FINAL

ISC/18/ANNEX/11

ANNEX 11

18th Meeting of the
International Scientific Committee for Tuna
and Tuna-Like Species in the North Pacific Ocean
Yeosu, Republic of Korea
July 11-16, 2018

Report of The Shark Working Group Workshop

July 2018

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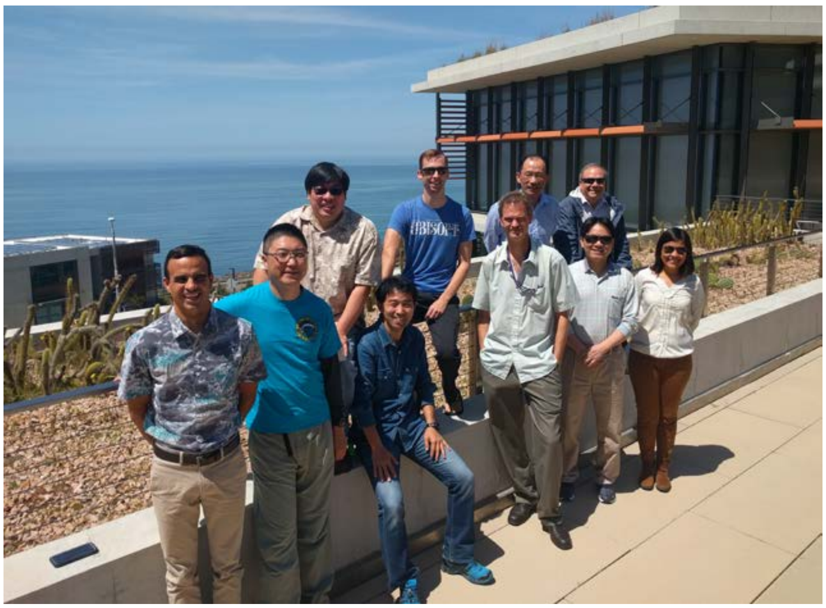
Annex 11

REPORT OF THE SHARK WORKING GROUP WORKSHOP

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

April 9-16, 2018
La Jolla, California, USA



1.0 INTRODUCTION

The Shark Working Group (SHARKWG or WG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) held a 7-days meeting (with a Sunday break) at the National Oceanic and Atmospheric Administration (NOAA) Southwest Fisheries Science Center (SWFSC) in La Jolla, California from April 9-16, 2018. The main goal of the workshop was to complete a benchmark North Pacific Shortfin Mako (SFM) stock assessment.

Mikihiko Kai, SHARKWG Chair, opened the meeting. Participants included members from Chinese Taipei, Japan, Mexico, United States of America (USA), as well as a scientist from the Inter-American Tropical Tuna Commission (IATTC). Participants are listed in Attachment 1A. SHARKWG Chair, Mikihiko Kai, and Fisheries Resource Division director of the Southwest Fisheries Science Center, Gerard DiNardo, welcomed SHARKWG participants and wished everyone a productive meeting and pleasant visit to La Jolla.

2.0 DISTRIBUTION OF MEETING DOCUMENTS

Five working papers and two information papers were distributed and numbered (Attachment 2). Several oral presentations were also made during the meeting. All papers were approved for posting on the ISC website where they will be publicly available.

3.0 REVIEW AND APPROVAL OF AGENDA

The draft meeting agenda was reviewed and adopted with minor revisions (Attachment 3).

4.0 APPOINTMENT OF RAPPORTEURS

The following participants served as rapporteurs for each item of the approved agenda.

Item	Rapporteurs
1-5.	M. Kai
6.	K-M. Liu, M. Kinney (Doc. 1)
	M. Kanaiwa, W-K. Chen (Doc. 2)
	F. Carvalho, L. Mondragón –Sánchez (Doc. 3)
	M. Kinney, K-M. Liu (Doc. 4)
7.	S. Teo, M. Kanaiwa
8.	F. Carvalho, W-K. Chen (Doc. 5)
9.	M. Kinney, S. Teo
10-13.	M. Kai

5.0 SUMMARY OF MODELLING SHARKWG MEETING AND CURRENT MEETING OBJECTIVES

The Chair of the SHARKWG summarized the ISC pre-assessment SHARKWG meeting held at the NOAA SWFSC in La Jolla, CA, USA from February 19-24, 2018. Several stock assessment scientists in NOAA and IATTC and the Chair participated in the meeting (Attachment 1B). The main purpose of the meeting was to determine the "base case" stock synthesis (SS) model for the stock assessment of North Pacific SFM. First, the WG conducted a conditioning of SS using an Age Structure Production Model (ASPM; 1994-2016) with the fishery and biological data provided in the data preparatory meeting to specify the model structures and parameters. However, several issues were raised due to the misspecification of production function such as natural mortality schedules (Ms) and stock-recruitment relationships (SRR) with fishery data such as catch and CPUE. The specific issues were high Ms for all ages, unknown shape of the SRR and unknown initial equilibrium catch that made it difficult to fit the Japanese shallow-set longline CPUE (the most representative index among the fleets) to the data.

