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REPORT OF THE FOURTEENTH MEETING OF THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN[1]

WCPFC-NC10-2014/IP-01

ISC[2]

[1] This is a draft document and may not be cited without authorization from the ISC Chair.
[2] International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

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

PLENARY SESSION

16-21 July 2014
Taipei
Taiwan

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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 (2013)
ALBWG	Albacore Working Group	John Holmes (Canada)
BILLWG	Billifsh Working Group	Jon Brodziak (USA)
PBFWG	Pacific Bluefin Working Group	Ziro Suzuki (Japan)
SHARKWG	Shark Working Group	Suzanne Kohin (USA)
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
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 (Korea
DWPS	Distant-water purse seine (Korea)
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 (Chinese Taipei)
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
NC	Northern Committee (WCPFC)
NRIFSF	National Research Institute of Far Seas Fisheries of Japan
OFDC	Overseas Fisheries Development Council (Chinese Taipei)
OLPS	Offshore large purse seiner (Korea)
PICES	North Pacific Marine Science Organization
PIFSC	Pacific Islands Fisheries Science Center (USA)
SAC	Scientific Advisory Committee (IATTC)
SC	Scientific Committee (WCPFC)
SPC-OFP	Oceanic Fisheries Programme, Secretariat of the Pacific Community
SPR	Spawning potential ratio, spawner per recruit
SSB	Spawning stock biomass [replace SB with SSB throughout]
SSB-ATHL	The average of the ten historically lowest SSB estimates
STLL	Small-scale tuna longline (Chinese Taipei)
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
GRT	Gross registered tons

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Highlights of the ISC14 Plenary Meeting

The 14th ISC Plenary, held in Taipei, Chinese-Taipei from 16-21 July 2014 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 and the North Pacific Marine Science Organization. The Plenary reviewed results, conclusions, new data and updated analyses of the Billfish, Albacore, Shark and Pacific Bluefin tuna working groups. The Plenary endorsed the findings that the North Pacific albacore tuna, North Pacific blue shark, Western Central North Pacific swordfish stocks are not overfished nor experiencing overfishing, and that the Eastern Pacific Ocean swordfish stock is not overfished but likely experiencing overfishing. It re-iterated that the Pacific bluefin tuna and striped marlin stocks are overfished and experiencing overfishing, and that the Pacific blue marlin stock is not overfished nor experiencing overfishing. It further provided information on biological reference points for North Pacific albacore tuna and the probability of achieving specific biomass levels, the range of historic recruitment as well as catch and effort data tables for Pacific bluefin tuna for managers to consider in crafting management measures. A special seminar on the impacts of climate change on fish and fisheries was held. Plenary discussed formalizing the ISC structure and administration and will continue researching means of doing both. Plenary also noted the strides WGs had made in incorporating best available scientific information (BASI) into stock assessment work, enhanced stock assessment reports and the increased transparency in Working Group efforts. Observers from Pew Charitable Trust, International Seafood Sustainability Foundation and World Wildlife Fund attended. The ISC workplan for 2014-2015 includes completing a new North Pacific striped marlin assessment and a first shortfin mako shark assessment, and enhancing database and website management. The Plenary re-elected Chi-Lu Sun for a second term as ISC Vice-Chair, the following working group Chairs: Suzanne Kohin for the Shark Working Group, Ren-Fen Wu for the Statistics Working Group, Jon Brodziak for the Billfish Working Group. The next Plenary will be held in the United States in July 2015.

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 (USA). 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 2013 the catch of priority species monitored by the ISC was 92,509 t of North Pacific albacore tuna (NPALB, *Thunnus alalunga*), xxxx t of Pacific bluefin tuna (PBF, *T. Orientalis*), xxxx t of swordfish (SWO, *Xiphias gladius*), xxxx t of striped marlin (MLS, *Kajikia audax*), and xxxx t of blue shark (BSH, *Prionace glauca*). [1] The total estimated catch of these five species is xxxx t, or approximately xx% from the 201x total estimate (estimated to be XXX,XXX t). Annual catches of priority stocks throughout their ranges are shown in Table 14-1 through Table 14-5.

1.2 Opening of the Meeting

The Fourteenth Plenary session of the ISC (ISC14) was convened in Taipei, Taiwan at 0900 on 16 July 2014 by the ISC Chairman, G. DiNardo. A roll call confirmed the presence of delegates from Canada, Chinese Taipei, Japan, Korea, and USA (*Annex* 1). A representative from the Western and Central Pacific Fisheries Commission (WCPFC) was also present. The International Sustainable Seafood Foundation (ISSF), Pew Charitable Trusts, and World Wildlife Fund-Japan (WWF) were present as observers.

ISC Members China and Mexico, the Secretariat of the Pacific Community (SPC), the Fisheries and Agriculture Organization of the United Nations (FAO), as well as organizations with significant interest, including the Inter-American Tropical Tuna Commission (IATTC), did not

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[1] FAO three-letter species codes are used throughout this report interchangeably with common names. See the list of acronyms and abbreviations for common and scientific names associated with these codes.

attend the Plenary. North Pacific Marine Science Organization (PICES) did not attend the opening.

G. DiNardo introduced S.-H. Hu, Deputy Minister of the Taiwan Council of Agriculture, Executive Yuan, and T.-Y. Tsay, Deputy Director General of the Taiwan Fisheries Agency, as special guests at the meeting. S.-H. Hu gave the welcome address for the meeting.

2 ADOPTION OF AGENDA

The proposed agenda for the session was considered and adopted with no changes (*Annex 2*). 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 *Annex 3*.

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 the Canadian North Pacific albacore troll fishery in 2013 (*ISC/14/PLENARY/04*). The Canadian fleet of 183 vessels operated primarily in the coastal waters of Canada and the United States and adjacent high seas areas. Preliminary estimates of 2013 catch and effort are 5,090 tonnes (t) and 6,469 vessel days (v-d), respectively, which represent a 104% increase in catch and an 8% increase in effort relative to 2012. Catch and effort were split primarily between Canadian waters (59% of the catch and 66% of the effort) and US waters (31% of the catch and 24% of the effort) while the remaining catch and effort occurred in adjacent high seas waters. The 2013 seasonal pattern of nominal catch-per-unit-of-effort (CPUE) was similar to the average for 2000-2009, with a peak in mid-July and a slow decline through August, September and October, and average CPUEs in 2013 were generally within the confidence intervals of the long-term averages. Seventy-five (75) vessels participated in the on-board size sampling program and measured 17,150 fish on 175 trips for a sampling rate of 2.24% of the reported catch. These measurements were dominated by fish between 65-71 cm fork length (FL) corresponding to 2-year old fish, and a significant number of fish between 75-78 cm FL, which are 3-years old. The major change affecting the operation of this fishery between 2012 and 2013 was the implementation of a new fishing regime under the terms of the bilateral treaty between Canada and the United States, which permitted access for fishing to domestic waters by vessels from the other country. In 2013, 45 Canadian vessels (a reduced number relative to recent historical levels) were permitted to fish in US waters for three months, which is a shorter season than previously fished. Research in 2013 was focused on modelling climatic effects on albacore stock productivity and distribution and abundance in the EPO. Several vessels (N = 5) were equipped with scales and collected weight-length data and will be collecting these data again in 2014 as a way to monitor growth conditions.

<u>Discussion</u>

The decline in nominal 2013 CPUE below the 95% confidence interval in August (Figure 4, *ISC/14/PLENARY04*) was noted. It was also explained that the incidentally-caught PBF was released because it may have been caught in U.S. waters where only NPALB may be retained.

Regarding the spatial distribution of length-frequency measurements, it was explained that fewer were taken in U.S. waters, because fewer vessels were permitted to fish in 2013. It was noted that the pop-up archival tagging of NPALB is a follow-up to work conducted by the USA to obtain information on movement patterns of fish leaving Canadian waters.

3.2 Chinese Taipei

W.-J. Wang presented the national report of Chinese Taipei (*ISC/14/PLENARY/05*). There are two principal tuna fisheries of Chinese-Taipei operating in the North Pacific Ocean, the tuna longline fishery and 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 comprise the large-scale tuna longline (LTLL, vessels larger than 100 GRT) and small-scale tuna longline (STLL, vessels less than 100 GRT) fleets. The total catch of tunas and billfish (including SWO, MLS, BUM, BLM, and SFA) by the longline fishery (LTLL and STLL combined) in the North Pacific Ocean was 29,598 t in 2013. There were 82 active LTLL vessels and 1,296 active STLL vessels operating in the Pacific Ocean in 2013. For the purse seine fishery, the total catch was 212,480 t caught by 34 vessels in the Pacific Ocean in 2013. The total catch by other offshore and coastal fisheries was estimated at 3,053 t.

For the LTLL fishery, Category I data sources include weekly catch reports and commercial data from individual fishing vessels. Categories 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, Category I data sources 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 and Category II data are obtained from logbooks.

In March 2010, a catch documentation scheme (CDS) was established and implemented for vessels fishing for PBF. When PBF are caught, fishers are required to attach a tag and to measure length and weight of each PBF.

An observer program on the LTLL fleet has been implemented in the Pacific Ocean since 2002. The program was gradually expanded in later years and hence the number of observed trips increased. The program was further expanded to the STLL fleet in 2012. Fifteen observed trips were conducted for each of the LTLL and STLL fleets in 2013.

<u>Discussion</u>

Chinese Taipei noted that its vessels are able to fish in an area between Taiwan and Japan based on a bilateral fisheries agreement where more smaller-size PBF were caught and measured in 2013.

A question was asked about the apparent increase in NPALB catch in 2013; Chinese Taipei responded that it was uncertain about the reasons and additional research would be required.

Chinese Taipei noted that observer coverage of its LTLL fleet has been over the target level of 5%, while it is much harder to place observers on STLL vessels and the coverage rate has not reached 5% for that fishery. It was also noted that the Fisheries Agency of Taiwan has field offices in three major domestic fishing ports for port sampling.

3.3 Japan

H. Shimada and Y. Takeuchi reported on the recent trends in Japanese tuna fisheries in the North Pacific Ocean (*ISC/14/PLENARY/06*). There are three major Japanese tuna fisheries—longline, purse seine, pole-and-line—and other miscellaneous fisheries like troll, driftnet, and setnet. The total landing of tunas (excluding skipjack) caught by Japanese fisheries in the North Pacific Ocean was 119,631 t in 2012 and 104,635 t in 2013. Total landings of SWO and MLS were 6,752 t in 2012 and 6,640 t in 2013. Landings of SKJ were 211,482 t in 2012 and 186,019 t in 2013. In addition to fisheries descriptions, Japanese research activities on tuna and tuna-like species in the Pacific Ocean in 2013 were briefly described. . Larval PBF cruise surveys were described and results from the most recent three years were summarized (ISC/14/INFODOC??).. Pacific bluefin tuna and albacore tuna ageing workshops held in November 2013 were mentioned and subsequent progress reported (SC/14/INFODOC??/??).

Y. Takeuchi also presented results of recent studies by Japan on harvest control rules (HCRs) and reference points for PBF, which is independent of the ISC (ISC/14/INFODOC/??).

Discussion

It was noted that pole-and-line vessels switched from targeting SKJ to targeting NPALB in 2012 because of poor catch of SKJ. In addition, in 2012 the purse seine fleet catch of NPALB increased substantially. Japan noted that while the PBF catch in the purse seine vessels increased in 2013 compared with the extremely low 2012 catch, the catch is still low by historical standards. Since the increased catch in the purse seine fishery in 2013 was mainly age-3 fish, it was noted that this may indicate that the 2010 year class was larger than the 2009 year class.

There was a suggestion that Japan report purse seine vessels targeting tuna separately from those targeting coastal pelagic species since these are distinct fisheries in terms of location and fishing season. . Although catches from the two fisheries were separated as part of data preparation by the PBFWG, it was noted that both vessel types operate under the same type of license, resulting in their catches being reported together in the National Report. It was suggested that the procedures employed by the WG could be used to facilitate the suggestion.

It was suggested that future HCR research be reviewed in the PBFWG and consider the level of recruitment uncertainty and management objectives (i.e., stabilized catch levels) when developing a plausible HCR for PBF.

3.4 Korea

Z. G. Kim presented the National Report for the Republic of Korea (*ISC/14/PLENARY/07*). Korean fisheries fishing for tunas and tuna-like species in the North Pacific are the distant water tuna longline (DWLL) and distant water tuna purse seine (DWPS) fisheries. Offshore large purse seiners and troll are also involved in the catch of PBF in Korean waters. Total Korean distant water catch of tuna and tuna-like species in the North Pacific was 56,692 t in 2013, of which 11,306 t was longline catch and 45,386 t was purse seine catch. The 2013 catch was 45.1% of the peak catch in 2003. BET, YFT, SWO, and BUM accounted for 53.4%, 17.6%, 9.5%, and 8.5% of the total 2013 longline catch, respectively. SKJ, YFT, and BET were 89.9%, 9.6 % and 0.5% of total purse seine catch, respectively. Longline fishing effort decreased from 42,485 thousand hooks in 2003 to 34,102 thousand hooks in 2013. Purse seine fishing effort decreased from 2,876 sets in 2003 to 1,644 sets in 2013. Purse seine fishing effort, which mostly occurred in the central Pacific area in 2012, moved to the western Pacific area in 2013. Longline effort was relatively higher in the eastern Pacific areas.

PBF catch by Korean offshore large purse seiners (OLPS) in Korean waters was 604 mt and that of coastal trollers was 0.04 t in 2013. The catches were distributed in the southern waters off Korea centering around Jeju Island throughout the year with the highest catch in June. A survey for PBF larva was conducted in 2013 in the southern waters off Korea but no PBF larvae were caught. An onboard observation by scientific observer of the operational characteristics of OLPS was carried out from 30 March to 21 July, 2013. There were no daytime fishing operations targeting PBF during the survey and the rate of PBF identification with sonar equipment prior to setting was 33.3 %.

<u>Discussion</u>

A question was asked on how OLPS captains determine whether a set is being made on PBF or coastal pelagics. Korea suggested based their observation of fishing operations that vessel captains are able to successfully distinguish PBF schools from coastal pelagics with sonar system at a 33.3% success rate. It was explained that purse seine vessels generally target coastal pelagics, but also catch PBF. It was also confirmed that the coastal troll fishery targets PBF. Clarification was sought as to why Korea conducted the larval survey off of Jeju Island. It was noted that Japan has identified two spawning “hot spots” and this survey was intended to determine if there is a continuum in spawning activity between the two hot spots.

3.5 United States

C. Werner presented the USA national report (*ISC/14/PLENARY/09*) to the Plenary covering fishery data submissions and relevant research by its Pacific Islands and Southwest Fisheries Science Centers related to its purse seine, albacore, and longline fisheries in the North Pacific in 2013. Highlights were provided of research on the socioeconomics of the Hawaii’s longline fishery, and on the modeled and observed changes in tropical Pacific ecosystem structure in response to pelagic fishing pressure. Also highlighted were findings on tagging studies of swordfish and albacore. For albacore off the US west coast, results from otolith studies were also presented, and findings on the distribution of albacore in relation to the presence of sea surface temperature fronts were discussed. Recent findings on SMA were mentioned as well as the successful completion of a capacity building workshop on stock assessment methods held in La Jolla, California, and attended by academic and government Mexican scientists. The new facility for the Pacific Islands Fisheries Science Center was also highlighted.

Discussion

It was noted that archival tags were applied to juvenile NPALB between 65 and 80 cm in length to better understand the differences in diving behavior in inshore versus offshore areas, and their movement throughout the North Pacific.

4 REPORT OF THE ISC CHAIRMAN

The ISC had another busy year since the ISC Plenary met in Busan, Korea in July 2013. The year was spent completing benchmark assessments for North Pacific blue shark and albacore tuna, and update assessments for North Pacific swordfish and Pacific Bluefin tuna, as well as working on preparations for new stock assessments for shortfin mako shark (SMA) and North Pacific striped marlin in 2015. Preparatory work consisted of collecting fishery and biological data, compiling and analyzing data, testing of hypotheses and stock assessment model assumptions, and exploring new models or variations of standard models for use in the upcoming assessments. 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 complete assignments on time has far reaching implications and following established protocols for ISC participation is paramount. 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 intercessional workshops were held to facilitate collaboration among Member scientists in implementing ISC work plans and coordinating research on the stocks. In addition, the ISC conducted two ageing workshops and made progress towards the development of a collaborative scientific research program with PICES. We continue to address recommendations stemming from the 2013 peer review of the ISC function, and Suzanne Kohin, Jon Brodziak and Ren-Fen Wu were re-elected as Chair's of the ISC Shark, Billfish and Statistics Working Groups, respectively.

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 Members with insufficient support cannot participate actively and hence, can delay progress of a working group in completing assignments. To date, the support for administration of ISC activities has been provided solely 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.

He closed the report by thanking all colleagues who worked on ISC tasks and who provided the support to ISC in advancing the objectives and purpose of the organization. The service of Chi-Lu Sun, vice Chairman, for support and insightful advice is acknowledged. A special thanks and appreciation is owed to the Chairs of the Working Groups, namely Ren-Fen Wu, Jon Brodziak, John Holmes, Ziro Suzuki, 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, Yumi Okochi, is appreciated. Finally, he acknowledged the professional assistance of Sarah Shoffler and Lennon Thomas for their dedicated service to ISC and for assistance in completing tasks assigned to the Chairman. In that capacity, they served as point of contact for the office of the Chairman, led in organizing the facilities for annual meetings, led in writing and assembling technical information required for agenda items of meetings and for responding to inquiries, and served as advisors on aspects of ISC operations. Thanks were extended to all for contributing to another successful year for ISC and for the support and service provided.

5 INTERACTION WITH REGIONAL ORGANIZATIONS

5.1 WCPFC

A. Beeching detailed ISC interactions with the WCPFC, first describing the SC9 response to ISC presentations on six stocks: NPALB, PBF, North Pacific SWO, North Pacific BSH, North Pacific MLS and Pacific BUM. Second, it was noted that no issues were raised in relation to data sharing between ISC and WCPFC. Finally, WCPFC10 decisions in relation to NC and ISC were summarized.

Discussion

It was noted that the question of whether the North Pacific BSH is a northern stock was tasked to SC by the NC and endorsed at WCPFC10. With regard to WCPFC requests for ISC to undertake specific analyses in relation to PBF, ISC did not receive a formal request from NC to conduct this work. However, it was noted that most of the informally requested analyses are in the updated stock assessment completed this year (see Section 11.2).

5.2 PICES

5.2.1 Report of the 2013-2014 PICES Meetings

J. Holmes represented ISC at the Twenty-second Annual Meeting of PICES 11-20 October 2013 in Nanaimo, British Columbia, Canada. He presented a poster on the activities of the ISC and presented a plan for a joint workshop session at the 2014 Annual Meeting to the Fishery Science Committee, requesting their support of the proposal. He also reported that interactions with meeting participants concerning ISC activities were positive and that the proposed workshop was ultimately supported and approved for 2014 by PICES.

ISC was invited to present a poster at the 16–26 October 2014 PICES Annual Meeting, *Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*, in Yeosu, Korea. ISC Vice-Chair Chi-Lu Sun will attend the meeting to present the poster.

5.2.2 Prospective Collaboration

The Chair discussed the joint PICES-ISC workshop to be convened on 16-17 October 2014 at the 2014 PICES Annual Meeting. The proposed workshop was discussed and recommended at

ISC13 as a way to foster greater scientific collaboration between the two organizations. Acceptance of the workshop by PICES was facilitated by the FUTURE program within PICES, which is an integrated science program to understand how marine ecosystems in the North Pacific respond to climate change with three major science themes: ecosystem resilience and vulnerability, coastal ecosystem response to human activities, and ecosystem response to natural and anthropogenic forcing. The proposed workshop topic is "Dynamics of Pelagic Fish in the North Pacific in Response to Climate Change." The goal is to understand how climate change affects highly migratory species and to develop a research plan that promotes partnership with PICES. The objective is to have the partnership last for up to five years, but this depends on further discussion.

Four research themes are proposed for this partnership:

1. Population (Species) Productivity
    a. Recruitment dynamics
    b. Demographic parameters
2. Behavioral (Phenology)
    a. Shifts in distribution (footprint)
3. Fishers and Fisheries
    a. Fleet dynamics
    b. Socio-economic impacts
4. Modeling
    a. Accounting for climate change in assessment models

Discussion

Members recognized the importance of establishing a PICES-ISC partnership and agreed with the proposed research themes.

6 REPORTS OF WORKING GROUPS AND REVIEW OF ASSIGNMENTS

6.1 Albacore

J. Holmes reported on the activities of the ALBWG over the past year (*ISC/14/ANNEXES/04, 10,11*). The ALBWG held a stock assessment data preparation workshop for 5-12 November 2013 in Shimizu, Japan, followed by the joint Albacore-Pacific Bluefin Tuna Ageing Workshop on 13-16 November 2013 in Shimizu. The stock assessment workshop was held 14-28 April 2014 in La Jolla, USA, at which a new stock assessment was finalized, a request from NC9 to update information on biological reference points based on 2014 stock assessment results was completed, and work plans were developed for the next year for review and approval by ISC14.

