmark assessment should be observed assuming an assessment is conducted.

It was noted that reviewers can be selected from government agencies as long as they have no direct involvement in the ISC or other Pacific tuna RFMOs.

The outgoing Chair will continue working with Members to solicit a third reviewer, if at all possible.

12.3 Work Group Election Results

12.4 Election of the Chair and Vice Chair

Dr. John Holmes, Canada, was elected as ISC Chair and Dr. Eric Chang, Chinese Taipei, was elected as the ISC Vice Chair for three-year terms (dates). [These changes in the leadership will be reflected in the 2018 Organizational Chart.]

12.5 Organizational Chart and Contact Persons

BILLWG: MX, add person

Add outgoing and incoming Chair and Vice Chair.

12.6 Other Business

12.6.1 Template for Stock Status and Conservation Advice

At ISC15, Plenary agreed to develop a template for WGs to present information on stock status and conservation advice in order to produce greater consistency across stock assessments and the scientific information ISC provides and to facilitate Plenary deliberations. The U.S.A. provided a draft template (**ISC/17/PLENARY/13**) for ISC to consider adopting noting that as a science organization, ISC documents should be results-focused.

Discussion

It was noted that the proposed template was used as a guide for presenting stock status and conservation advice for the new NPALB and BSH assessments. More generally, the way in which the framework can be adapted to the specifics of a particular stock assessment was discussed. The template is proposed as a minimum set of contents for such reporting while striving to be flexible enough to accommodate different approaches and needs of WGs. The purpose is to agree upon some level of consistency in the way in which ISC stock assessment results are reported.

[Chair to work with US to confirm their review of RFMOs.] The U.S.A. reported that in their search they could not find any other tuna RFMO that had formally adopted such a detailed template (WCPFC, IATTC, IOTC, ICCAT). But it was noted that the RFMOs do follow their own general formats. The U.S. noted that the terms “overfished” and “overfishing” have specific legal definitions within its domestic policy framework related to domestically required biological reference points. Plenary discussions provided many useful comments for improving the template, all of which were incorporated into the revised version of the template (Plenary 13).

After considerable discussion and input from the Members, it was agreed that further review is needed before the template can be adopted. An important aspect of this further review is to involve fishery managers since the objective is to guide the production of consistent and concise statements about stock status and conservation information for managers. To this end it was agreed that the revised template should be presented to the NC and Members should also discuss the template with fishery managers in their respective governments.

Although not formally adopted, working groups were encouraged to consult the draft template when formulating stock status and conservation information in future stock assessment reports.

12.6.2 Candidate Reference Points

The Chair drew the Plenary’s attention to ISC/10/PLENARY/04, Biological Reference Points for Tuna and Tuna-Like Species in the North Pacific Ocean. He recommended that this document be revisited and updated. The need for timely advice on candidate reference points is only growing as the WCPFC develops harvest strategies for HMS stocks under its purview. The ISC should be prepared to respond. An update of this document, both to narrow the suite of candidates and evaluate candidates based on the latest information, would serve that purpose.

13 ADOPTION OF REPORT

The Report of the Meeting was adopted.

14 CLOSE OF MEETING

The meeting was closed at 2:15 PM 17 July 2017.

15 CATCH TABLES

Table 15-1. North Pacific albacore catches (in metric tons) by fisheries, 1952-2012. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Table 15-1. Continued

Table 15-2. Pacific bluefin tuna catches (in metric tons) by fisheries, 1952-2012. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Table 15-2. Continued

Table 15-3. Annual catch of swordfish (*Xiphias gladius*) in metric tons for fisheries monitored by ISC for assessments of North Pacific Ocean stocks, 1951-2010. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Table 15-3. Continued.

Table 15-4. Annual catch of striped marlin (*Kajikia audax*) in metric tons for fisheries monitored by ISC for assessments of North Pacific Ocean stocks, 1951-2011 "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recents years are provisional.

Table 15-5. Retained catches (metric tons, whole weight) of ISC Members of blue marlin (*Makaira nigricans*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Table 15-6. Retained catches (metric tons, whole weight) of ISC Members of blue sharks (*Prionace glauca*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Table 15-7. Retained catches (metric tons, whole weight) of ISC Members of shortfin mako sharks (*Isurus oxyrhinchus*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.