To improve the fitting of the CPUE, Ms were downscaled and parameters of the low-fecundity stock recruitment relationships (LFSR; Taylor et al. 2013) were re-parameterized in addition to fixing initial equilibrium catch to 5000 tons. These changes improved the fitting of CPUE to the data. Then, the WG conducted an estimation of selectivity parameters. However, it was impossible to simultaneously fit both CPUE and length composition data. Finally, the WG decided to conduct a grid exploration using ASPM to search for the most plausible combinations of the parameters. For the parameters used in the grid, the WG decided to focus on four parameters; LFSR (Sfrac and Beta), Ms and initial equilibrium catch. The values are summarized in **Tables 1, 2**. Sfrac was changed from 0.5 to 1.0 by 0.1. Beta of LFSR was changed from 1 to 4 by 1. Three scenarios were given for the Ms: The value of scenario 1 was given based on the original Ms derived from the same method used in Kai and Fujinami (2018). The value of scenario 2 was given based on a constant-Ms derived from the empirical equation of cetaceans (Hoenig 1983). The value of scenario 3 was given based on Ms for North Atlantic SFM (Cortés 2017). Initial equilibrium catch of 5000 tons was calculated from the rough estimation of the catch for 1975-1993 using a proportion of SFM catch to blue shark catch after 1993. Another two values of 20% higher and lower catches were given in consideration of the uncertainty in the estimation.

The Chair of the SHARKWG reviewed the current meeting objectives and the desired outcomes. They included: 1) review a preliminary stock assessment of the North Pacific SFM using Stock Synthesis (SS); 2) improve the assessment model(s) through careful review of model diagnostics and re-analysis; 3) decide on the "base case" run(s) to put forward to represent the stock dynamics; 4) conduct diagnostics, sensitivity analysis, and future projections; 5) summarize the stock status; 6) draft conservation information; and 7) develop an outline of the stock assessment report and a plan to complete the report before the ISC Plenary.

Table 1. The values of low fecundity stock-recruitment relationships and initial equilibrium catch given for the grid exploration.

Sfrac	Beta	Catch (tons)
0.5	1	4000
0.6	2	5000
0.7	3	6000
0.8	4	
0.9		
1		

Table 2. Original and three scenarios of natural mortality schedules given for the grid exploration.

Age	Original-M (Kai and Yokoi, 2017)	Scenario1 (Arbitrarily given based on original)	Scenario2 (Constant-M; Hoenig 1983)	Scenario3 (ICCAT, 2017)
0	0.369	0.3	0.128	0.080
1	0.271	0.2	0.128	0.080
2	0.220	0.1	0.128	0.080
3	0.188	0.1	0.128	0.080
4	0.167	0.1	0.128	0.080
5	0.152	0.1	0.128	0.080
6	0.141	0.1	0.128	0.080
7	0.133	0.1	0.128	0.080
8	0.126	0.1	0.128	0.080
9	0.121	0.1	0.128	0.080
10	0.117	0.1	0.128	0.080
11	0.113	0.1	0.128	0.080
12	0.110	0.1	0.128	0.080
13	0.108	0.1	0.128	0.080
14	0.106	0.1	0.128	0.080
15	0.104	0.1	0.128	0.080
16	0.102	0.1	0.128	0.080
17	0.101	0.1	0.128	0.080
18	0.100	0.1	0.128	0.080
19	0.099	0.1	0.128	0.080
20	0.098	0.1	0.128	0.080
21	0.097	0.1	0.128	0.080
22	0.097	0.1	0.128	0.080
23	0.096	0.1	0.128	0.080
24	0.096	0.1	0.128	0.080
25	0.095	0.1	0.128	0.080
26	0.095	0.1	0.128	0.080
27	0.095	0.1	0.128	0.079
28	0.094	0.1	0.128	0.078
29	0.094	0.1	0.128	0.077
30	0.094	0.1	0.128	0.076
31	0.094	0.1	0.128	0.075

6.0 REVIEW AND FINALIZE ALL SUPPORTING SHORT FIN MAKO WG PAPERS

ISC/18/SHARKWG-2/01*: *Estimation of initial equilibrium catch for North Pacific SFM, Mikihiko Kai and Kwang-Ming Liu