Accomplishments of the ALBWG over the past year include:

1. Fishery definition work for the stock assessment model was completed and input data series (catch, size composition, CPUE) were reviewed for consistency with the new fishery definitions and conflicts in primary data sources;
2. CPUE indices for inclusion in the model using a checklist of information needs supporting CPUE index development established earlier and as a result the base case model is fitted to four indices from two fisheries;

3. A new consensus stock assessment base case model was developed and the current status of the stock was assessed using fishery data from 1966 to 2012;
4. Information and advice on biological reference points was updated based on 2014 assessment model results as requested by NC9;
5. Age determination protocols for albacore were developed and a manual of best practices is in development;
6. The ALBWG catch table was updated with preliminary 2013 catch figures; and
7. Recommendations on conservation were developed based on the 2014 base case model results and future projections.

The ALBWG proposed the following work plans and schedule for 2014/15:

1. Aug 2014-June 2015 – No intersessional workshops are scheduled;
2. Aug 2014 – S. Teo will present the 2014 assessment at the Tenth meeting of the SC;
3. Sept 2014 – J. Holmes will present the 2014 assessment at the Tenth Regular Session of the NC;
4. May 2015 – J. Holmes will present the 2014 assessment results to the Sixth meeting of the IATTC SAC; and
5. July 2015 – 1-day update meeting in advance of ISC15.

The ALBWG brought forward two issues for consideration by the ISC Plenary:

1. Data from China – currently the ALBWG can obtain aggregated catch data from sources other than China directly. The Chinese fishery seems to be growing in size and it may be catching the largest albacore since it operates between the equator and 15°N. There is a need for more and better data on the size composition of the catch in this fishery along with detailed spatial and temporal information on catch and that could be obtained through the ongoing participation of Chinese scientists in ALBWG workshops.
2. The 2014 assessment implemented a two-sex growth model. Very little sex-specific information is currently available. The ALBWG requests that the ISC Plenary encourage all members to collect sex-specific size composition data from their fleets.

The ALBWG Chair also noted that the request from NC9 to update information on biological reference points based on the 2014 assessment results was successfully completed. The recommended responses drafted by the ALBWG are found in the stock assessment workshop report (*ISC/14/ANNEX/10* and *ISC/14/PLENARY/10*) (see Section 11.2).

<u>Discussion</u>

It was noted that the Center for Independent Experts (CIE) reviews of the 2011 stock assessment highlighted several important issues that the WG addressed in the most recent stock assessment. In particular, CIE comments helped crystallize thinking on which indices to use in the current assessment.

It was noted that the WG used published data combined with some additional unpublished data to determine the sex-specific growth model used in the assessment model. NPALB are sexually dimorphic with respect to maximum age and growth and a better model fit is achieved by using sex-specific growth. However, further work needs to be done on differences in spatial distribution by size and sex. The contribution of Ian Stewart of the International Pacific Halibut Commission as one of the participants from the US in the stock assessment workshop was noted.

Members thanked the ALBWG for their hard work and endorsed the 2014-2015 ALBWG workplan.

6.2 Pacific Bluefin Tuna

Z. Suzuki, PBFWG Chair, summarized the activities of the PBFWG (*ISC/14/ANNEX/16*). The PBFWG has met twice after ISC13, 17-22 February 2014 in La Jolla, California, USA, to update the stock assessment (see *ISC/14/ANNEX/16* and *ISC/IM14/ANNEX/04*) and 14 July 2014 in Taipei, Chinese Taipei, prior to the ISC14 Plenary. The 14 July WG meeting focused on updating PBF catch statistics, reviewing inter-sessional activities, the draft responses to the requests of NC9, the status of juvenile and adult catches, and a work plan for activities leading up to the next full stock assessment before ISC16.

PBF catch statistics from 1952 to 2013 by calendar year were updated (see *ISC/14/ANNEX16*, Table 6-1). The preliminary PBF catch estimate for 2013 is 12,124 t, lower than the 2012 catch of 15,636 t, and seventh lowest since the 1990 catch of 8,653 t. Each member county provided information on their fisheries and research activities including catch and effort trends and operational changes. Responses to the requests of NC9 (see Section 11.2) regarding future projections and the range of historical variation in recruitment were presented. Juvenile and adult catches were summarized (see *ISC/14/ANNEX/16*, Section 2.4).

The work plan for completing the next full assessment in early 2016 includes the following activities. The first workshop, in early 2015, will be on model and data improvements. The second workshop, in late 2015, will be on data finalization for full assessment, and the third workshop, in early 2016, will be the full assessment. Dates and venues will be decided shortly. PBFWG members agreed that the PBFWG Chair should contact IATTC and Mexico when deciding the date and venue of the workshops. In scheduling, conflicts with other scheduled meetings should be avoided.

The PBFWG Chair informed WG members about a concept paper on a rebuilding plan and harvest control rules for PBF, a progress report on the Pacific Bluefin Tuna and Albacore Tuna Aging Workshop, and current status of spawning grounds and periods PBF (*ISC/14/INFODOC/20).*

<u>Discussion</u>

Regarding the recent low recruitment level, the PBFWG Chair noted that there is no clear explanation but that will be an important consideration in the next full assessment. It was also noted that historical recruitment was bootstrapped from the forward projections made in response to the NC request.

There was considerable discussion of the table showing juvenile and adult catch by country, which was provided in response to the NC request (see Section 11.2). In particular, the definition of juveniles in the NC9 request differs from the description in the definition used in the recent stock assessment. This discrepancy will be pointed out in the ISC responses to NC.

The utility of considering the points brought out by the CIE review when preparing the next stock assessment was noted. The ISC members thanked the PBFWG for their hard work and endorsed the proposed PBFWG work plan. They also pointed out that the venue of future WG workshops should attempt to ensure participation from IATTC and Mexican scientists.

6.3 Billfish

J. Brodziak, BILLWG Chair, provided the ISC14 Plenary with an overview of the work assignments and tasks completed by the BILLWG since ISC13. This included a list of future work expected to be conducted by the BILLWG following ISC 14.

The BILLWG held a workshop in February 2014 in Honolulu, Hawaii for the purpose of conducting swordfish stock assessments. This meeting included participants from Chinese Taipei, the IATTC, Japan, and the USA. Nine working papers were reviewed, revised, and accepted at this meeting by the BILLWG as providing the best available scientific information for swordfish stock assessment. The meeting produced two assessment documents. These were: North Pacific Swordfish (*Xiphias gladius*) Stock Assessments in 2014 (*ISC/14/ANNEX/9*) and Executive Summary: North Pacific Swordfish Stock Assessments (*ISC/14/BILLWG-2/1*).

Assessment tasks completed prior to the February 2014 BILLWG workshop were to complete collaborations between ISC members and partners for the preparation of catch data and standardization of fishery CPUE by Chinese Taipei, Japan, Korea, Mexico, and the USA for the swordfish stock assessments.

Other tasks completed prior to the February 2014 BILLWG workshop were to participate in the Fifth International Billfish Symposium held in Taipei, Taiwan, during November 2013. The Symposium was convened by ISC Vice-Chair Chi-Lu Sun and ISC Chair Gerard DiNardo. Attendees from the ISC Billfish Working Group included Jon Brodziak, Yi-Jay Chang, Minoru Kanaiwa, Ai Kimoto, Nan-Jay Su, William Walsh, Su-Zan Yeh, and Kotaro Yokawa. Overall, this successful symposium included 45 presentations and 15 posters with 22 manuscripts submitted to Fisheries Research for consideration of publication in a special issue of the journal.

Assessment tasks completed during the February 2014 BILLWG workshop were to conduct stock assessments for the Western and Central North Pacific Ocean (WCNPO) and Eastern Pacific Ocean (EPO) swordfish stocks. Assessment tasks completed subsequent to the workshop during March-June 2014 included conducting retrospective analyses for WCNPO and EPO swordfish assessments and conducting stochastic stock projections to evaluate alternative the consequences of alternative future harvest scenarios in 2017.

The future work plan of the BILLWG included one primary work assignment to conduct a stock assessment update for the WCNPO striped marlin stock in 2015. To accomplish this work, the BILLWG planned to hold two intercessional assessment meetings: a data preparation meeting to be hosted in Honolulu by the Pacific Islands Fishery Science Center (PIFSC) in late-November or early-December 2014 and an assessment modeling meeting to be hosted at a site to be determined in March or April 2015.

Discussion

Members thanked the BILLWG for their hard work and endorsed the 2014-2015 BILLWG workplan.

6.4 Shark

S. Kohin, SHARKWG Chair, provided a summary of SHARKWG activities over the past year (*ISC/14/ANNEX/06/12/13*). The focus of the SHARKWG over the past year was on improving the blue shark data and indices and updating the 2013 assessment. This was a request by SC9 which the ISC accepted. The assessment was completed and conducted collaboratively with ISC members. Meetings of the SHARKWG since ISC13 were held in Honolulu and La Jolla, USA and Keelung, Chinese Taipei. These included an informal workshop on blue shark CPUE indices, the Second ISC Sponsored Shark Age and Growth Workshop, and two SHARKWG meetings. Chinese Taipei, Japan, USA, IATTC, and the SPC all actively participated in at least one SHARKWG meeting. Although SMA was not the focus of the working group, some information on SMA fishery data and biology was discussed over the past year.

The informal blue shark CPUE workshop was held in Honolulu, Hawaii, during December 2013. The goals of the workshop were to examine: 1) changes in fishery practices that may have affected CPUE trends, 2) the handling of targeting effects, 3) representativeness of observer coverage, 4) trends in Japanese training vessel data, and 5) diagnostics of standardization models. Key outcomes of the workshop were:

- For the Japanese training vessel data, a high variability in reported catch between vessels was noted, especially after the early 2000s, and it was determined that further work is necessary to understand the reasons and potentially correct the information before it could be used to track trends in blue shark abundance.
- For the Japanese and Hawaii longline fisheries, nominal CPUE trends based on data from an overlapping space and time were compared and found to be declining in both cases; analysis of a subset of the Japanese fishery data in the overlapping space/time produced a pattern more similar to that of the Hawaii fishery, which is consistent with the conclusion that regional effects on abundance may occur.
- Trends in observer coverage for the Hawaii longline fishery were examined and found to be inconsistent over time; a recommendation was made to re-estimate the indices using only the data from 2000 forward.
- Participants reviewed a paper on the index developed by SPC using their longline observer data holdings; the recommendation was made to recalculate the index excluding the Hawaii observer data because of redundancy with the HI deepset longline index.
- Taiwan indices were re-estimated based on a recommendation to add an area effect for northern versus southern fishing areas and other suggestions.
- Spatial patterns in the relative catch of blue shark and swordfish in the Japan longline fishery and use of the swordfish catch ratio to account for targeting were described. It was concluded that targeting is largely accounted for by area and time factors in the CPUE standardization.

Based on work conducted at the workshop, improved indices were submitted for consideration at the January 2014 data preparatory meeting.

Highlights of the Age and Growth Workshop and the two SHARKWG meetings were briefly presented (Annexes *ISC/14/ANNEX/06/12/13*).

The SHARKWG proposed a workplan for providing stock status information on SMA to the ISC Plenary in 2015. The SHARKWG recognizes the difficulty in estimating shark catch and discards and the challenges presented by spatial segregation of shortfin mako sharks by size and sex. Data compilation will be time-consuming; however, the WG will attempt to complete the SMA data compilation and stock assessment before ISC15. If data limitations are identified at the data prep meeting, the SHARKWG will consider using fishery indicators to provide SMA stock status information to ISC15.

The SHARKWG established the following tentative deadline and meeting schedule:

September 1, 2014	Deadline for submission of SMA size, sex and location data in templates provided.
Late summer, 2014 (early October); 1-2 day webinar	Review progress and assignments on preparation of SMA data and biological inputs
Fall/Winter 2014 (mid to-late November); Location TBD, (tentatively set for Mexico)	SMA data prep meeting
Spring 2014 (March or April) Location TBD	SMA assessment meeting

Finally, S. Kohin reported that she had been elected to serve as the SHARKWG Chair for another term.

<u>Discussion</u>

Efforts by the SHARKWG to compile SMA data series were discussed. Member countries are aware of the need to compile data series and have it ready for upcoming WG data preparation meetings. Initial evaluation of member data submissions are promising.

It was noted that the evaluation of BSH CPUE indices by the SHARKWG in an informal workshop may help address concerns that have been raised by the SC.

With respect to SMA, the ISC agreed with the approach of trying to complete a full assessment before ISC15. If the workgroup identifies data shortcomings, then the provision of stock status by fishery and biological indicators will be considered. In this regard, the approach that the IATTC scientific staff has taken on silky shark and skipjack tuna may prove useful.

The SHARKWG plans to schedule a webinar to advance work on the SMA assessment intersessionally; this will be a useful test of the utility of webinars for ISC WG activities. Webinars are a more informal and logistically simpler way to accomplish some tasks short of an in-person meeting.

Members thanked the SHARKWG for their hard work and endorsed the 2014-2015 SHARKWG workplan.

6.5 Seminar

G. DiNardo convened a seminar meeting at the 14th Meeting of the ISC on 19 July 2014. The presenters and abstracts of their talks are included below.

H.-J. Lu presented on *Changes in the fish species composition in the coastal zones of the Kuroshio Current and China Coastal Current during periods of climate change: Observations from the set-net fishery*. Changes in fish distribution and migration patterns have occurred in mid- and high-latitude oceans world-wide in response to climate change. Since the 1980s, the sea surface temperature (SST) of the southern East China Sea has increased significantly, particularly in winter. The mechanisms behind these changes in migratory fish assemblages are difficult to elucidate from general capture fisheries databases. This study collected a long-term data set of set-net catches, reported from the remote Tung-Ao Bay in northeastern Taiwan to analyze catch composition. Both the total number of species and the Shannon–Wiener index (H) showed an increasing trend, while the cumulative percentages of the top 10 captured fish species decreased annually. These results indicated that in the coastal zone at the front of Kuroshio Current (KC) and China Coastal Current (CCC), increased SST caused fluctuations in the presence of cold-water and warm-water fishes and in the timing of fishing seasons. Additionally, results based on multi-dimensional scaling (MDS) and cluster analyses showed that the study period could be divided into two clusters, 1993–1997 and 1998–2011, with an 80% similarity value. The boundary of these clusters was consistent with changes in SST. A species composition change analysis of these clusters showed that clustering was associated with changes in the intensities of the CCC and KC, especially in winter seasons. A northward expansion of low-latitude fish species was observed in Tung-Ao Bay, similar to expansion of high-latitude fish species into Polar region.

M.-A. Lee presented on *Effects of climate variability on the distribution and fishing conditions of yellowfin tuna (Thunnus albacares) in the Indian Ocean*. Variations in the abundance and distribution of pelagic tuna populations have been associated with large-scale climate indices such as the Southern Oscillation Index in the Pacific Ocean and the North Atlantic Oscillation in the Atlantic Ocean. Similarly to the Pacific and Atlantic, variability in the distribution and catch rates of tuna species have also been observed in association with the Indian Ocean Dipole (IOD), a basin-scale pattern of sea surface and subsurface temperatures that affect climate in the Indian Ocean. The environmental processes associated with the IOD that drive variability in tuna populations, however, are largely unexplored. To better understand these processes, we investigated longline catch rates of yellowfin tuna and their distributions in the western Indian Ocean in relation to IOD events, sea surface water temperatures (SST) and estimates of net primary productivity (NPP). Catch per unit effort (CPUE) was observed to be negatively correlated to the IOD with a periodicity centered around 4 years. During positive IOD events, SSTs were relatively higher, NPP was lower, CPUE decreased and catch distributions were restricted to the northern and western margins of the western Indian Ocean. During negative IOD events, lower SSTs and higher NPP were associated with increasing CPUE, particularly in the Arabian Sea and seas surrounding Madagascar, and catches expanded into central regions of the western Indian Ocean. These findings provide preliminary insights into some of the key environmental features driving the distribution of yellowfin tuna in the western Indian Ocean and associated variability in fisheries catches.

C.-T. Tseng presented on *Spatial and temporal distributions of Pacific saury associated with environmental factors in the northwestern Pacific Ocean*. A 5-year (2006–2010) fishery data coupled with multi-sensor satellite images had been examined to determine the pelagic habitat characterization of Pacific saury in the Northwestern Pacific Ocean (NWPO). The results showed that the monthly average CPUEs (metric tons/day/boat) ranged from 10.8 of early fishing season (June to August) to 23.1 of the highest CPUE in October. The totally average CPUE is 15.3. Its major fishing grounds located within 37–48^{o}N latitude and 145–165^{o}E longitude. The monthly mean centers of gravities of fishing grounds had a remarkable latitudinal movement. In addition, Pacific saury's habitat preferences were also determined using the empirical cumulative distribution function. As a result, the high CPUEs corresponded to areas where sea surface temperature (SST) ranged from 14–16^{o}C, Chlorophyll-*a* concentrations ranged from 0.4–0.6 mg m^{-3} and net primary productions ranged from 600–800 mg C m^{-2} day^{-1}. Then, local areas within the NWPO with similar satellite-derived oceanographic parameters were assumed to be potential habitat zones of Pacific saury.

Moreover, possible changes in potential habitat zones of Pacific saury were estimated under four scenarios of SST increase due to climate change. Results revealed an obvious poleward shift of potential saury habitats under the influence of SST increase. Based on these SST preferences in concert with the corresponding fish distributions, monthly potential saury habitats were predicted. Possible changes in potential saury habitats were estimated under 4 scenarios: the present years and with 1, 2, and 4 °C rises in SST due to climate change. Results showed an obvious poleward shift of potential saury habitats during the influence of increases in SSTs. The southernmost boundary of potential saury habitat located at 40.24°N latitude at the present time shifted to 46.15°N latitude under the scenario of a 4 °C rise in SSTs.

Consequently, above mentioned results can improve our understanding of the variability in the spatial distribution of saury habitats, and can form the basis for fishery management and fishing forecasts in the future.

N.-J. Su presented on *Ensemble-based analysis of climate change effects on the habitat of striped marlin (Kajikia audax) in the North Pacific Ocean*. Striped marlin is a highly migratory species distributed throughout the North Pacific Ocean, which shows considerable variation in spatial distribution as a consequence of habitat preference. This species may therefore shift its range in response to future changes in the marine environment driven by climate change. It is important to understand the factors determining the distribution of striped marlin and the influence of climate change on these factors, to develop effective fisheries management policies given the economic importance of the species and the impact of fishing. We examined the spatial patterns and habitat preferences of striped marlin using generalized additive models fitted to data from longline fisheries. Future distributions were predicted using an ensemble analysis, which represents the uncertainty due to several global climate models and greenhouse gas emission scenarios. The increase in water temperature driven by climate change is predicted to lead to a northward displacement of striped marlin in the North Pacific Ocean. Use of a simple predictor of water temperature to describe future distribution, as in several previous studies, may not be robust, which emphasizes that variables other than sea surface temperatures from bioclimatic models are needed to understand future changes in the distribution of large pelagic species.

N. Suzuki presented on *Preliminary comparisons between spatiotemporal fluctuations in larval distributions and environmental conditions from 2011 to 2013 in waters of spawning grounds of Pacific bluefin tuna*. A number of research surveys to analyze the geographical distribution of Pacific bluefin tuna (PBF) larvae have been carried out for more than a half of century by Japanese scientists. These surveys could be categorized into three generations. The first generation of surveys (1956-1989) was focused on understanding horizontal extent of larval distribution in the northwestern Pacific Ocean, clearly illustrating two geographically-isolated spawning grounds, that is, the Nansei area and the Sea of Japan, and indicating month-to-month changes of occurrence of PBF larvae. The second one (2007-2010) was concentrated in development of basic strategy for larval sampling in waters of the major spawning ground around the Nansei Islands. Adaptive sampling trials adjusting to oceanographic conditions succeeded to converge the survey area using specific oceanographic and geographic features for future researches and also year-to-year fluctuation in amounts of larval catches was detected. The most recent surveys (2011-), the third generation, have been continuing to reevaluate spatiotemporal extent of larval distribution around Japanese waters including the two spawning grounds and to identify spawning spots and their surrounding environments. Possible spawning spots were estimated from all of each sample of PBF larvae using backward calculation on an oceanographic numerical model, though much less larval collections in the Sea of Japan may provide rough estimates of the spots in the area.

Although a whole picture of larval distribution of PBF have been represented steadily, larval demography and/or abundance induced from fluctuations observed in the amounts of larval catches have never been investigated because of lack of detailed examinations regarding relationships between the year-to-year fluctuations and oceanographic conditions. It should be a key approach to detect correlation of fluctuations between larval catches and environmental conditions, in order to understand mechanisms of interactions between wild PBF reproduction and environments. In this presentation, we introduce an example of year-to-year fluctuation in the amounts of PBF larval catches observed in the Nansei area which appears to be connected with oceanographic conditions. We compare the amounts of larvae sampled in the middle of May to both geographic distributions and a time series of anomaly of sea surface temperature simply, and then discuss a possible trigger to influence the opening of the spawning periods. Additionally fluctuation of food web environments for the larvae observed in the Sea of Japan is also introduced. These findings are expected to help us to understand larval demography of PBF in the near future.

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

It was recommended that the authors of these studies consider the some relationship of the presented research to stock assessment applications in the future. It would be good to use indicators for biodiversity, habitat quality, and socioeconomic benefit in the prediction of Indian Ocean Dipole events, for example, to be used as an early indicator of success or failure prior to the fishing season.

N. Suzuki's research was discussed. It was noted that satellite imagery can provide another view of bluefin early life history survival based on predator-prey relations. More sampling is probably needed to understand how temperature anomalies affect early life history of bluefin tuna. Although there is no definitive answer, the reason for two widely-separated spawning areas, in the Sea of Japan and Nansei area, might be the relatively shallow depths in waters between the Korean peninsula and Southern Japan, which separates the two spawning areas. [Applicability to other species]

The ISC Chair thanked the presenters for their presentations and noted that that the research is consistent with the intent of the emerging PICES-ISC collaboration.

7 STOCK STATUS AND CONSERVATION ADVICE

7.1 Albacore

J. Holmes, ALBWG Chair, summarized results of the stock assessment the ALBWG conducted (*ISC/14/ANNEX/11*). All available fishery data for albacore were used in the stock assessment and it was assumed that there is instantaneous mixing of albacore on a quarterly basis. Catches were relatively low in the 1950s and 1960s and increased to a peak in the mid-1970s before declining and reaching a secondary peak by the late 1990s. Following a second decline in the early 2000s, catch has recovered slightly, but continues to fluctuate without trend. Surface gears (troll, pole-and-line) have accounted for approximately twice as much albacore catch as longline gear since the early 1950s.

Catch and size composition data from ISC countries (Canada, Chinese Taipei, Japan, Korea, Mexico, and USA) and catch data from some IATTC and WCPFC member countries, including China (Table 7-1) were obtained for the assessment. Standardized catch-per-unit-effort data for 11 indices used to measure trends in relative abundance were provided by Japan, USA, Canada, and Chinese Taipei. However, the ALWBG concluded that the Japan pole-and-line (PL) and longline (LL) indices were the indices most representative of trends in juvenile and adult albacore abundance, respectively, and the base case model was therefore fitted to these indices only. The NPALB stock was assessed using an age-, length-, and sex-structured Stock Synthesis (SS Version 3.24f) model fitted to time series of standardized CPUE and size composition data over a 1966 to 2012 time frame. Sex-specific growth curves were used because there is evidence of sexually dimorphic growth, with adult male albacore attaining a larger size and age than female albacore. The assumed value of the steepness parameter in the Beverton-Holt stock-recruitment relationship was $h = 0.9$, based on two independent estimates of this parameter. 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 some of the data series used in the analyses, growth curve parameters, natural mortality, stock-recruitment steepness, starting year, selectivity estimation, and weighting of size composition data.

Stochastic stock projections were conducted externally to the base case model to evaluate the impact of various levels of fishing intensity on future female spawning stock biomass (SSB). Future recruitment was based on random resampling of historical recruitment for three periods:

(1) low recruitment (29.1 x 10^6 recruits), 1983-1989, (2) average recruitment (42.8 x 10^6 recruits), 1966-2010, and high recruitment (54.8 x 10^6 recruits), 1966-1975. The projection calculations incorporate the structure of the assessment model (e.g., multi-fleet, multi-season, size- and age-selectivity) to produce results consistent with the assessment model. Projections started in 2011 and continued through 2041 under two levels of fishing mortality (constant $F_{2010\text{-}2012}$, constant $F_{2002\text{-}2004}$, constant catch averaged for 2010-2012) and three levels of recruitment (low, average, and high).

Estimates of total stock biomass (age-1 and older) show a long-term decline from the early 1970s to 1990 followed by a recovery through the 1990s and subsequent fluctuations without trend in the 2000s (Figure 7-1A). Female SSB exhibits similar long-term changes, with a decline from the early 1970s to the early 1990s, a recovery in the late 1990s and a levelling off in the late 2000s (Figure 7-1B). Female SSB was estimated to be approximately 110,101 t in the terminal year of the assessment (2012) and stock depletion was estimated to be 35.8% of unfished SSB. Average historical recruitment is approximately 42.8 x 10^6 recruits annually, but there are periods of above and below average recruitment at the beginning of the assessment time frame followed by fluctuations around the average since the 1990s (Figure 7-1C).

Biological reference points were computed with the base case model (Table 7-1). The point estimate (± SD) of maximum sustainable yield (MSY) is 105,571 ± 14,759 t and the point estimate of spawning biomass to produce MSY (SSB_{MSY}, adult female biomass) is 49,680 ± 6,739 t. The SSB-ATHL threshold (i.e., the average of the ten historically lowest SSB estimates) is estimated to be 117,835 t, which is more than twice the SSB_{MSY} level. The ratio of $F_{2010\text{-}2012}/F_{MSY}$ is estimated to be 0.52 and the ratio of $F_{2010\text{-}2012}/F_{SSB\text{-}ATHL}$ is estimated to be 0.72. $F_{2010\text{-}2012}$ (current F) is below $F_{SSB\text{-}ATHL}$, F_{MSY} and all MSY-proxy reference points except F_{MED} and $F_{50\%}$ (Table 7-1) and these ratios are lower than ratios estimated using $F_{2002\text{-}2004}$, consistent with the intent of previous ALBWG recommendations for conservation. The ALBWG notes that Kobe plots, which depict stock status in relation to MSY-based and MSY proxy reference points from the base case model (Figure 7-2), are presented for illustrative purposes since biological reference points have not been established for the North Pacific albacore stock, with the exception of the $F_{SSB\text{-}ATHL}$ interim reference point used by the WCPFC Northern Committee (NC).

Table 7-1. Potential reference points and estimated F-ratios using current F ($F_{2010\text{-}2012}$) and $F_{2002\text{-}2004}$ (reference years for North Pacific albacore CMMs adopted by the IATTC and WCPFC) to assess current stock status, associated spawning biomass and equilibrium yield for North Pacific albacore when exploited at $F_{2010\text{-}2012}$. Median SSB and yield are shown for $F_{SSB\text{-}ATHL}$ as this simulation-based reference point is based on a non-equilibrium concept.

Reference Point	$F_{2002\text{-}2004}/F_{RP}$	$F_{2010\text{-}2012}/F_{RP}$	SSB (t)	Equilibrium Yield (t)
$F_{SSB\text{-}ATHL}$	0.85	0.72	100,344	90,256
F_{MSY}	0.76	0.52	49,680	105,571
$F_{0.1}$	0.56	0.51	73,380	93,939
F_{MED}	1.34	1.30	156,291	74,640
$F_{10\%}$	0.71	0.63	22,867	96,590
$F_{20\%}$	0.80	0.71	54,530	105,418
$F_{30\%}$	0.92	0.81	86,192	99,612
$F_{40\%}$	1.07	0.94	117,855	89,568
$F_{50\%}$	1.29	1.13	149,517	77,429

The ALBWG noted three issues with the $F_{SSB\text{-}ATHL}$ reference point: (1) $F_{SSB\text{-}ATHL}$ is interpreted as the fishing mortality, F, that will lead to 50% of future SSB falling below the SSB-ATHL threshold level during a 25-year projection period,[2] (2) the time frame used to calculate the SSB-ATHL threshold was the model time frame (1966-2012), which, because of changes in the spawning biomass trajectory, means that there was a low SSB period in the 2000s. Thus, SSBs estimated in 2007 through 2010 were used in the threshold calculation against which current F ($F_{2010\text{-}2012}$) was evaluated; and (3) $F_{SSB\text{-}ATHL}$ is extremely conservative if it is intended to be interpreted as a limit reference point for the stock, because the SSB-ATHL threshold is more than twice the biomass necessary to support MSY (i.e., SSB-ATHL > 2 x SSB_{MSY})

[2] How actually calculated.

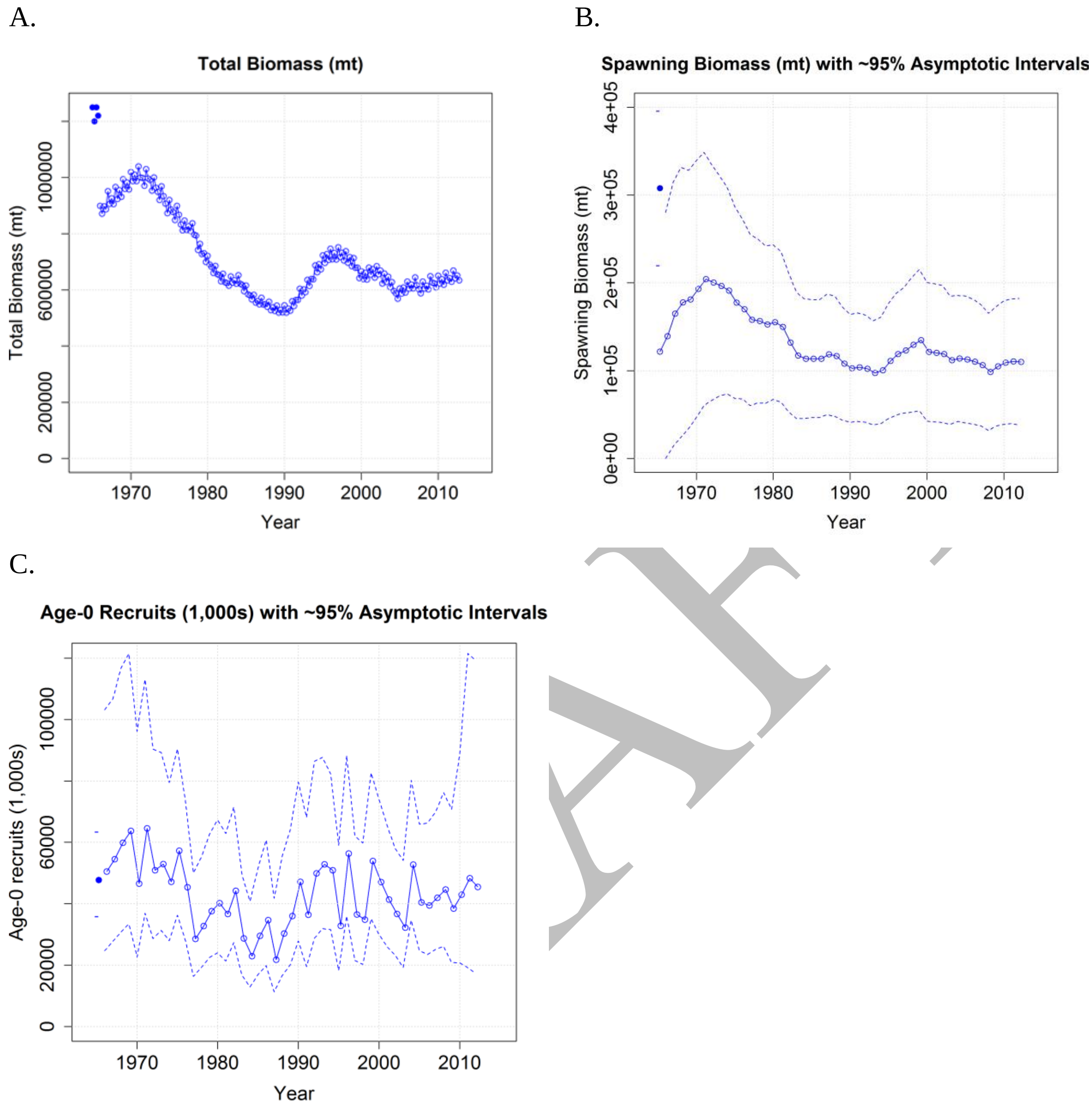

Figure 7-1. Estimated total age-1+ biomass (A), female spawning biomass (B), and age-0 recruitment (C) of North Pacific albacore tuna (*Thunnus alalunga*). The open circles represent the maximum likelihood estimates of each quantity and the dashed lines in the SSB (B) and recruitment (C) plots are the 95% asymptotic intervals of the estimates (± 2 standard deviations) in lognormal (SSB – B) and arithmetic (recruitment – C) space. 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 spawning biomass (B) and recruitment (C).

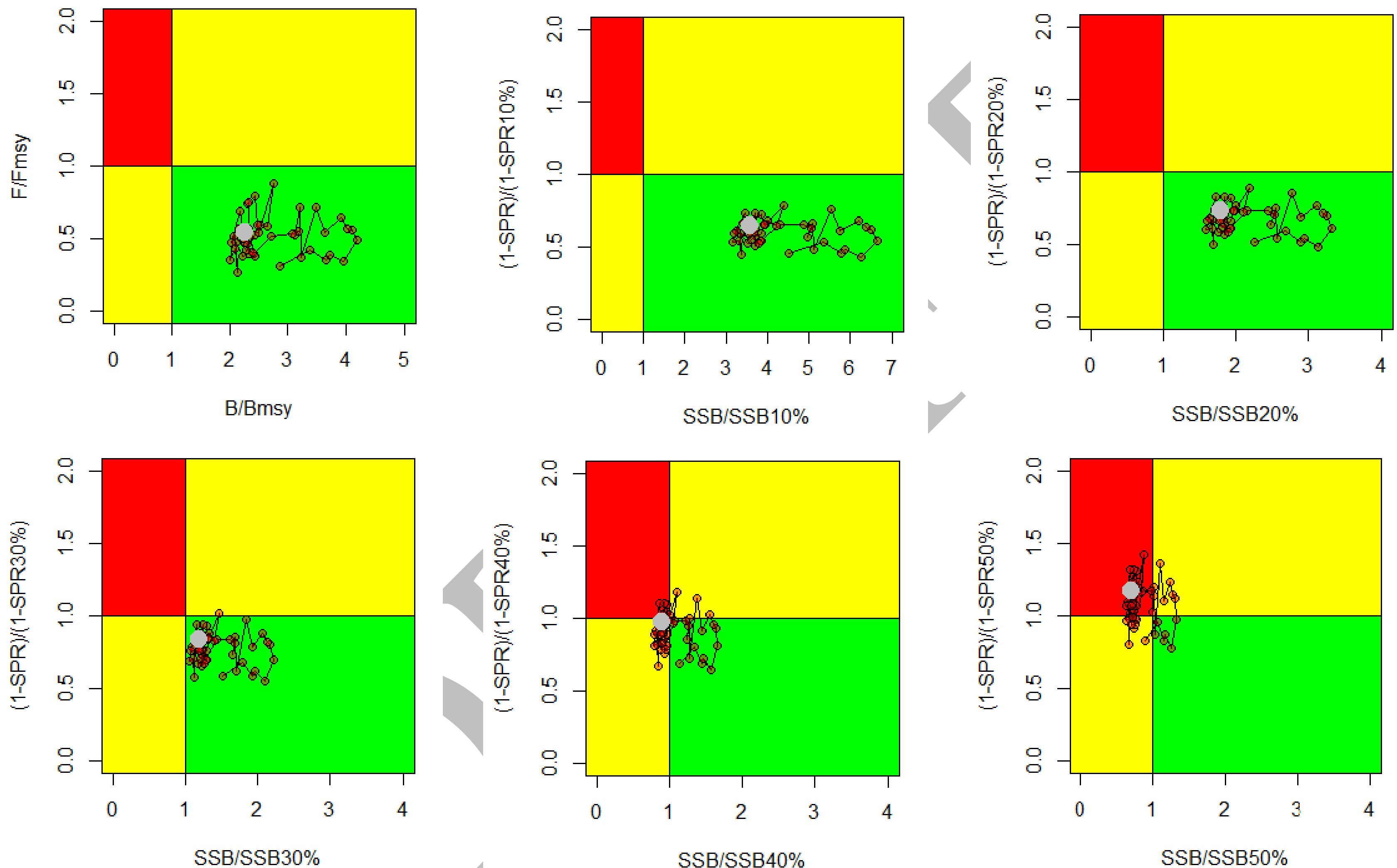

Figure 7-2 Alternative Kobe plots showing North Pacific albacore (*Thunnus alalunga*) stock status based on Fcurrent ($F_{2010\text{-}2012}$) relative to MSY-based reference points (top left) and MSY proxies consisting of SPR-based fishing intensity reference points ($F_{10\%\text{-}50\%}$) for the 2014 base case model. Grey dots are the terminal year (2012) of the assessment. These plots are presented for illustrative purposes since reference points have not been established for the North Pacific albacore stock. See the text of the assessment report regarding comments on the interim reference point $F_{SSB\text{-}ATHL}$.

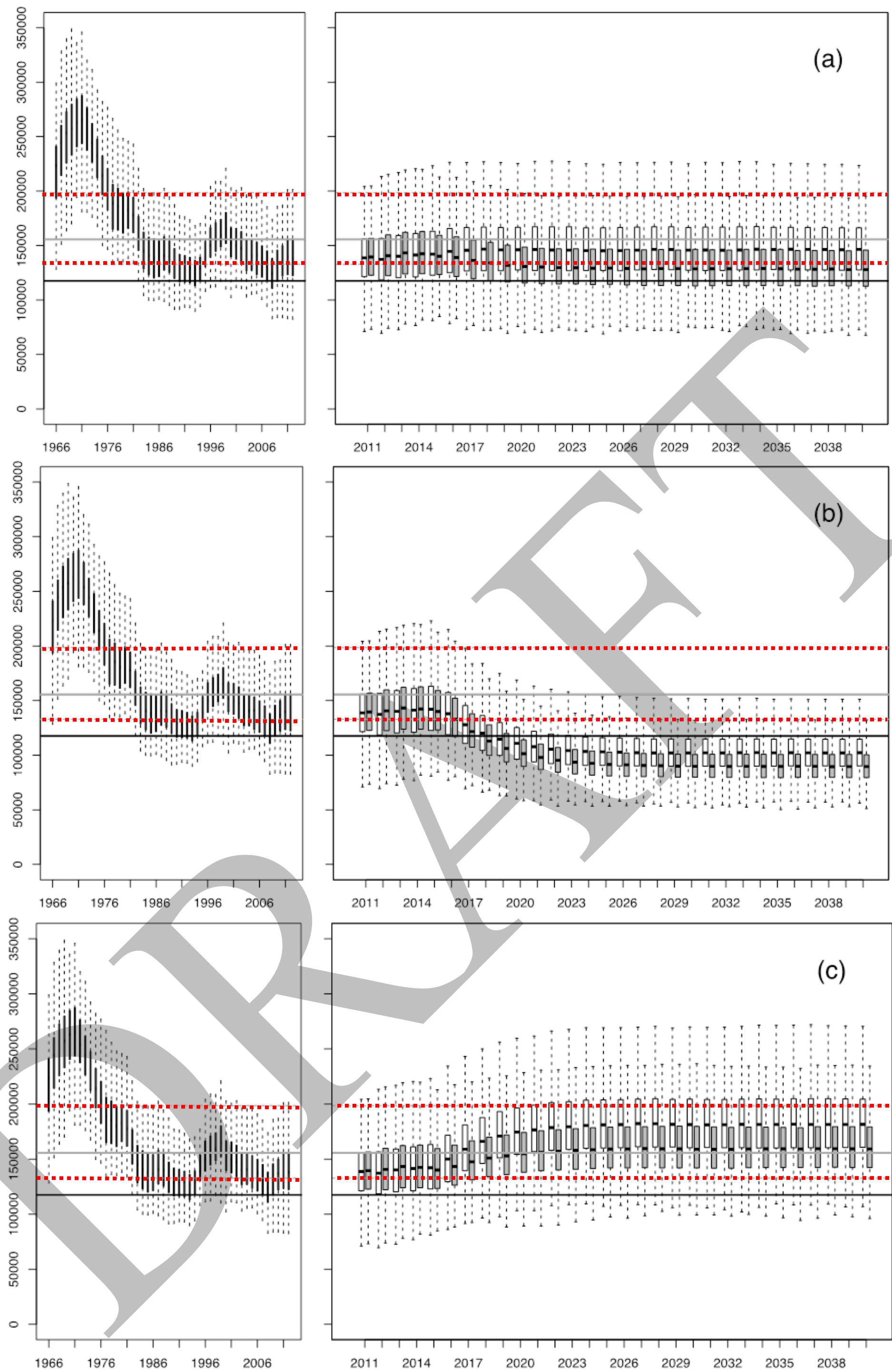

Figure 7-3 Historical (left) and future trajectories of North Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) based on to two constant harvest scenarios (F2002-2004 - gray boxplot; F2010-2012 - white boxplot) for average historical recruitment (a), low historical recruitment (b) and high historical recruitment (c) scenarios. The solid gray and red dashed lines represent median, 25% and 75% quintiles of past SSB, respectively. The solid black line is the average of 10 lowest estimated historical female SSB values, i.e., the SSB-ATHL threshold. Outlier values are not shown in these figures.