Summary

This working paper provides an estimate of initial equilibrium catch for North Pacific SFM using an annual catch ratio of SFM to North Pacific blue shark. We estimated the catch prior to 1994 for five fleets (1. Japanese shallow-set offshore and distant water longline (JPSSLL); 2. Japanese deep-set offshore and distant water longline (JPDSLL); 3. Japanese coastal longline (JPCOLL); 4. Japanese driftnet (JPDN); 5. Taiwanese small longline (TWSMLL)) and we combined them with the catch of other fleets. The average catch of SFM from 1975 to 1993 was 4,813 tons. The catch of four fleets (1. US Hawaii shallow-set longline (HWSSLL); 2. US Hawaii deep-set longline (HWDSLL); 3. US recreational (USREC); 4. IATTC purse seine (IATTCPS)) were not included in the catch amount because the unit is number. Probably, the annual total catch of SFM for the four fleets prior 1994 were not large due to the small number of catches compared to the catch of main fishery such as Japanese and Taiwanese fleets. We therefore recommend that the WG uses 5,000 tons as an initial equilibrium catch of SFM in the stock assessment.

Discussion

The WG asked how the drift net catch was estimated. It was explained that the ratio of SFM to blue shark from 1994-2015 was applied to the blue shark catch estimates from 1975-1993. The blue shark catch estimates were from the stock assessment report for blue shark (ISC 2017a). There is no data prior to 1980 and therefore the estimates for 1975-1979 were set equal to the 1980 estimate.

The WG commented that the US also has a drift net fishery. It was explained that the data for this fishery is in the catch table of the report (ISC 2017b).

The WG noted that Taiwan and South Korea also had drift net fisheries. The WG looked at a FAO report (1991) on the drift net fisheries. There are several types of drift net fisheries. A large mesh salmon fishery off Alaska probably does not catch SFM. The small mesh squid fishery and the shore based large mesh salmon fishery both catch SFM. However, the squid fishery probably has a much lower catch rate. There is no information on large mesh fisheries for Taiwan and South Korea and it is unknown if this is just a lack of reporting or if the fisheries did not exist. Taiwan and South Korea do have squid fisheries and they each have about 10-20% of the Japanese catch of blue shark. The WG looked at INPFC (1993) that has information on the catches in the drift net fisheries. There is no information on SFM as they are grouped in the category “other sharks”. However, in the large mesh fishery most of the other sharks were SFM. In the squid fishery the “other sharks” category also has thresher sharks and the proportion is unknown. In the large mesh fishery, the ratio of SFM to blue shark is about 20%, while in the squid fishery it is about 1%. There are reports of effort for the Taiwan squid fishery but not catch. More information is needed to determine if the catch of SFM in the Taiwan and South Korea squid fisheries is large enough to necessitate its inclusion in the model.

The ratios of the drift net fishery were derived from 1 vessel with an observer collected from 1 year (1990). The historic estimate of SFM catch estimated in this study may be an overestimate because the SFM catch assumed the same ratio to blue shark catch across both the small and large mesh fisheries. **The WG decided that to account for this they would run sensitivity analysis with 50% above and below the estimated historic SFM catch in order to account for this likely overestimation (-50%), and for the lack of data from Taiwan and South Korea which could add to the catch (+50%)**.

ISC/18/SHARKWG-2/02: ***Standardized CPUE of SFM caught by Japanese shallow-set longline fisheries from 1975 to 1993, Mikihiko Kai and Minoru Kanaiwa***

Summary

This working paper provides the yearly changes in standardized CPUE of SFM caught by Japanese shallow-set longline fishery from 1975 and 1993 in the western and central North Pacific. Since Japanese logbook data before 1994 have no/little information about species of sharks, we estimated the catch number of SFM using the catch ratio of SFM to sharks from 1994 to 1999. The nominal CPUE was standardized using a spatio-temporal generalized linear mixed model (GLMM). The best model was selected using AIC for several candidate models which have different random effects as explanatory variables. The full model was selected and the standardized CPUE showed a decreasing trend from 1976 to 1987 and then it gradually increased up to 1993.

Discussion

The WG mentioned that the trend of the index looked similar to those of blue shark because the catch of SFM was estimated from the total catch for "sharks" (it includes a high proportion of blue shark catch) that having a strong assumption that the area and season specific catch ratios of SFM to sharks from 1975 to 1993 were the same as those between 1994 and 1999. The WG mentioned that the CPUE trend is reasonable because it had decreased after the large amount of catch around the 1980s. The WG mentioned that the index before 1994 is the most important index for improving model fit and diagnostics. **The WG therefore agreed to use the index in the stock assessment and extend the term of the stock assessment to 1975-2016, however, the WG noted that the index ending in 1993 has a large uncertainty compared to the index starting in 1994**.