Discussion

Utility of the current interim reference point, $F_{SSB\text{-}ATHL}$, was discussed. Possible differences between how the WG calculated the $F_{SSB\text{-}ATHL}$ reference point and how the NC may have specified the reference point were noted. Two main differences were noted: 1) the WG calculated the SSB-ATHL threshold from the entire model time frame (1966-2012) while the NC may have specified a specific time frame (1966-2005); and 2) the WG calculated $F_{SSB\text{-}ATHL}$ as the fishing mortality that will lead to 50% of future SSB falling below the SSB-ATHL threshold during a 25 year projection period but this interpretation may differ from that of the NC. In addition, it was noted that the WG had some concerns about the appropriateness of $F_{SSB\text{-}ATHL}$ for the NPALB stock. Two main concerns were noted: 1) the SSB trajectory has changed in this assessment, which resulted in several years near the end of the time series (2007-2010) being included in the SSB-ATHL threshold calculation and included in the calculation of current F ($F_{2010\text{-}2012}$) being evaluated; and 2) the $F_{SSB\text{-}ATHL}$ is extremely conservative if it is intended to be interpreted as a limit reference point for the stock because the SSB-ATHL threshold is more than twice the biomass necessary to support MSY. Overall, it was recommended that the ALBWG Chair be very explicit about how the $F_{SSB\text{-}ATHL}$ reference point was calculated and the WG's concerns when presenting the information to the NC so that the NC can address these concerns. The ISC Chair also noted that concerns of this nature should be brought to his attention earlier in the assessment process in order to foster dialogue with NC members to address these questions prior to the completion of the assessment. Given the issues discussed, the NC should be asked to reconsider the use of the $F_{SSB\text{-}ATHL}$ as the interim limit reference point.

In addition, the NC should also be made aware that the SSB in the current assessment only refers to female SSB, because a sex-specific model was used, and is different from the SSB used in previous assessments. It was also noted that the recruitments used for the forward projections were resampled from estimated historical recruitment values, rather than using a stock-recruit relationship. Given a steepness value of 0.9 and the healthy status of the SSB, the stock is on the flat part of the stock-recruit relationship, and resampling historical recruitments for the future projections likely did not substantially affect the results. There was also some discussion about local depletion of the NPALB but there did not appear to be any evidence of that.

Stock Status and Conservation Advice

Stock Status

Because the F for 2010-2012 relative to most candidate reference points, except F_{MED} and $F_{50\%}$, are below 1.0, NPALB is not experiencing overfishing (Table 7-1). Although no biomass-based reference points have been developed for this stock, there is little evidence from this assessment that fishing has reduced SSB below reasonable candidate biomass-based reference points (Figure 7-2), so the ALBWG concludes that the stock is likely not in an overfished condition at present.

Conservation Advice

The current exploitation level ($F_{2010\text{-}2012}$) is estimated to be below that of $F_{2002\text{-}2004}$, which led to the implementation of conservation and management measures (CMMs) for the North Pacific albacore stock in the EPO (IATTC Resolution C-05-02 supplemented by Resolution C-13-03) and the WCNPO (WCPFC CMM 2005-03)**.** Assuming average historical recruitment and fishing at a constant current F, median female SSB is expected to remain relatively stable between the 25th and median historical percentiles over both the short- and long-term, with a 13% probability that female SSB falls below the SSB-ATHL threshold during a 25-yr projection period. In contrast, if a low recruitment scenario is assumed, then median female SSB declines under both harvest scenarios (constant $F_{2010\text{-}2012}$, constant $F_{2002\text{-}2004}$) and the probability that it falls below the SSB-ATHL threshold in the 25-yr projection period increases to 65% as calculated by the ALBWG and noted above. The high recruitment scenario is more optimistic, with median future SSB increasing above the historical median SSB and the estimated probability of falling below the SSB-ATHL threshold is correspondingly low at 3%.

The ISC concludes that the North Pacific albacore stock is healthy and that current productivity is sufficient to sustain recent exploitation, assuming average historical recruitment continues.

7.2 Pacific Bluefin Tuna

Z. Suzuki, PBFWG Chair, summarized results of the stock assessment conducted by the PBFWG and reviewed at the 2014 Intersessional Plenary (*ISC/IM14/Annex4*).

Discussion

The meaning in the conservation advice of "substantial reduction" in juvenile mortality was discussed. Scenario 6 was the most conservative of the harvest scenarios evaluated but further reductions in catch may be needed to prevent SSB from declining further. Additional, more conservative, scenarios may need to be evaluated. It was noted that reductions in juvenile catch are in relation to the 2002-2004 baseline period in the 2014 stock assessment.

The ISC reiterated the stock status and conservation advice from the March Intersessional Plenary Meeting.

Stock Status and Conservation Advice [repaste original stock status and conservation advice from intersessional report]

Stock Status

Using the updated stock assessment, the 2012 SSB was 26,324 t and slightly higher than that estimated for 2010 (25,476 t).

The recruitment level in 2012 was estimated to be relatively low (the eighth lowest in 61 years), and the average recruitment level for the last five years may have been below the historical average level (Figure 7-4). Estimated age-specific fishing mortalities on the stock in the period 2009-2011 relative to 2002-2004 (the base period for WCPFC Conservation and Management Measure 2010-04) increased by 19%, 4%, 12%, 31%, 60%, 51% and 21% for ages 0-6, respectively, and decreased by 35% for age 7+ (Figure 7-5).

Although no target or limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the current *F* average over 2009-2011 exceeds all target and limit biological reference points (BRPs) commonly used by fisheries managers except for F_{loss}, and the ratio of SSB in 2012 relative to unfished SSB (depletion ratio) is less than 6%. In summary, based on reference point ratios, overfishing is occurring and the stock is overfished.

For illustrative purposes, two examples of Kobe plots (plot A based on SSB_{MED} and F_{MED}, plot B based on $SSB_{20\%}$ and $SPR_{20\%}$, (Figure 7-6) are presented. Because no reference points for PBF have yet been agreed to, these versions of the Kobe plot represent alternative interpretations of stock status in an effort to prompt further discussion.

Historically, the Western Pacific Ocean (WPO) coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleet has increased its impact, and the effect of this fleet is currently greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, thereafter decreasing significantly. The WPO longline fleet has had a limited effect on the stock throughout the analysis period. 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 (Figure 7-7).

Conservation Advice

The current (2012) PBF biomass level is near historically low levels and experiencing high exploitation rates above all biological reference points except for F_{LOSS}. Based on projection results, the recently adopted WCPFC CMM (2013-09) and IATTC resolution for 2014 (C-13-02) if continued in to the future, are not expected to increase SSB if recent low recruitment continues.

In relation to the projections requested by NC9, only Scenario 6,[3] the strictest one, results in an increase in SSB even if the current low recruitment continues. Given the result of Scenario 6, further substantial reductions in fishing mortality and juvenile catch over the whole range of juvenile ages should be considered to reduce the risk of SSB falling below its historically lowest level.

If the low recruitment of recent years continues the risk of SSB falling below its historically lowest level observed would increase. This risk can be reduced with implementation of more conservative management measures.

Based on the results of future projections requested at NC9, unless the historical average level (1952-2011) of recruitment is realized, an increase of SSB cannot be expected under the current

[3] For the WCPO, a 50% reduction of juvenile catches from the 2002-2004 average level and F no greater than $F_{2002-2004}$. For the EPO, a 50% reduction of catches from 5,500 t. From the scientific point of view, juvenile catches were not completely represented in the reductions modeled under Scenario 6 for some fisheries although these reductions comply with the definition applied by NC9.

WCPFC and IATTC conservation and management measures,[4] even under full implementation (Scenario 1).[5]

If the specifications of the harvest control rules used in the projections were modified to include a definition of juveniles that is more consistent with the maturity ogive[6] used in the stock assessment, projection results could be different; for example, rebuilding may be faster. While no projection with a consistent definition of juvenile in any harvest scenario was conducted, any proposed reductions in juvenile catch should consider all non-mature individuals.

Given the low level of SSB, uncertainty in future recruitment, and importance of recruitment in influencing stock biomass, monitoring of recruitment should be strengthened to allow the trend of recruitment to be understood in a timely manner.

[4] WCPFC: Reduce all catches of juveniles (age 0 to 3-(less than 30 kg)) by at least 15% below the 2002-2004 annual average levels, and maintain the total fishing effort below the 2002-2004 annual average levels. IATTC: Catch limit of 5000 t with an additional 500 t for commercial fisheries for countries with catch history. (1. In the IATTC Convention Area, the commercial catches of bluefin tuna by all the CPCs during 2014 shall not exceed 5,000 metric tons. 2. Notwithstanding paragraph 1, any CPC with a historical record of eastern Pacific bluefin catches may take a commercial catch of up to 500 metric tons of eastern Pacific bluefin tuna annually. (C-13-02), see https://www.iattc.org/PDFFiles2/Resolutions/C-13-02-Pacific-bluefin-tuna.pdf)

[5] Although these measures assume F be kept below $F_{2002-2004}$, $F_{2009-2011}$ was higher than $F_{2002-2004}$.

[6] 20% at age 3; 50% at age 4; 100% at age 5 and older

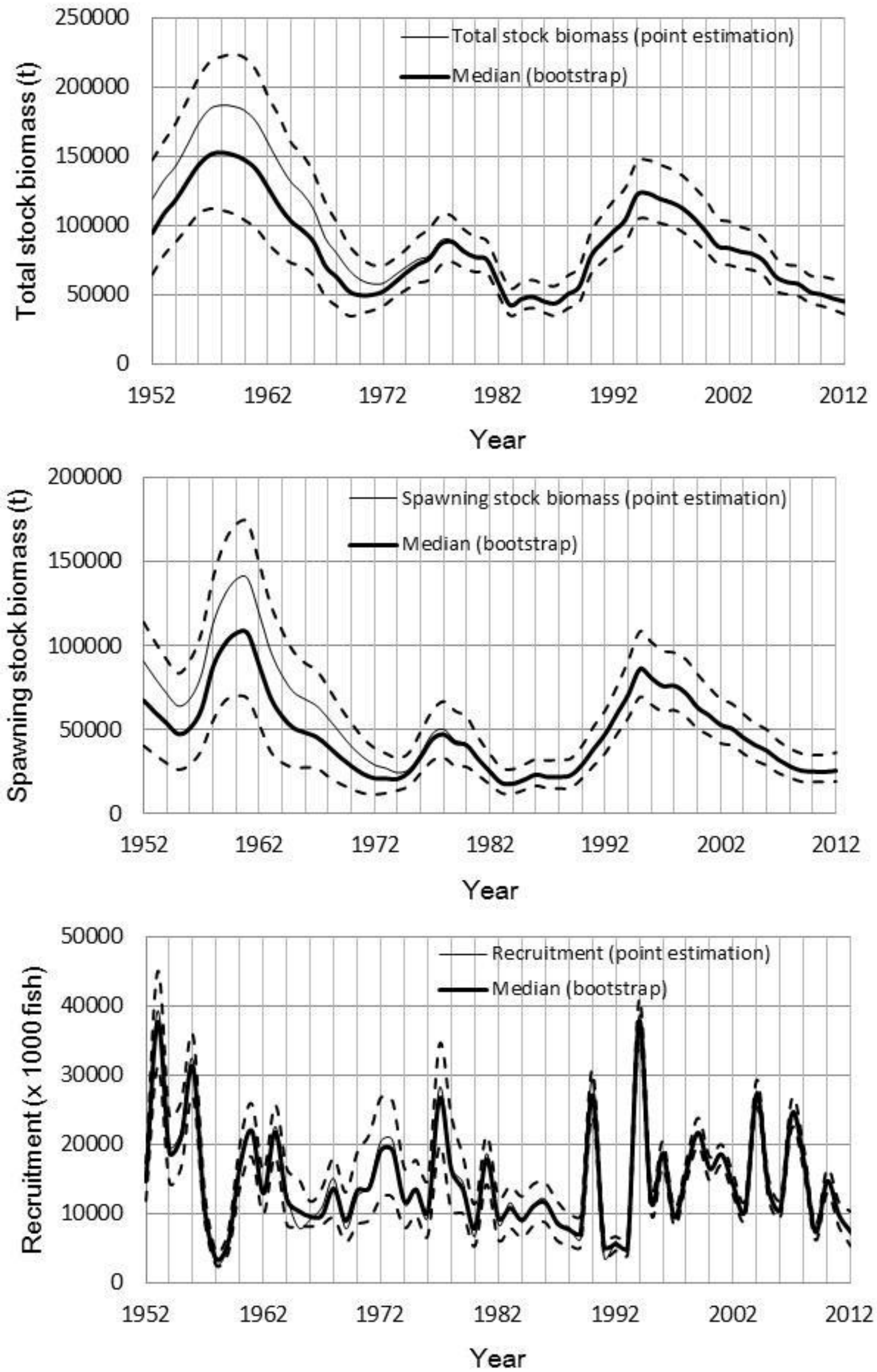

Figure 7-4. Total stock biomass (upper panel), spawning stock biomass (middle panel) and recruitment (lower panel) of PBF from the base case run (Run1). Thick line indicates median, thin line indicates point estimate, and dashed lines indicate the 90% confidence interval.

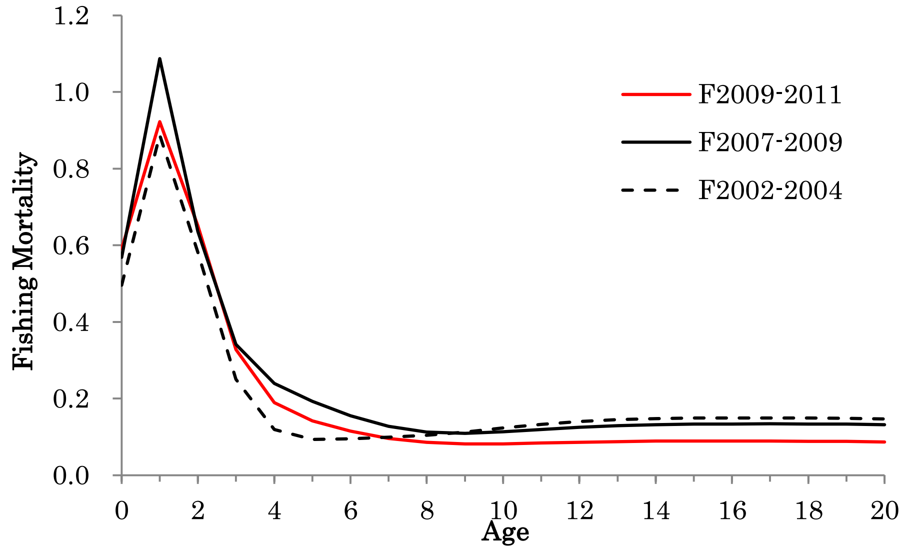

Figure 7-5. Geometric mean annual age-specific fishing mortalities for 2002-2004 (dashed line), 2007-2009 (solid line) and 2009-2011 (red line).

A. B.

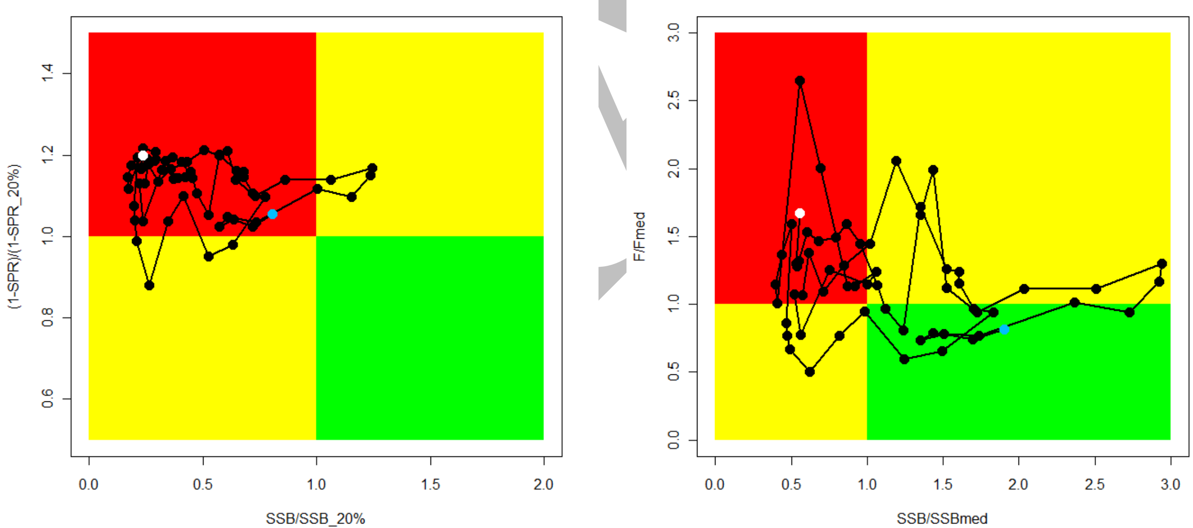

Figure 7-6. Alternative Kobe plots for Pacific bluefin tuna (*Thunnus orientalis*). A. *SSB_{med}* and *F_{med}*; B. *$SSB_{20\%}$* and *$SPR_{20\%}$*. Citation of these Kobe plots should include clarifying comments in the text. The blue and white points on the plots show the start (1952) and end (2012) year of the period modeled in the stock assessment respectively.

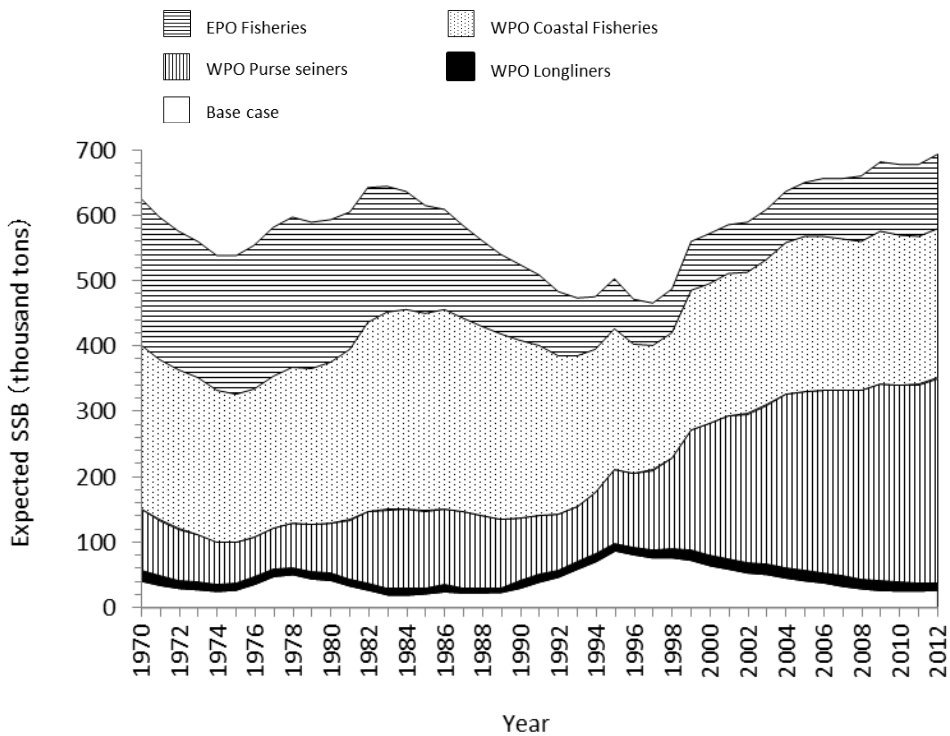

Figure 7-7. Trajectory of the spawning stock biomass of a simulated population of Pacific bluefin tuna (*Thunnus orientalis*) that was unexploited (topmost line) and that predicted by the base case (white area). The shaded areas between the two lines show the proportions of impact of each fishery.

7.3 Blue Marlin

ISC conducted an assessment in 2013. No new information was available at the time of ISC14.

<u>Discussion</u>

It was agreed to reiterate the advice put forward at ISC13 since there is no new information.

<u>Stock Status and Conservation Advice (Repeat advice from ISC13 without edits]</u>

Stock Status

Estimates of total stock biomass show a long-term decline. Population biomass (age-1 and older) averaged roughly 123,523 mt in 1971-1975, the first 5 years of the assessment time frame, but then declined by approximately 40% to an average of 78,663 mt in 2011. Female spawning biomass was estimated to be 24,990 mt in 2011 (Figure 7-8) [Note: Figure 7-8 does not include age 1 and older]. Fishing mortality on the stock (average F, age-2 and older) averaged roughly F = 0.26 yr^{-1} during 2009-2011.

The predicted value of the spawning potential ratio (SPR, the predicted spawning output at current F as a fraction of unfished spawning output) is currently $SPR_{2009\text{-}2011}$ = 23%. Average annual in 2007–2011 was about 823,000 recruits, and there was no apparent long-term recruitment trend. The overall trends in spawning stock biomass showed a long-term decline. In contrast, recruitment fluctuated without any trend over the same period (Figure 7-8).

Kobe plots depict the stock status in relation to MSY-based reference points (Figure 7-9) from the base case SS model (Figure 7-8). The Kobe plots indicate that the Pacific blue marlin spawning stock biomass decreased to the MSY level in the mid-2000s, and since then has increased slightly. The base case assessment model indicates that the Pacific blue marlin stock is currently not overfished and is not subject to overfishing relative to MSY-based reference points.

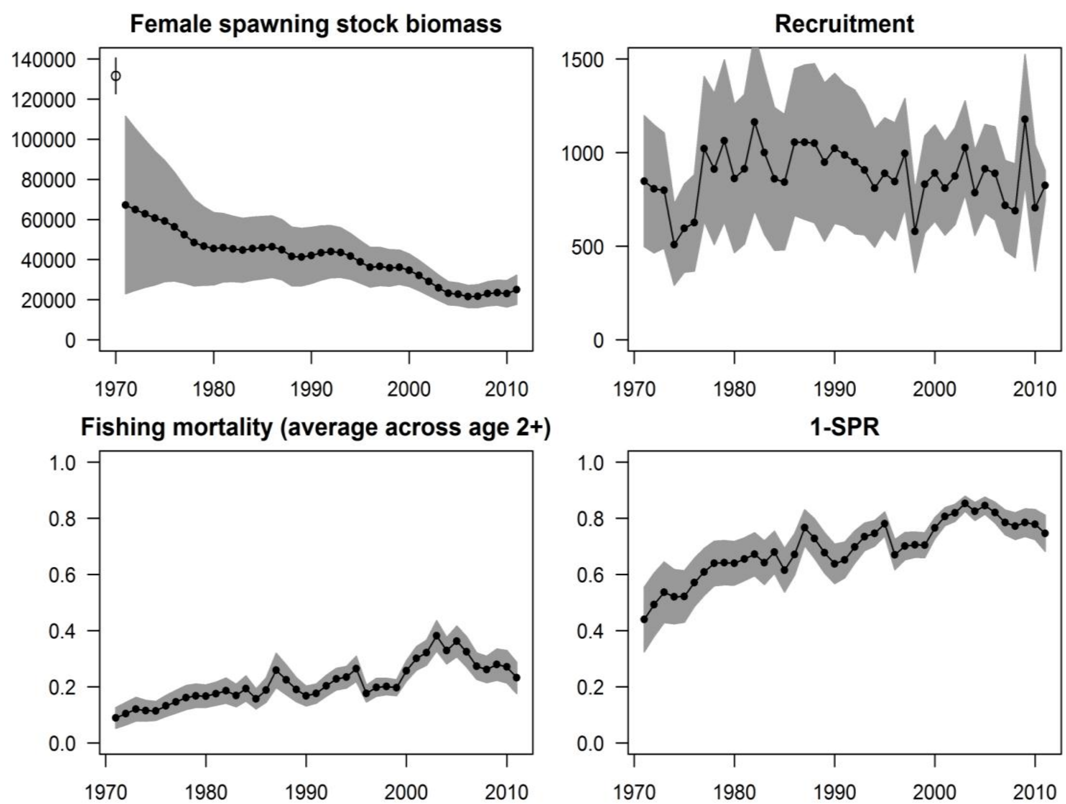

Figure 7-8. Estimates of female spawning stock biomass (top left panel), recruitment (top right panel, fishing mortality (bottom left panel) and fishing intensity (bottom right panel) from the Stock Synthesis base-case model (point estimate, solid circle) with +/- 1.96 standard deviation shown (shaded area).

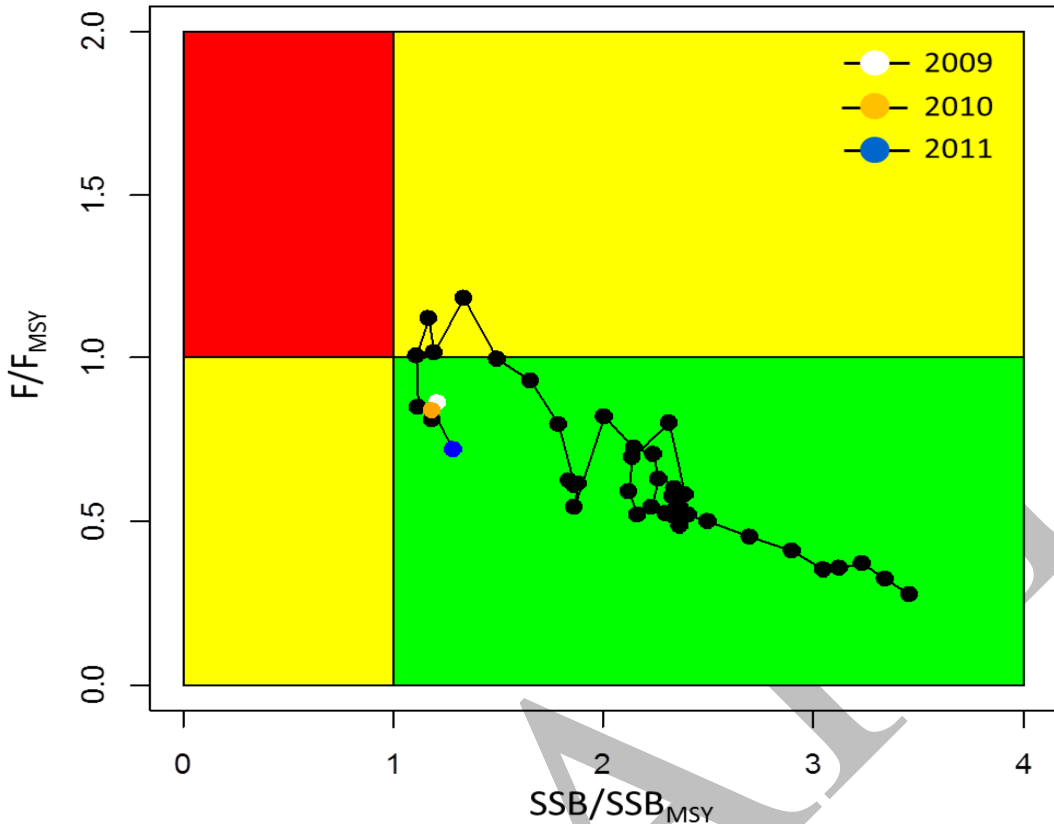

Figure 7-9. Kobe plot for blue marlin (*Makaira mazara*).

Conservation advice

Based on the most recent stock assessment, the Pacific blue marlin stock is not currently overfished and is not experiencing overfishing. The stock is nearly fully exploited. Stock biomass has declined since the 1970s and has been stable since the mid- 2000s with a slight recent increase. The fishing mortality rate should not be increased from the 2009-2011 level to avoid overfishing.

7.4 Striped Marlin

The BILLWG Chair noted that there was no new information for the WCNPO striped marlin stock and presented stock status and conservation advice recommendations.

<u>Discussion</u>

It was agreed that ISC12 advice should be advanced with some modifications to contextualize it.

Stock Status and Conservation Advice

Stock Status

Female spawning biomass is currently low (Figure 7-10) and averaged roughly 1,518 mt during 2007-2009 (56% of SSB_{MSY}, the female spawning biomass to produce MSY). Fishing mortality on the stock (average F on ages 3 and older) is currently high (Figure 7-11) and averaged roughly $F = 0.76\ yr^{-1}$ during 2007-2009 (24% above F_{MSY}). Recruitment averaged about 328,000 recruits annually during 1994-2008, which was roughly 30% below the 1975-2010 average. Compared to MSY-based reference points, the current (average during 2007-2009) spawning biomass is 44% below SB_{MSY} and the current fishing mortality exceeds F_{MSY} by 24%. Therefore, overfishing is currently occurring relative to MSY and the stock is in a depleted state (Figure 7-12).

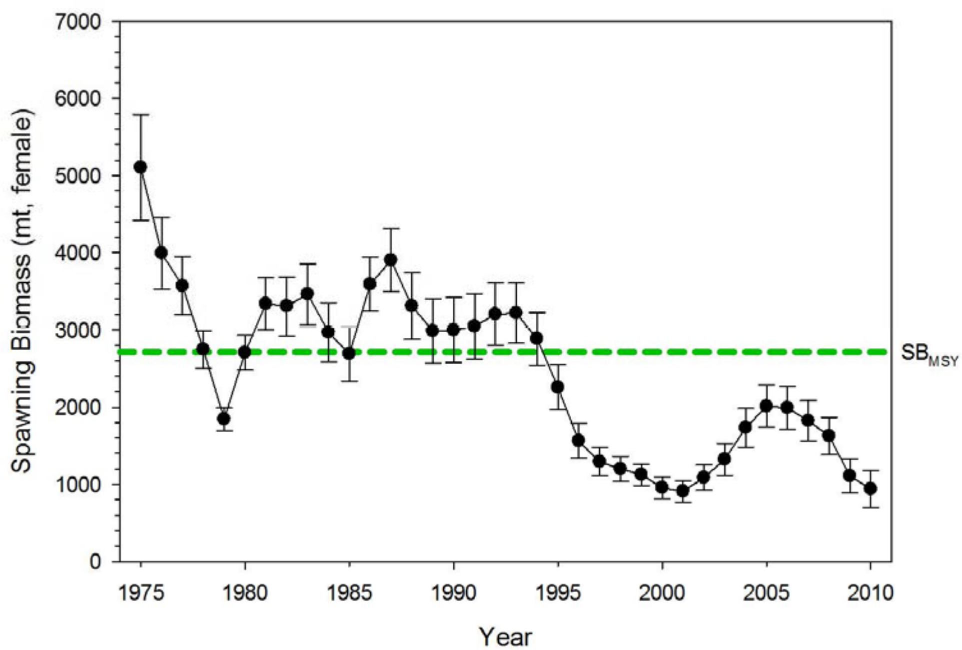

Figure 7-10. Trends in estimates of spawning biomass of WCNPO striped marlin (*Kajikia audax*) during 1975-2010 along with 80% confidence intervals.

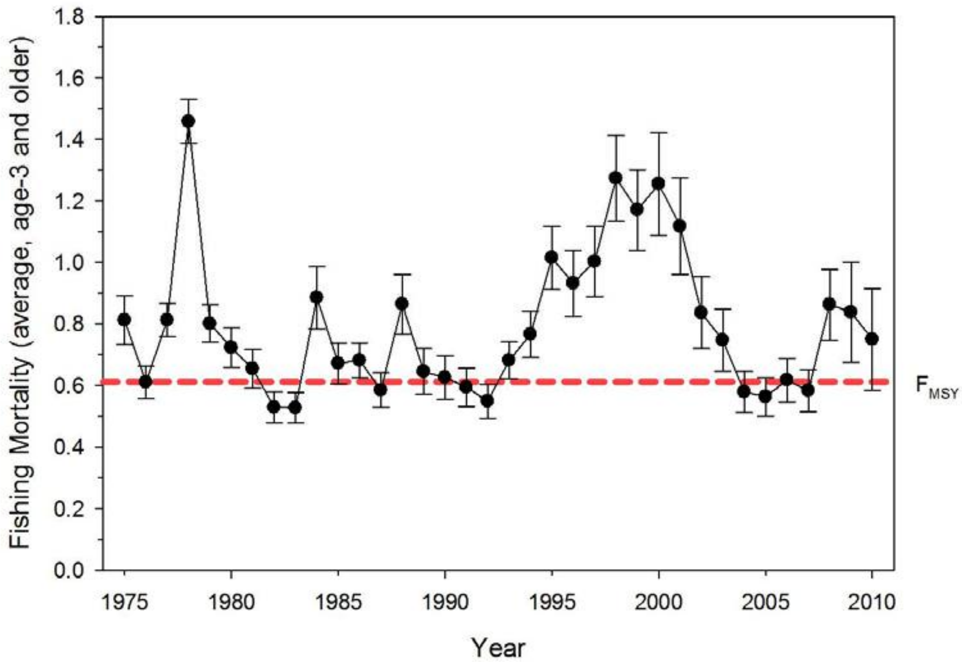

Figure 7-11. Trends in estimates of fishing mortality of WCNPO striped marlin (*Kajikia audax*) during 1975-2010 along with 80% confidence intervals.

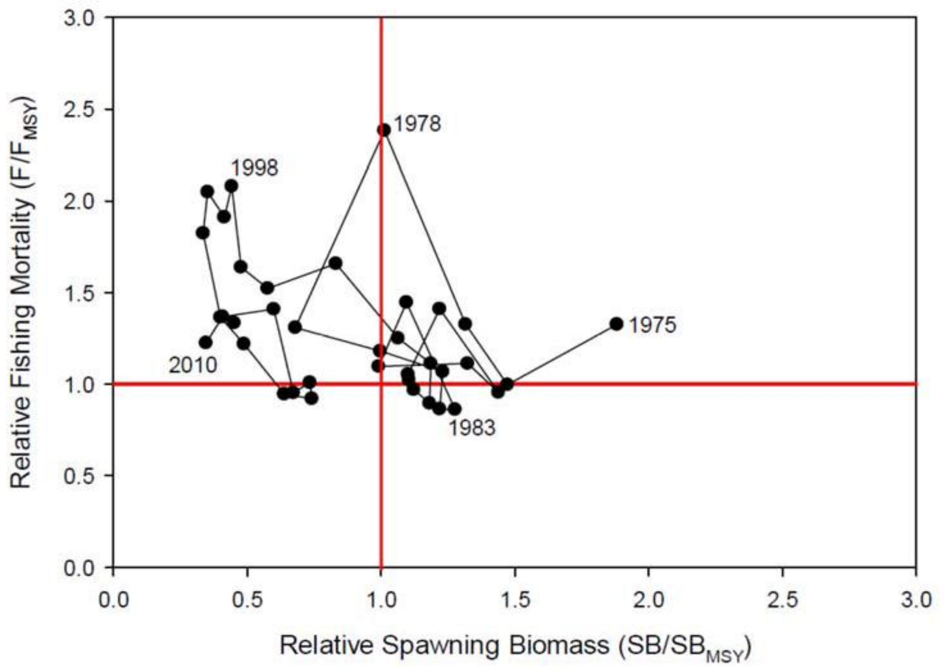

Figure 7-12. Figure 7-8. WCNPO striped marlin (*Kajikia audax*) Kobe plot, 1975-2012.

Conservation Advice

The most recent assessment of WCNPO striped marlin at ISC12 indicated that the stock was experiencing overfishing and that spawning stock biomass was depleted and at 35% of B_{MSY}. No new information on stock status was available at ISC 14. The Plenary reiterated that reducing fishing mortality would likely increase spawning stock biomass and would improve the chances of higher recruitment. The Plenary recommended that a stock assessment be conducted in 2015.

7.5 Swordfish

J. Brodziak presented the 2014 assessment for WCNPO and EPO SWO. In the North Pacific, the swordfish (*Xiphias gladius*) population is composed of two stocks, separated by a diagonal boundary extending from Baja, California, to the Equator. These are the WCNPO stock, distributed in the Western and Central Pacific, and the EPO stock, distributed in the Eastern Pacific (Figure 7-13).

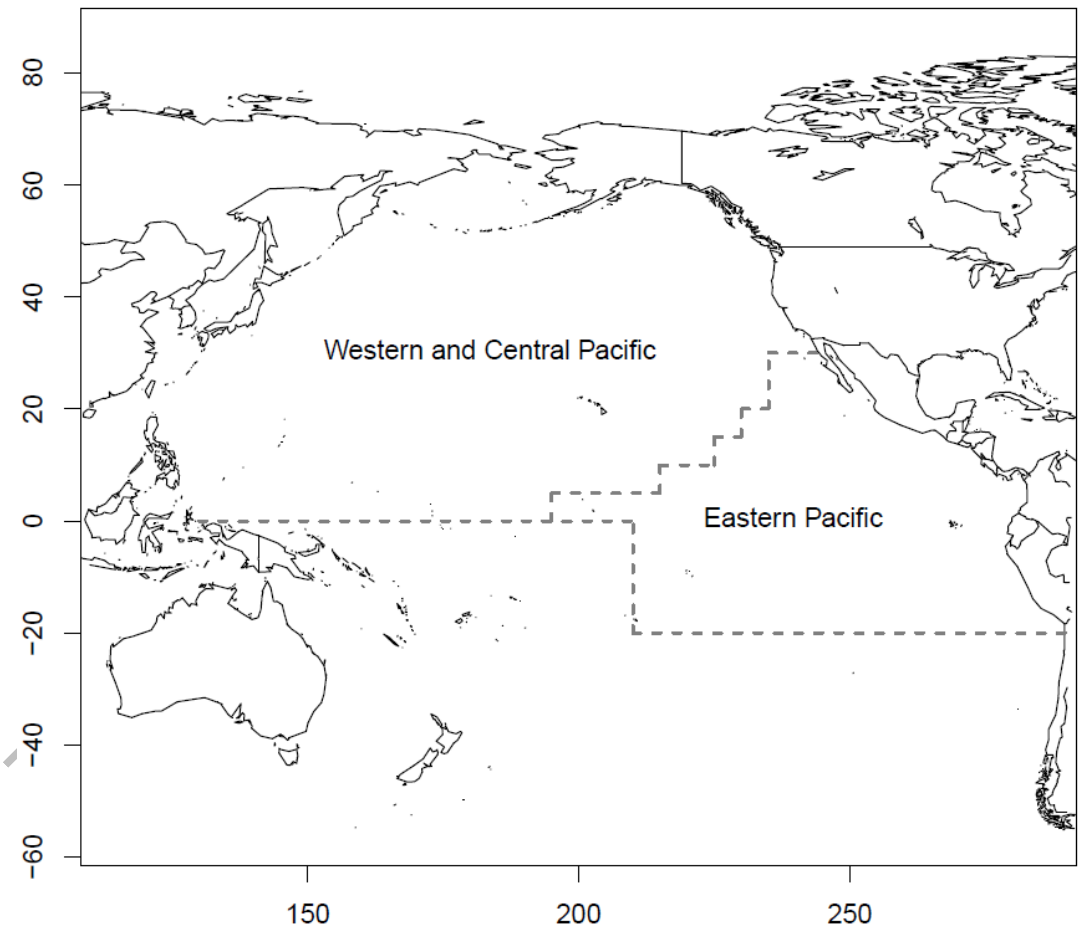

Figure 7-13. Two-stock structure for swordfish (*Xiphias gladius*) in the North Pacific Ocean, indicating separate stocks in the WCNPO and in the EPO.

All available catch data and CPUE information from ISC member countries and all other sources were gathered for conducting the swordfish stock assessment updates. For the WCNPO swordfish stock, catch data were updated for this assessment and this led to an increase of about 10% and 30% in reported catch biomass during 1960-1999 and 2000-2009, respectively. Fishery catch data were taken from all available fishery-dependent data by Japan, Taiwan, Korea, USA, and other countries in the WCNPO stock area. Standardized fishery-dependent CPUE swordfish were estimated for Japanese distant water and offshore longline fisheries, Taiwanese distant water longline fisheries, and the shallow-set sector of the Hawaii-based pelagic longline.

Total catches of EPO swordfish from all countries and sources were updated during 1951-2012 and recent catch data from 2007-2012 were recompiled using updated data provided by the IATTC, the WCPFC, and the individual countries of Japan, Taiwan, Korea, Mexico, and Chile. Estimates of standardized commercial fishery CPUE for EPO swordfish were provided by Japan and Taiwan through 2012.

Generalized surplus production models used for updating the WCNPO and EPO swordfish assessments had a very similar structure to the previous assessment and were formulated as Bayesian state space models with explicit observation and process error terms. Exploitable biomass time series were estimated from the observed relative CPUE abundance indices and from catches using observation error likelihood function and prior distributions for model parameters. Parameter estimation was based on Markov Chain Monte Carlo simulation using Gibbs sampling was applied to numerically sample the posterior distribution of quantities of interest, e.g., exploitable biomass.

Biological reference points based on maximum sustainable yield were calculated from the generalized surplus production model results for the WCNPO and EPO swordfish stocks (Table 7-2). For WCNPO swordfish (Table 7-2), the point estimate and coefficient of variation (CV) of maximum sustainable yield, exploitable biomass to produce MSY, and harvest rate to produce MSY were: MSY = 14,920 t with CV = 12%, B_{MSY} = 60,720 t with CV =19%, and H_{MSY} = 0.25 with CV = 22%. For EPO swordfish (Table 7-2), the point estimate and CV of maximum sustainable yield, exploitable biomass to produce MSY, and harvest rate to produce MSY were: MSY = 5,490 t with CV = 30%, B_{MSY} = 31,170 t with CV = 22%, and H_{MSY} = 0.18 with CV = 34%. Overall, the biological reference points indicated that the WCNPO stock was larger and more productive than the EPO stock.

Table 7-2. Estimates of current levels of exploitable biomass (B_{2012}, t), average harvest rate ($H_{2010-2012}$, percent of exploitable biomass), and recent average yield ($C_{2010-2012}$, t) along with estimated MSY-based biological reference points for the WCNPO and EPO swordfish stocks.

Reference Point	WCNPO Stock Estimate	EPO Stock Estimate
B_{2012}	72,500 t	58,590 t
$H_{2010-2012}$	15%	18%
$C_{2010-2012}$	9,996 t	9,709 t
B_{MSY}	60,720 t	31,170 t
H_{MSY}	25%	18%
MSY	14,920 t	5,490 t

<u>Discussion</u>

The BILLWG noted that it was concerned about uncertainty regarding the stock boundaries for the WCNPO and EPO stocks and how this affects assessment results. DNA analysis shows heterogeneity in stock structure within these two areas. While these issues merit further investigation, these uncertainties do not have a material effect on the conclusions reached on stock status.

It was also noted that landings by Taiwanese STLL vessels were allocated to the Indian Ocean and Pacific Ocean for 2000-2002. Concern was raised about the attribution of these catches to specific stocks. However, this issue was carefully reviewed by the BILLWG and this information was used as input for the stock assessment as the best available data. An alternative run was conducted and the result was not sensitive to the new catch information.

Stock Status and Conservation Advice

Stock Status

Exploitable biomass of WCNPO swordfish fluctuated at or above B_{MSY} throughout the assessment time horizon and has remained high in recent years (Table 7-3 and Figure 7-14). As expected, there was an inverse pattern between estimated biomass and harvest rate as harvest rate fluctuated at or below H_{MSY}. Trends in exploitable biomass and harvest rate from the current assessment are very similar to those from the 2009 assessment. In recent years, catches and harvest rates of WCNPO swordfish have had a declining trend, with exploitable biomass fluctuating around 70,000 mt, since 2007 (Table 7-3 and Figure 7-14). The Kobe plot showed that the WCNPO swordfish stock does not appear to have been overfished or to have experienced overfishing throughout most of the assessment time horizon of 1951-2012 (Figure 7-15). For the current status, results indicated it was very unlikely that the WCNPO swordfish population biomass was below B_{MSY} in 2012 ($Pr(B_{2012} < B_{MSY})$=14%). Similarly, it was extremely unlikely that the swordfish population was being fished in excess of H_{MSY} in 2012 ($Pr(H_{2012} > H_{MSY}) < 1\%$). Retrospective analyses indicated that there was no retrospective pattern in the estimates of exploitable biomass and harvest rate.

Table 7-3. Reported annual values of catch (t) and posterior mean values of exploitable biomass (B, t), relative biomass (B/B_{MSY}), harvest rate (percent of exploitable biomass), relative harvest rate (H/H_{MSY}), and probability of annual harvest rate exceeding H_{MSY} for the WCNPO swordfish stock.

Year	2006	2007	2008	2009	2010	2011	2012	Mean[1]	Min[1]	Max[1]
Reported Catch	15,051	15,799	13,631	12,375	10,670	9,456	9,863	12,962	6,753	21,972
Exploitable Biomass	76,320	72,290	68,620	68,770	68,970	68,560	72,500	81,860	60,200	121,300
Relative Biomass	1.26	1.19	1.13	1.13	1.14	1.13	1.20	1.35	0.99	2.00
Harvest Rate	21%	23%	21%	19%	16%	15%	14%	17%	10%	31%
Relative Harvest Rate	0.84	0.93	0.84	0.76	0.66	0.59	0.58	0.69	0.39	1.23
$Pr(H > H_{MSY})$	0.18	0.34	0.19	0.09	0.02	0.00	0.00	0.12	0.00	0.80

[1] During 1951-2012

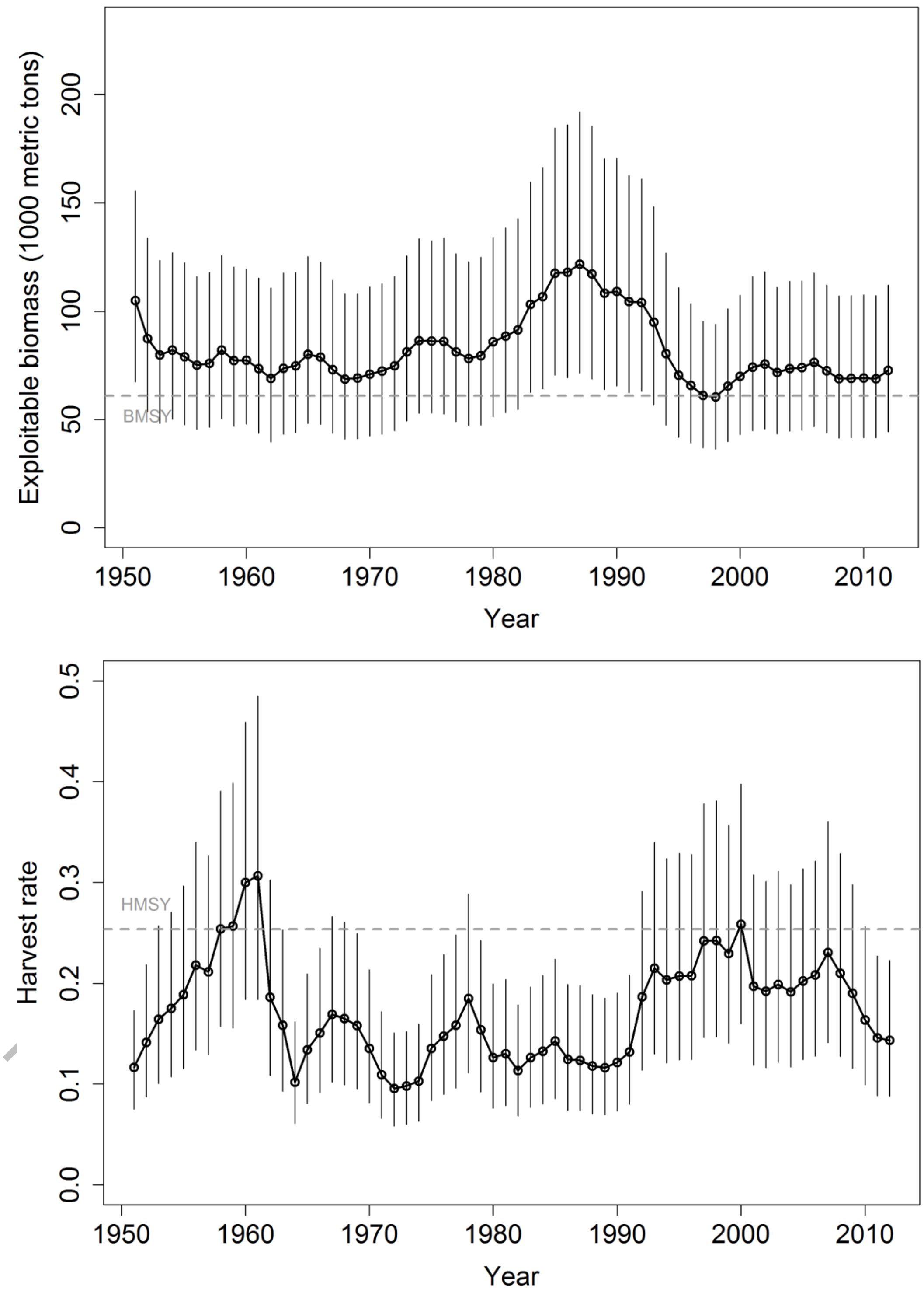

Figure 7-14. Trends in exploitable biomass (top) and harvest rate (bottom) of swordfish (*Xiphias gladius*) in theWCNPO stock area. Estimated mean values from the posterior distribution (black circles and solid line), 95% confidence interval bars (solid vertical lines), and estimated biological reference points (B_{MSY} and H_{MSY}, horizontal dashed lines) are presented.

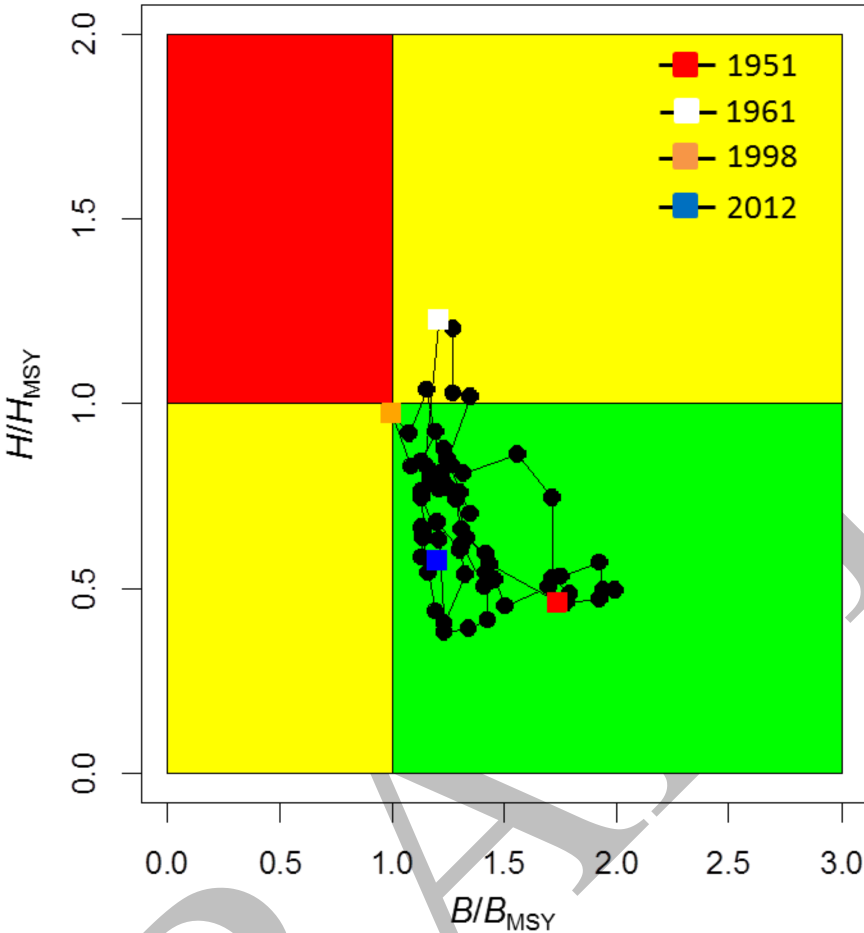

Figure 7-15. Kobe plot [check for consistency in usage] showing the estimated trajectories of relative exploitable biomass (B/B_{MSY}) and relative harvest rate (H/H_{MSY}) for swordfish (*Xiphias gladius*) in the WCNPO stock area during 1951-2012.

For the EPO stock, time series of estimates of exploitable biomass and harvest rate over the assessment time horizon differed from the previous assessment in recent years but have remained high in recent years (Table 7-4 and Figure 7-16). Exploitable biomass had a declining trend during 1969-1995 and has 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, and also the most recent year, 2012 (Figure 7-16). The Kobe plot showed that overfishing likely occurred in only a few years, but may be occurring in recent years (Figure 7-17). In 2012, there was a 55% probability that overfishing was occurring in 2012, but there was a less than 1% probability that the stock was overfished. Retrospective analyses indicated that there was a clear retrospective pattern of underestimating exploitable biomass and overestimating harvest rate.

Table 7-4. Reported annual values of catch (t) and posterior mean values of exploitable biomass (B, t), relative biomass (B/B_{MSY}), harvest rate (percent of exploitable biomass), relative harvest rate (H/H_{MSY}), and probability of annual harvest rate exceeding H_{MSY} for the EPO swordfish stock.

Year	2006	2007	2008	2009	2010	2011	2012	Mean[1]	Min[1]	Max[1]
Reported Catch	3,235	3,701	4,262	7,473	9,631	9,586	9,910	3,561	1	9,910
Exploitable Biomass	43,100	47,980	53,840	60,570	62,120	60,810	58,590	48,875	31,510	67,070
Relative Biomass	1.38	1.54	1.73	1.95	2.00	1.95	1.87	1.58	1.02	2.16
Harvest Rate	8%	9%	9%	14%	17%	18%	19%	8%	<1%	22%
Relative Harvest Rate	0.49	0.50	0.51	0.80	1.00	1.03	1.11	0.49	0.00	1.30
$Pr(H > H_{MSY})$	0.01	0.02	0.02	0.20	0.44	0.47	0.55	0.11	0.00	0.71

[1] During 1951-2012

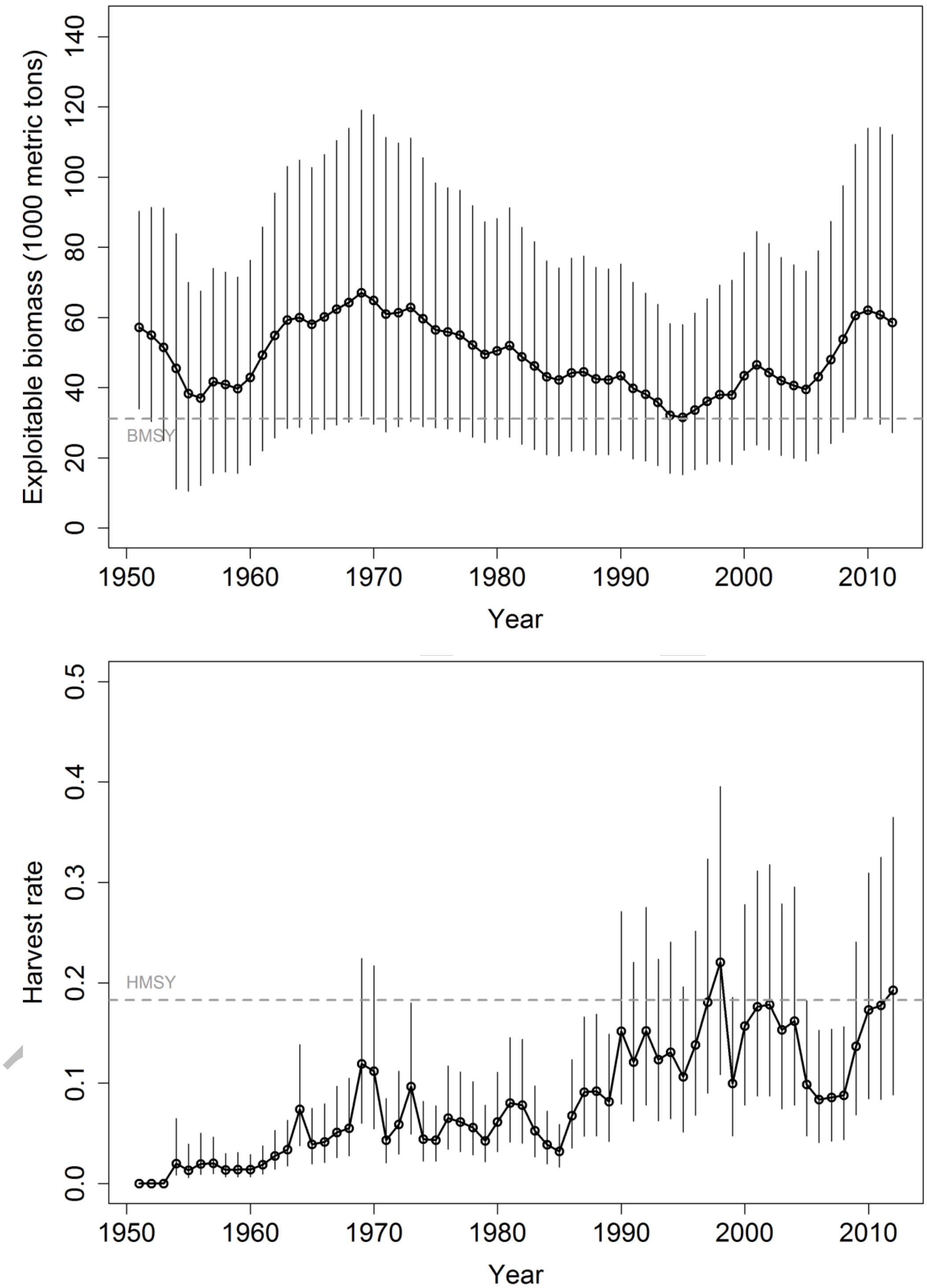

Figure 7-16. Trends in exploitable biomass (top) and harvest rate (bottom) of swordfish (*Xiphias gladius*) in the EPO stock area. Estimated mean values from the posterior distribution (black circles and solid line), 95% confidence interval bars (solid vertical lines), and estimated biological reference points (B_{MSY} and H_{MSY}, horizontal dashed lines) are presented.

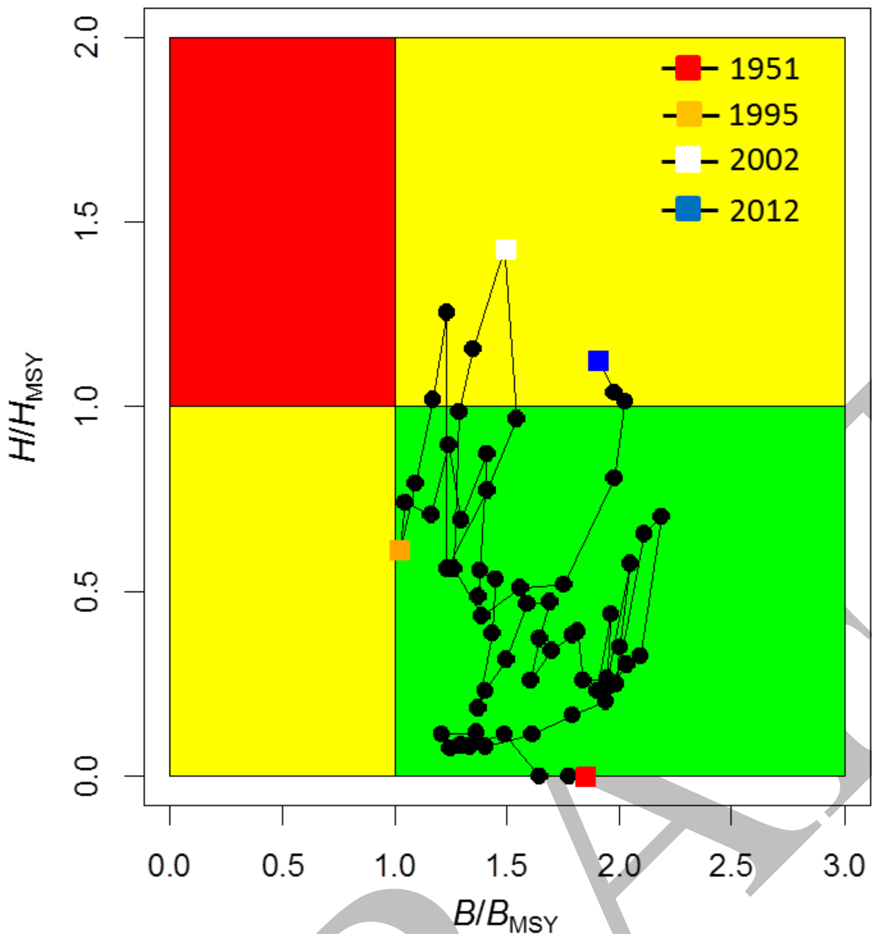

Figure 7-17. Kobe plot showing the estimated trajectories of relative exploitable biomass (B/B_{MSY}) and relative harvest rate (H/H_{MSY}) for swordfish (*Xiphias gladius*) in the EPO stock area during 1951-2012.

Conservation Advice

For the WCNPO stock, stochastic projections for eight harvest scenarios were conducted through 2016 (Figure 7-18). Results relative to MSY-based reference points indicated that exploitable biomass would likely remain above B_{MSY} through 2016 under the status quo catch or status quo harvest rate scenarios (Figure 7-18). 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 B_{MSY} by 2016 (Figure 7-18) with harvest rates exceeding H_{MSY}. In comparison, the stock would not be expected to experience any overfishing during 2014-2016 under the status quo catch and status quo harvest rate scenarios. (Figure 7-18)

For the EPO stock, stochastic projections showed that exploitable biomass will likely have a decreasing trajectory during 2014-2016 under all eight of the harvest scenarios examined (Figure 7-19). Under the high harvest rate scenarios (status quo catch, Maximum observed harvest rate, 150% of H_{MSY}), exploitable biomass was projected to decline to be roughly equal to B_{MSY} in 2016 (Figure 7-19) and maintain 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 persist, exploitable biomass will very likely decrease and a moderate risk of overfishing will likely continue to occur.

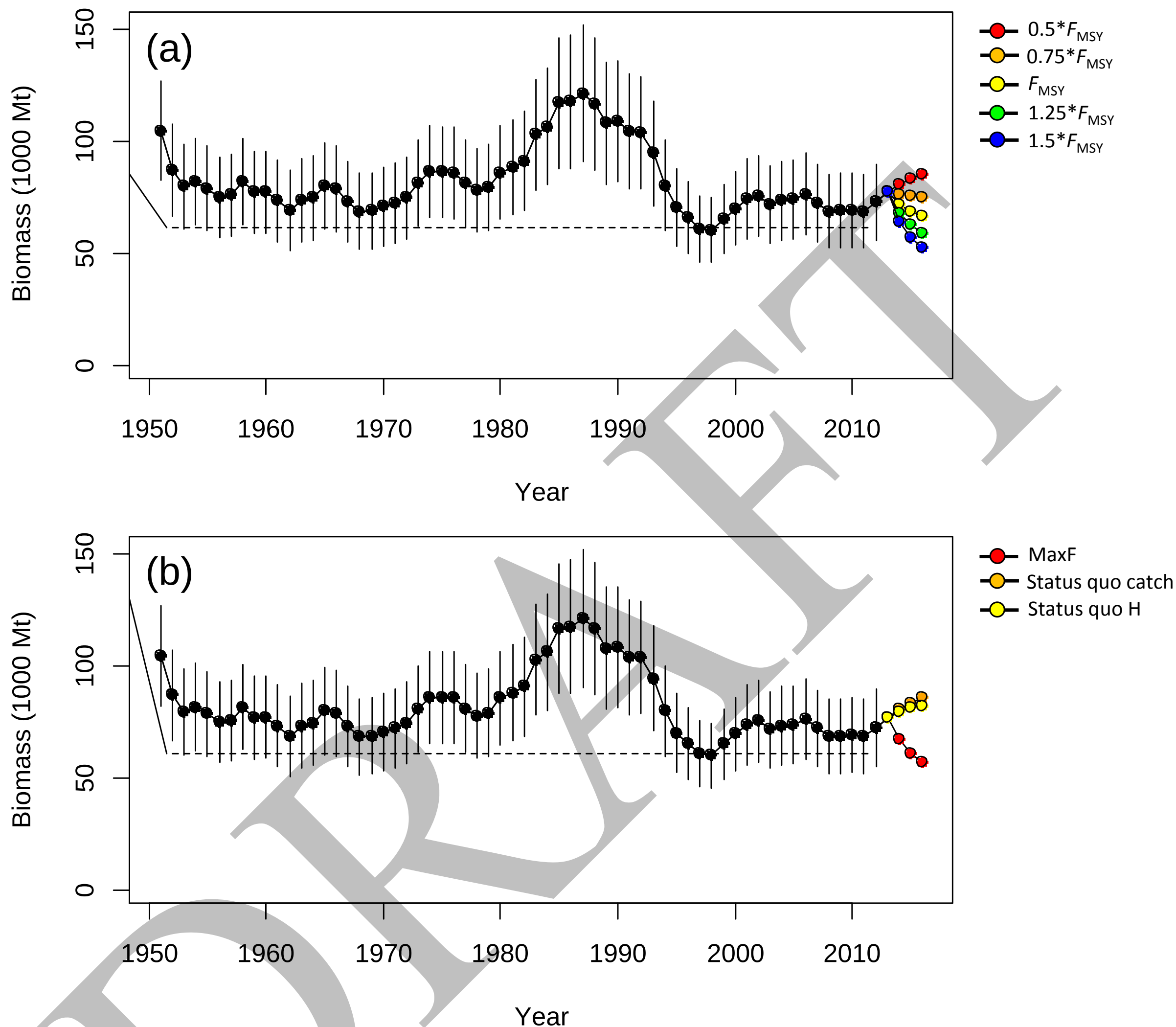

Figure 7-18. Stochastic projections of expected exploitable biomass (1000 metric tons) of swordfish (*Xiphias gladius*) in the WCNPO stock area during 2013-2016 under alternative harvest rates. Upper panel shows projection results of applying a harvest rate set to be 50%, 75%, 100%, 125%, and 150% of the value of estimate of H_{MSY} (denoted as F_{MSY} in the Figure). Lower panel shows projection results of applying a status quo harvest rate based on the 2010-2012 average estimates, a status quo catch based on the 2010-2012 average catch, and the maximum observed harvest rate in the 1951-2012 time series.

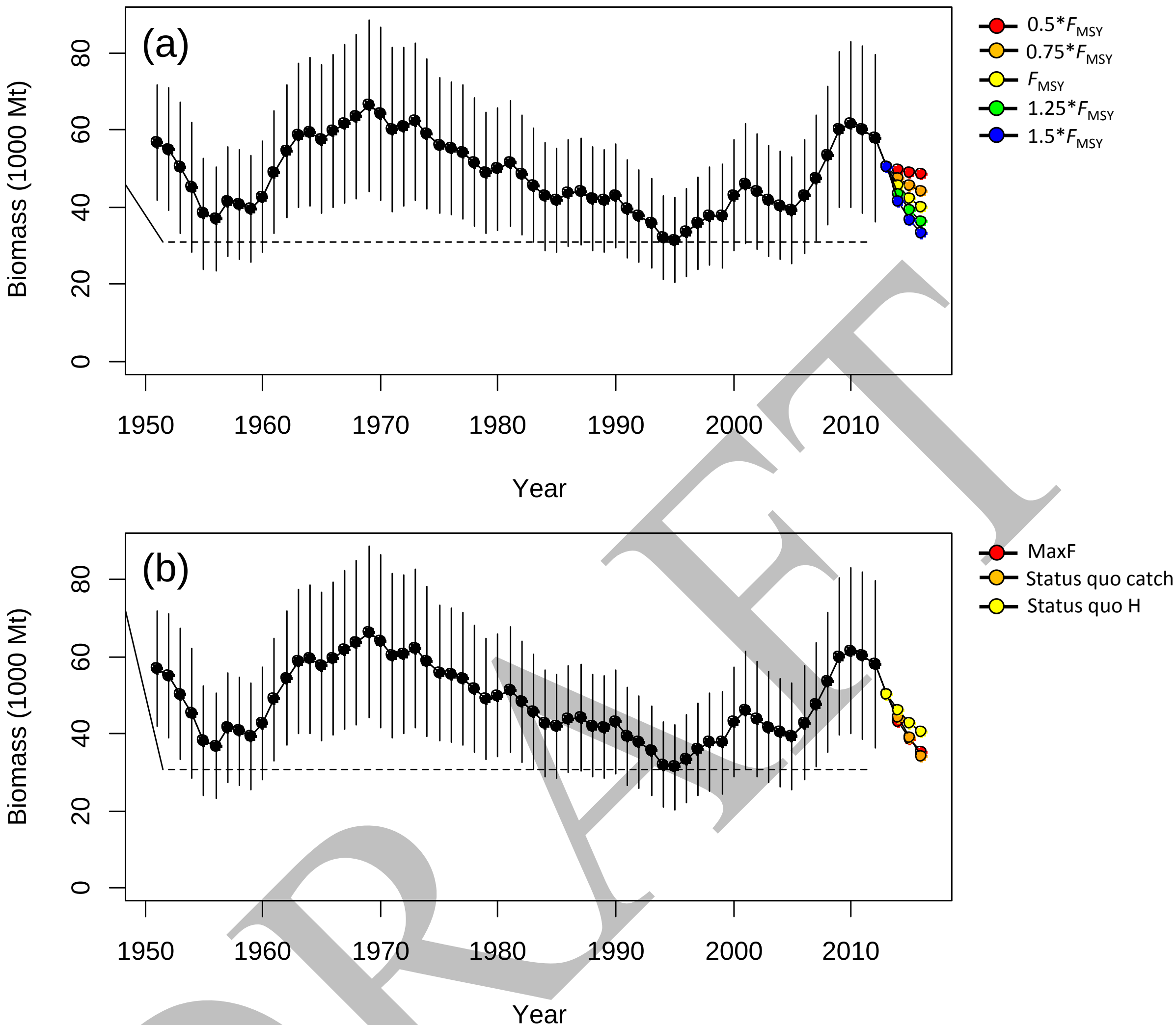

Figure 7-19 Stochastic projections of expected exploitable biomass (1000 metric tons) of swordfish (*Xiphias gladius*) in the EPO stock area during 2013-2016 under alternative harvest rates. Upper panel shows projection results of applying a harvest rate set to be 50%, 75%, 100%, 125%, and 150% of the value of estimate of H_{MSY} (denoted as F_{MSY} in the Figure). Lower panel shows projection results of applying a status quo harvest rate based on the 2010-2012 average estimates, a status quo catch based on the 2010-2012 average catch, and the maximum observed harvest rate in the 1951-2012 time series.

The risk analyses of harvesting a constant annual catch of WCNPO swordfish during 2014-2016 showed that there would be virtually no chance of the stock being overfished or experiencing overfishing in 2016 (Figure 7-20) if current annual catches of about 10,000 t were maintained.

The risk analyses for harvesting a constant catch of EPO swordfish during 2014-2016 showed that the probabilities of overfishing and becoming overfished increased as projected catch increased in the future (Figure 7-20). Maintaining the current catch of EPO swordfish of approximately 9,700 t would lead to a moderate risk of overfishing in 2016 but would lead to less than 1% probability of the stock being overfished in 2016.

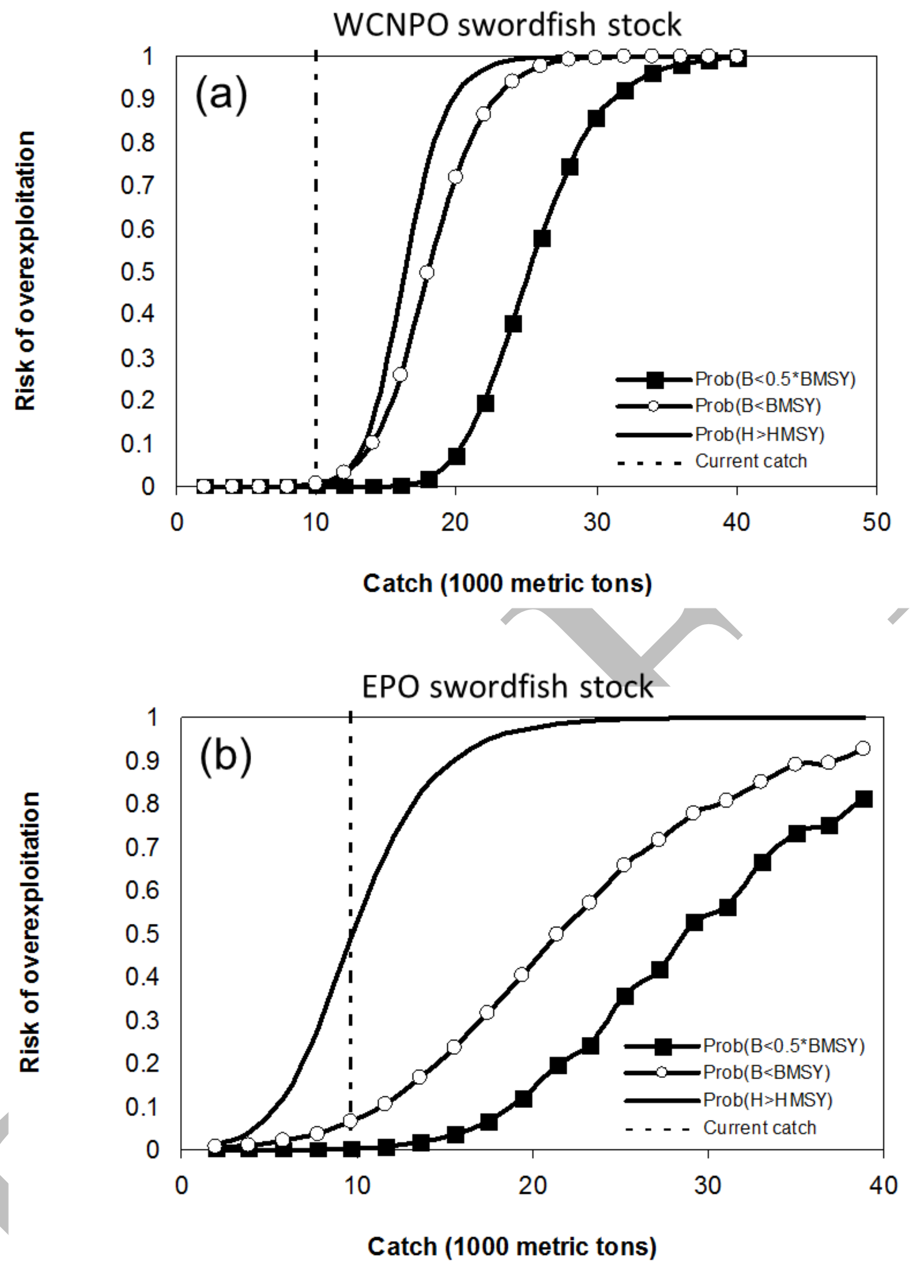

Figure 7-20. Probabilities of experiencing overfishing ($H > H_{MSY}$, solid line), of exploitable biomass falling below B_{MSY} ($B < 0.5*B_{MSY}$, open circles), and of being overfished relative to a reference level of ½B_{MSY} ($B < 0.5*B_{MSY}$, solid squares) in 2016 for swordfish in the WCNPO stock area (a) and EPO stock area (b) based on applying a constant catch biomass (x-axis, thousand t) in the stock projections.

The WCPO swordfish stock is healthy and is above the level required to sustain recent catches.

For the EPO swordfish stock, overfishing may be occurring in recent years, and the recent average yield of roughly 10,000 t, 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 B_{MSY}, any increases in catch above recent[7] levels should consider the uncertainty in stock structure and unreported catch.

7.6 Blue Shark

The ISC Shark Working Group (SHARKWG) used two stock assessment approaches to examine the status of blue shark (*Prionace glauca*) in the North Pacific Ocean: a Bayesian Surplus Production (BSP) model and an age-based statistical catch-at-length model. These efforts provide an updated assessment of North Pacific blue shark based on the 2013 SHARKWG assessment.

BSH are widely distributed throughout temperate and tropical waters of the Pacific Ocean but the ISC SHARKWG recognizes two stocks in the North and South Pacific, respectively, based on biological and fishery evidence.

Catch records for BSH in the North Pacific are limited and, where lacking, have been estimated using statistical models and information from a combination of historical landings data, fishery logbooks, observer records and research surveys. In these analyses, estimated BSH catch data refer to total dead removals, which includes retained catch and dead discards. Estimated catch data in the North Pacific date back to 1971, although longline and driftnet fisheries targeting tunas and billfish earlier in the twentieth century likely caught BSH. The nations catching BSH in the North Pacific include Japan, Chinese Taipei, Mexico, and USA, which account for more than 95% of the estimated catch. Estimated catches of BSH were highest from 1976 to 1989 with a peak estimated catch of approximately 113,000 t in 1981. Over the past decade BSH estimated catches in the North Pacific have remained relatively steady at an average of 46,000 t annually. While a variety of fishing gears catch BSH, most are caught in longline fisheries and fewer are taken in gillnet fisheries. The total catch in 2011 decreased from 2010 by close to 25% due to a decrease in Japanese effort associated with damage from the March 2011 Great East Japan Earthquake.

Annual catch estimates were derived for a variety of fisheries by nation. Catch, effort, and size composition data were grouped into 18 fisheries for the period 1971 to 2012. Historical catch time series for Japan were improved for the current assessment by the use of more accurate processed-to-whole-weight conversion factors. Data for the Taiwanese large longline fishery were also updated by removal of erroneous catch. Blue shark catch in 2012, although estimated for many fleets, represents a large amount (about 60%) of substituted catch carried over from 2011, and is thus considered more uncertain than that prior to 2012. Models were run using data for both the 1971-2011 and 1971-2012 time periods.

The SHARKWG developed both new and revised standardized CPUE time series and used criteria to select representative indices for the assessment. Data for the recent (post-1994) Japanese shallow longline fleet that operates out of Hokkaido and Tohoku ports was separated into two periods for standardization before and after 2011 because the fleet behavior greatly changed as a result of the March 2011 Great East Japan Earthquake. The two year standardized

[7] Recent is 3-year average for 2010-2012.

CPUE index for the Japan longline fishery post-2011 was not used in the current assessment. Due to low observer coverage rates in the Hawaii deep-set longline fishery prior to 2000, the Hawaii index was shortened relative to that used in the prior assessment to incorporate only the higher quality data. Similarly, observer coverage decreased in the SPC longline fishery after 2009, thus the SPC index was standardized using data through 2009.

Due to uncertainty in the input data and life history parameters, multiple models were run with alternative data/parameters. In addition, two types of population dynamics models were used, a state-space Bayesian Surplus Production Model (BSP[8]) and an age-based statistical catch-at-length model, Stock Synthesis (SS[9]). These models were designed to capture the maximum range of uncertainty in the input information. In total, 84 BSP models and 1,080 SS models representing different combinations of input datasets and structural model hypotheses were used to assess the influence of these uncertainties on biomass trends and fishing mortality levels for North Pacific BSH. Though fewer BSP models were run, a far greater number of parameters were specified in the SS models to estimate sex-specific dynamics and take advantage of a novel stock recruitment function; the BSP runs used both the Bayesian approach and an appropriate range of input parameters to assess uncertainties given the model.

Reference case model runs were selected for the purpose of assessing the current stock status. Input parameter values for the reference case runs were chosen based on the best available information regarding the life history of Pacific blue sharks and knowledge of the historical catch time series and fishery data. For example, for the reference case, initial catch was set at 40,000 t, because Japan longline fishing effort increased and spread rapidly in the 1950s with effort stabilizing by the late 1950s into the 1960s. Standardized CPUE from the Japanese shallow longline fleet that operates out of Hokkaido and Tohoku ports for the periods 1976-1993 and 1994-2010 were used as measures of relative population abundance in the reference case assessments.

For the BSP models, a single catch time series was used with a variety of CPUE time series and priors assigned to several parameters, including the intrinsic rate of population increase (*r*) and the ratio of initial biomass to carrying capacity (B_{init}/K) to fit a Fletcher-Schaefer production model in a Bayesian statistical framework to address uncertainty regarding these parameters. For the SS models, a two-sex, size-based model was used that explicitly modeled the different sizes of BSH taken in 18 fisheries and utilized a survival based spawner-recruit function, referred to as the low fecundity spawner recruitment relationship (LFSR). Historical information regarding exploitation levels prior to the start time of the model were examined to derive plausible input values, and sex-specific estimates of natural mortality-at-age were based on two independent growth studies from the North Pacific. The SS code searches for the set of parameter values that maximize the goodness-of-fit, then calculates the variance of these parameters using inverse Hessian matrices. In both modeling approaches, estimated model parameters and derived outputs were used to characterize stock status and explore the range of uncertainty under different scenarios.

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[8] McAllister MK, Babcock EA (2006) Bayesian Surplus Production model with the Sampling Importance Resampling algorithm (BSP): a user’s guide.

[9] Stock Synthesis (version 3.24F; http://nft.nefsc.noaa.gov/Download.html)

Stock projections of biomass and catch of BSH in the North Pacific from 2012 to 2031 were conducted assuming alternative harvest scenarios and starting biomass levels. *Status quo* catch and F were based on the average over the recent 5 years (2006-2010). Estimated catch from 2011 was not used for projections due to the impact of the March 2011 Great East Japan Earthquake on Japanese fishing effort. A simulation model was used for annual projections, and included uncertainty in the population size at the starting year of stock projection, fishing mortality and productivity parameters.

Discussion

The challenge of successfully completing the stock assessment, given data limitations, was recognized along with the SHARKWG's productive collaboration with SPC.

Concern was raised that increased landings of swordfish into foreign ports by the Taiwanese STLL fleet is not similarly reflected in the blue shark landings. Since blue shark are commonly caught in swordfish fisheries one would expect to observe a related increase in estimated blue shark catch.

It was noted that Chinese Taipei is going to review and submit revised catch records in the future with detailed documentation.

Stock Status and Conservation Advice

Stock Status

Based on the trajectory of reference case of the Bayesian Surplus Production model (BSP), median stock biomass of blue shark in 2011 (B_{2011}) was estimated to be 622,000 t. Median annual fishing mortality in 2011 (F_{2011}) was approximately 32% of F_{MSY} (Figure 7-21). Based on the trajectory of the Stock Synthesis (SS) reference case model, female spawning stock biomass of blue shark in 2011 (SSB_{2011}) was estimated to be 449,930 mt. The estimate of F_{2011} was approximately 34% of F_{MSY}. Target and limit reference points have not yet been established for pelagic sharks in the Pacific. Relative to *MSY*, the reference case and the majority of models run with input parameter values considered most probable based on the biology of blue sharks support the conclusion that the North Pacific blue shark stock is not overfished ($B_{2011}>B_{MSY}$) and overfishing is not occurring ($F_{2011}<F_{MSY}$).

While the results of the sensitivity runs varied depending upon the input assumptions, a few parameters were most influential on the results. These included the CPUE series selected as well as the shape parameters for the BSP models and the equilibrium initial catch and form of the LFSR relationship for the SS models.

A. B.

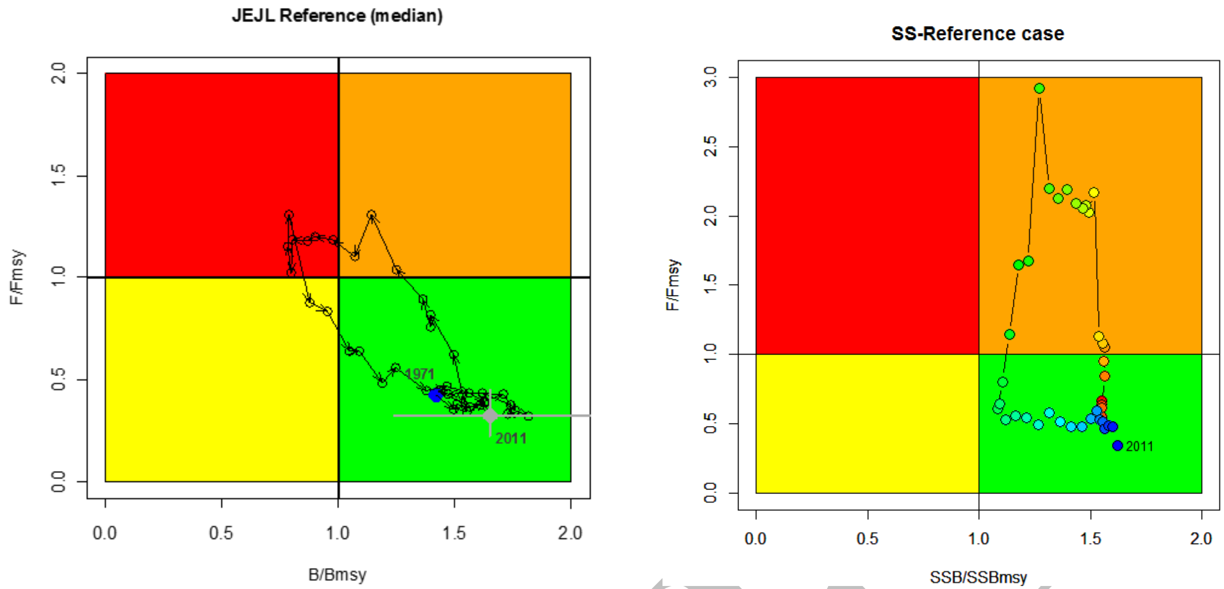

Figure 7-21. (A) Kobe plot showing median biomass and fishing mortality trajectories for the reference case Bayesian Surplus Production model for North Pacific blue shark (*Prionace glauca*). Solid blue circle indicates the median estimate in 1971 (initial year of the model). Solid gray circle and its horizontal and vertical bars indicate the median and 90% confidence limits in 2011. Open black circles and black arrows indicate the historical trajectory of stock status between 1971 and 2011. (B) Kobe plot showing estimated spawning biomass and fishing mortality trajectories for the reference case Stock Synthesis model for North Pacific blue shark. The circles indicate the historical trajectory from 1971-2011 colored from red (first year) to blue (terminal year).

Conservation Advice

Future projections of the reference case models show that median BSH biomass in the North Pacific will remain above B_{MSY} under the catch harvest policies examined (*status quo*, +20%, -20%). Similarly, future projections under different fishing mortality (*F*) harvest policies (*status quo*, +20%, -20%) show that median BSH biomass in the North Pacific will likely remain above B_{MSY}.

The North Pacific blue shark stock is healthy and is above the level required to sustain recent catches.

Given uncertainties regarding the estimated catch and choice of input parameters for the assessment, the catch and fishing effort on blue shark should be carefully monitored. Carefully designed observer programs and logbooks that record sharks by species, as well as continued research into the fisheries, biology and ecology of blue shark in the North Pacific are recommended to make improvements prior to the next assessment.

8 REVIEW OF STOCK STATUS OF SECONDARY STOCKS

8.1 Western and Central Pacific Ocean – Blue Shark, Silky Shark, and South Pacific Swordfish

A. Beeching presented SC9 information on tuna production in the WCPO and on three stock assessments (silky shark (updated assessment), the 2013 North Pacific BSH and South Pacific SWO). He also informed the ISC of the current tropical tuna assessments (BET, YF and SKJ) in relation to changes in the stock assessments and MULTIFAN CL following the peer review of the 2011 BET stock assessment, and finally advised the ISC plenary of upcoming WCPFC meetings. With regard to swordfish, Commonwealth Scientific and Industrial Research Organization (CSIRO) will be presenting a research plan at SC10 to address reported differences in swordfish growth rate data from Hawaii versus Australia. It was further noted that the principal researcher, Jessica Farley, was an expert resource at the ISC tuna age and growth workshop in November 2013, and would be sure to take into consideration different growth rates in swordfish by sex. The majority and most important peer review recommendations have been applied to the current tropical tuna assessments for 2014.

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

Collaboration between CSIRO and the PIFSC on swordfish growth research was noted.

The peer review process for tropical tuna assessments was discussed extensively. The peer review panel met with SPC stock assessment scientists during the assessment process and provided numerous recommendations on the assessment model and methods. The peer review report was presented at SC9 and endorsed by that body. Peer review recommendations are being implemented in 2014 SPC assessments. In particular, fishery statistical areas were modified in response to the peer review. It was also noted that WCPFC is implementing procedures to integrate peer review into all future assessments.

It was noted that there is no schedule for WCPFC peer reviews by stock, but there is an approved process in place if/when a peer review is authorized.

9 REVIEW OF STATISTICS AND DATA BASE ISSUES

9.1 Report of the STATWG

R.-F. Wu, the STATWG Chair, provided a summary of STATWG activities since ISC13 (see STATWG Report in Annex). The STATWG Steering Group held one inter-sessional meeting in Honolulu, Hawaii, in 21-23 January 2014. A meeting of the entire STATWG was held in Taipei, Taiwan, on 10-11 July 2014, prior to ISC14; two Information Papers and two Working Papers were submitted for this meeting.

It was reported that all of the items of the 2013 STATWG Work Plan were completed since ISC13. Accomplishments of the STATWG over the past year include:

1. A successful exchange of data inventories with the WCPFC and IATTC
2. Implementation of the online submission of Category III data on the ISC website

3. Revising the format of the report card for Member data submission
4. Drafting guidelines and formats for revising data in the ISC database
5. Documenting the comparison between 2013 data submission and historical data in the database
6. Planning for the publishing of the ISC data inventories on the ISC website
7. Reviewing the ISC catch tables with the Member Countries

At the 10-11 July STATWG meeting the following topics were presented and discussed:
1. Updates to Member's data collection systems
2. Data needs and concerns from the Chairs of the species Working Groups
3. Member performance and Report Card (*ISC/14/ANNEX14*) for the submission of 2013 data
4. Member performance for the submission of historical data (CAT Ic, Ie, II, and III)
5. Member issues with the online submission of Category III data

The 2014 Work Plan for the STATWG was presented, as well as recommendations to the ISC14 Plenary. The national contacts list for the STATWG was also provided (*ISC/14/ANNEX14*). R.-F. Wu was re-elected as the Chair of the STATWG for a second term.

The STATWG Steering Group will schedule their next meeting in Honolulu, Hawaii, USA, in January 2015, and will request the scheduling of a 2-day meeting prior to the ISC15 Plenary.

<u>Discussion</u>

The need for better communication between the STATWG and species WG was discussed. Each species WG should have a data manager as the principal point of contact for the STATWG. All the WGs, except for the SHARKWG, have identified a data manager.

The ISC endorsed the STATWG Work Plan.

9.2 Data Submission Report Card

Member	CAT Ic	CAT Ie	CAT II	CAT III
CAN				
CHN				
JPN	NK, MAK, SWO, MLS			LP
KOR				
MEX				
TWN				
USA	PS	MIS, RG		

	On Time and Complete
	On Time but Incomplete and/or not in ISC format
	Submitted Late but Complete
	Submitted Late and Incomplete and/or not in ISC format
	Not Provided

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

With respect to the data submission report card it was noted that Category I data for the US recreational fishery were incomplete. The USA explained that it is unlikely that Category I effort data for the private vessel sector of the recreational fishery will become available in the foreseeable future because there is no way to track the number of boats fishing. Since U.S. recreational catch of PBF is not insignificant (estimated at 984 mt in 2013) USA was urged to provide Category III length-frequency data. USA said it intends to begin collecting that information from the recreational commercial passenger fishing vessel (CPFV) fleet in 2014. The USA also explained that because of domestic reporting systems it is unable to distinguish pole-and-line vessels from troll vessels for catch and size data; those data are combined and were submitted on time.

9.3 Total Catch Tables

I. Yamasaki, the Database Administrator, presented the catch tables for the member countries for 2009-2013. The catch tables are based on Category I data submissions, and include the major fisheries of the member countries. The catch tables include the following ISC species of interest: NPALB, PBF, MLS, SWO, BUM, mako shark, SMA, and a category for other sharks. A catch table for non-ISC members was provided from WCPFC data and includes albacore, Pacific Bluefin tuna, striped marlin, and swordfish.

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

The total catch and North Pacific-wide catch tables were reviewed. Several additional data sources were noted for updating the tables. In particular, it was noted that North Pacific blue shark should be included in the tables.

10 REVIEW OF MEETING SCHEDULE

10.1 Time and Place of ISC15

ISC15 will be held in the USA at a location to be determined, 15-20 July 2015.

10.2 Time and Place of Working Group Intersessional Meetings

A draft schedule of proposed intersessional meetings was reviewed and amended, see Table 10-1.

Table 10-1. Schedule of working group meetings.

Date	Meeting	Contact
	2014	
Late Summer	SHARKWG- Webinar	S. Kohin Suzanne.Kohin@noaa.gov
Nov	SHARKWG- (Mako data prep)	S. Kohin Suzanne.Kohin@noaa.gov
Early Dec	BILLWG- Honolulu (Striped Marlin data prep)	J. Brodziak Jon.Brodziak@noaa.gov
	2015	
Jan	STATWG (Steering Committee)	R.-F. Wu fan@ofdc.org.tw
Feb or March	PBFWG (Model Development)	Z. Suzuki zsuzuki@affrc.go.jp
Late March or Early April	BILLWG (Striped Marlin Assessment)	J. Brodziak Jon.Brodziak@noaa.gov
Spring	SHARKWG (SMA Assessment)	S. Kohin Suzanne.Kohin@noaa.gov
9-10 Jul	STATWG – U.S.A. (Meeting)	R.-F. Wu fan@ofdc.org.tw
11 Jul	SHARKWG – U.S.A. (Meeting)	S. Kohin Suzanne.Kohin@noaa.gov
12 Jul	ALBWG – U.S.A. (Meeting)	J. Holmes John.Holmes@dfo-mpo.gc.ca
13 Jul	PBFWG – U.S.A. (Meeting)	Z. Suzuki zsuzuki@affrc.go.jp
13 Jul	BILLWG – U.S.A. (Meeting)	J. Brodziak Jon.Brodziak@noaa.gov
15-20 Jul	ISC14 – U.S.A. (Plenary)	G. DiNardo Gerard.DiNardo@noaa.gov

11 ADMINISTRATIVE MATTERS

11.1 Recommendations from Review of Function and Process

The list of recommendations from the Peer Review of ISC's Function (*ISC/13/PLENARY/10*) was presented to ISC Members. Some have been addressed, some are being addressed and some need to be addressed. Members were asked to review the list and prioritize the issues that ISC should address and be ready to discuss how to address them next year. The ISC Chairman will request a prioritization by December 2014.

- ISC needs to further standardize stock assessment reporting procedures
- A concern about "advocacy creep" in the ISC working groups and the need to stay science based
- Data that form the basis of stock assessments must be supported by substantial scientific documentation. ISC needs to develop an objective basis for including data streams into particular stock assessments
- Primary reports and documents must follow the best available scientific information (BASI) guidelines outlined in the ISC Operations Manual and should be clearly written and summarized on the website.
- ISC should establish transparent data sharing relationships with RFMOs in a way that independent analysts can access data used in WG stock assessments.
- There is great need to improve the interactions between WCPFC and ISC.
- ISC should look at data from the strategic perspective of asking: "*What is needed to implement the most appropriate stock assessment model?*"
- ISC needs a focused research portfolio to achieve integrated ecosystem assessments.
- ISC needs its own budget in order to conduct efficient research and administration.
- ISC needs to (i) develop a clear framework of operations for the organization's future, including protocol standardizations; (ii) incorporate ecosystem-based fisheries management (EBFM) concepts, approaches and methods; (iii) extend ISC research to the entire Pacific Ocean to cover trans-boundary species straddling two or more RFMOs, and later, for trans-oceanic migratory species; and, (iv) regularly publish '*Status Report of Tuna and Tuna-like Species, Their Fisheries and Habitats of the World*'.
- There is need to develop a regular stock assessment peer review process that is both efficient and cost effective. Independent peer reviews of research, including stock assessments, bolster an organization's credibility. The process of independent stock assessment reviews will require improved documentation of the assessment process relative to current practice, especially in data review and preparation. More consistency is required in the quality of peer-reviewers for future stock assessment reviews that include more experts with sufficient knowledge of tunas and tuna stock assessment methodologies.

<u>Discussion</u>

The Chair explained that over the course of the coming year he will communicate with members, identifying which recommendations have been addressed and which recommendations he thinks are highest priority. He will also elicit priorities from the Members for consideration. He expects to contact all members by the end of 2014.

11.2 NC9 Requests

S. Shoffler presented the ISC's response to the NC9's requests for information on NPALB regarding potential limit reference points and PBF regarding (1) probability of achieving particular SSB levels, (2) range of historical variation in recruitment and (3) PBF catch and effort tables presented in *ISC/14/PLENARY/10*.

Discussion

None.

11.3 Science Planning

Heads of delegation met on 15 July 2014, to discuss scientific topics that may be taken up by ISC working groups. The following topics were identified:

1. PICES-ISC Science Program
2. Management strategy evaluation (MSE)
3. Capacity building
4. Close-kin analysis
5. Otolith microchemistry
6. Size- and sex-specific data

Discussion

All the topics were endorsed. It was recognized that implementing MSE will require collaboration with other organizations, because of the time and resources required. It was suggested that MSE and close-kin analysis could be the seminar topic at ISC15. The ISC Chair will seek funding to support capacity building. Close-kin analysis and otolith microchemistry projects are being initiated in the PBFWG. Close-kin analysis may be a way of estimating stock abundance independent of traditional fishery dependent data sources. Scientists already developing this research technique for southern bluefin tuna can be consulted to assess progress and utility for PBF. It was noted that the implementation of an effective sampling design is important to the success of this technique.

It was also noted that Japan has already started to research close-kin analysis for PBF and that sampling design should be species and/or stock specific. It was agreed that developing a procedure for establishment of close-kin analysis, including sampling design and genetic experimental techniques, should be basically discussed in the PBFWG and forwarded to the ISC Chair for review and dissemination to ISC members.

11.4 Age and Growth Workshop/Manual

The National Research Institute of Far Seas Fisheries of Japan (NRIFSF) sponsored a PBF and NPALB tuna ageing workshop in November 2013 in Shimizu, Japan (*ISC/14/ANNEX/05*). It was attended by 39 scientists from Canada, Japan, Spain, Australia, the US, Chinese Taipei, and the IATTC. The objectives of the workshop were:

- Identifying age determination issues for PBF and NPALB,
- Discussing and sharing practical aging techniques among specialists to address age determination issues;
- Developing standardized protocols for tuna aging where appropriate;
- Documenting techniques and protocols in age determination manuals for PBF and NPALB; and

- Discussing the establishment of an Age Structure Exchange procedure between agencies to promote for quality assurance/quality control (QA/QC) and inter-laboratory calibration of age results.

The workshop included hands-on demonstrations of slide preparations and readings. Participants provided a number of recommendations for preparing, ageing and interpreting otolith rings and ages. The PBFWG and ALBWG are writing ageing manuals for the two species which will be published as living documents on the ISC website and as possibly a peer-reviewed printed publications.

<u>Discussion</u>

The Chair thanked the PBFWG and ALBWG for helping to organize the workshop and looks forward to the completion of the manuals.

11.5 Working Group Chairperson Elections

It was noted that election of the ALBWG Chair will occur in 2015; the current Chair, J. Holmes, is ineligible, because he is in his second term.

11.6 ISC Vice-Chair Elections

The current Vice Chair, C.-L. Sun, was elected for a second term.

11.7 Organizational Chart and Contact Persons

ISC/14/PLENARY/03

ISC Organizational Chart (July 2014)

Plenary

Gerard DiNardo (Chair) Chi-Lu Sun (Vice Chair)

J. Holmes (Canada)
X. Dai (China)
S. Lin (Chinese Taipei)
Z.G. Kim (Korea)
H. Honda (Japan)
M. Dreyfus (Mexico)
C. Werner (USA)
T. Neer (FAO)
A. Bychkov (PICES)
J. Hampton (SPC)

Webmaster
Y. Okochi

Database
I. Yamasaki

ALBWG

J. Holmes (Chair)
J. Childers (DM)
Z. Zhang
C.-Y. Chen
K. Satoh
S.C. Yoon
S. Lee
L. Song
X. Dai
K. Piner
C. Minte-Vera
M. Dreyfus
L. Fleischer
S. Teo
S. Harley

BILLWG

J. Brodziak (Chair)
D. Tagami (DM)
Y. Chang
X. Dai
C.-L. Sun
N.-J. Su
S. Lee
S.C. Yoon
K. Yokawa
Fleischer
H.-H. Lee
M. Hinton
J. Hampton

PBFWG

Z.Suzuki (Chair)
K. Oshima (DM)
L. Song
C.-C. Hsu
S.C. Yoon
S. Lee
Y. Takeuchi
M. Dreyfus
K. Piner
S. Teo
A. Aires-da-Silva
J. Hampton

SHARKWG

S. Kohin (Chair)
King
X. Dai
H.-W. Huang
K-M. Liu
S.C. Yoon
S. Oshimo
K. Castillo
Tovar
Piner
F.Cahlvaro
A.Aires-da- Silva
J. Hampton
H.W. Park

STATWG

R.-F. Wu (Chair)
J. Holmes
X. Dai
W.-J. Wang
S.C. Yoon
S. Lee
K. Uosaki
K. Oshima
M. Dreyfus
R.R. Trujillo
J. Childers
D. Tagami
T. Lawson
A. Perez
L. Fleischer

11.8 Other Business

Mechanisms to formalize ISC membership were discussed. In the short term this may be accomplished through a relationship with PICES, which would also create a mechanism for funding the ISC Secretariat. In the long term a formal agreement among member countries may be developed, but this will take substantial government-to-government negotiations. It was also noted that since most ISC members are also members of the WCPFC, and ISC has an MOU with the WCPFC NC, this may offer an umbrella for institutional arrangement.

Procedures for documenting the submission of revised historical data were discussed. It was recognized that data may enter the ISC process both through member submissions to the STATWG and compilation of data for stock assessments by species WGs. Species WGs may revise or adjust data as appropriate when preparing it for use in stock assessments. ISC generally does not disseminate stock assessment input data but it may be available in tabular format in stock assessment reports.

In general, when members submit a revised historical data time series this should be described in a standalone document accompanying the submission. The STATWG Chair noted that the STATWG is implementing a documentation procedure for revised data submissions, starting next year. Species WGs will implement the same process as the STATWG.

The possibility of shortening the Plenary meeting in future years was discussed, because members have become more efficient in conducting the business of the ISC. It was noted that this year considerable work was accomplished in an intersessional Plenary meeting, which likely made the ISC14 Plenary proceed more smoothly. However, members should not expect that intersessional Plenary meetings will be entertained in the future. It was also noted that there is no obligation for species WGs to meet immediately preceding the Plenary and WG chairs should use their discretion in deciding whether such meetings are necessary.

The deadline for submitting WG reports and stock assessment reports was discussed. Since the requirement for stock assessment reports separate from WG reports has been enforced in recent years, this has increased the number of reports expected by the current June 1 deadline. It was agreed that for stock assessment reports the deadline will be moved to June 15. For WG reports the current requirement that they be submitted within 30 days of the conclusion of the WG workshops will stay in place.

It was agreed that the topic for the science seminar at ISC15 will be announced by November 2014. It is expected that choice of a topic will be an outcome of the PICES joint workshop (see Section 5.2 above). Potential topics include close-kin analysis, otolith microchemistry, and management strategy evaluation.

Noting his upcoming retirement from NOAA Fisheries, a plaque was presented to S. Pooley in recognition of his contributions to ISC.

12 ADOPTION OF REPORT

13 CLOSE OF MEETING

G. DiNardo thanked the Taiwan Fisheries Agency for hosting the meeting and the Overseas Fisheries Development Council for providing administrative support, with special thanks to Tsui-Feng Hsia, Hui-Chun Tsai and Hui-Shan Ma who did an excellent job with meeting arrangements and logistics. He also expressed his appreciation to the Office of the Chair including Sarah Shoffler, Lennon Thomas, Suzan Yeh and Chi-Lu Sun for their outstanding support. He also thanked Kit Dahl for taking on the rapporteuring duties and producing a well-written report. G. DiNardo closed the successful 14th meeting of the ISC at 1:00 pm on 21 July 2014.

14 CATCH TABLES

Table 14-1. North Pacific albacore catches (in metric tons) by fisheries, 1952-2012. Blank indicates no effort. -- indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ().

Table 14-2. Pacific bluefin tuna catches (in metric tons) by fisheries, 1952-2012. Blank indicates no effort. -- indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ().

Table 14-3. Annual catch of swordfish (*Xiphias gladius*) in metric tons for fisheries monitored by ISC for assessments of North Pacific Ocean stocks, 1951-2010. Blank indicates no effort. - indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ().

Table 14-4. Annual catch of striped marlin (*Kajikia audax*) in metric tons for fisheries monitored by ISC for assessments of North Pacific Ocean stocks, 1951-2011. Blank indicates no effort. - indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ().

Table 14-5. 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. Blanks indicate no effort or data not available; zero indicates less than 0.5 mt. Other values rounded up to the nearest ton.