ISC/18/SHARKWG-2/03: ***Stock recruitment relationships of SFM, Isurus oxyrinchus, in the North Pacific, Mikihiko Kai***

Summary

This working paper provides estimates of steepness, which represents a fraction of the unfished recruitment when spawning stock biomass is 20% of the unfished spawning stock biomass, for North Pacific SFM (*Isurus oxyrinchus*). The author applied an existing age-structured model for the reproductive ecology of elasmobranchs, conducted numerical simulations to incorporate uncertainties in the natural mortality and produced the variance of steepness. The author also examined the impacts of different maximum ages and reproductive cycles on the estimates. The mean values and those standard deviation for steepness with the Beverton-Holt model and default maximum age 31 years were 0.316 (standard deviation = 0.054) and 0.252 (standard deviation = 0.039) for the reproductive cycle of 2 years and 3 years, respectively. The results suggested that the stock-recruitment relationship in North Pacific SFM remains little density-dependent and that its productivity is lower than that of other similar elasmobranchs.

Discussion

The WG questioned the shape of the stock-recruitment relationships and asked whether there was any evidence of cannibalism post birth. The WG mentioned that there is no information about the shape of the stock-recruitment relationships and little evidence to confirm cannibalism. The WG clarified that differences in values of steepness between the north Pacific and Atlantic stocks were caused by differences in natural mortality rates and the growth curves. The author pointed out that the estimated steepness ranged from 0.34 to 0.52 for the North Atlantic and from 0.44 to 0.72 for the South Atlantic. The higher values in the Atlantic were largely different from the lower estimates of steepness in the North Pacific because the M schedules of Atlantic SFM were lower and the different biological parameters such as growth curves. **The WG acknowledged that reducing the uncertainties in the biological parameters is necessary in order to improve the accuracy of the estimates of steepness in future work. The parameters of low fecundity stock recruitment relationships were not estimated in the study.**

ISC/18/SHARKWG-2/04*: *Preliminary demographic analysis of SFM* (*Isurus oxyrinchus*) *in the Mexican Pacific Ocean, Leonora Fernanda Mondragón-Sánchez, Javier Tovar-Ávila, José Leonardo Castillo-Géniz, José Ignacio Fernández-Méndez and Luis Vicente González-Ania.

Summary

Demographic analyses are commonly used to obtain information about the population dynamics of sharks. For SFM shark (*Isurus oxyrinchus*) such studies have been undertaken mainly in the Western Pacific Ocean. The objective of this study was to explore in a preliminary way the demography of *I. oxyrinchus* population caught in the Mexican Pacific, incorporating new available information on age and growth for the region, as well as the catch composition obtained from the Mexican observer´s program on board industrial longline shark fishing vessels during the last decade. The basic demographic parameters were estimated using life tables and age-based matrices. Elasticity matrices were used to determine the contribution of each age group to the population growth rate and the effect of different fishing mortality rates (F) evaluated. In addition, the rebound potential was calculated. The analyses indicated increasing population rates of the species in the Mexican Pacific Ocean under natural conditions for different scenarios of longevity and breeding seasonality. The juveniles produced the highest change in population growth rates (r and λ), followed by the adults. However, the influence of the age groups commonly caught by the Mexican fishery (2–4 years) to r and λ was considerably lower than that from the rest of the juveniles and adults, suggesting that the fishery may not have such a serious impact on the population of *I. oxyrinchus* if the rates of fishing mortality are adequate. The population tolerate up to an F=0.5 if catches focus on 2–4 age groups. Our results demonstrate that the recovery capacity for the species after being subject to F was lower than that reported previously. The impact of management measurements adopted to date in Mexico on the demography of the species need to be addressed in the future. The full understanding of the population dynamics of the species in Mexican waters is necessary to achieve sustainability.

Discussion

The WG asked to have more information on what the authors meant when they suggested that fishing only some of the juveniles would lead to higher recovery potential. The authors responded that it is similar to having a catch size limit, and that as long as some of the juvenile sizes are not fished, the population recovery potential would increase and the population could still double in a time period from 8-16 years. The WG also commented whether the stock can be sustainably utilized by catching a high percentage of juveniles.

7.0 STOCK SYNTHESIS (SS) MODELING OF NORTH PACIFIC SFM

Preliminary stock assessment models of shortfin mako in the North Pacific using Stock Synthesis, presented by: Felipe Carvalho.

Summary

Stock Synthesis model runs were conducted for the North Pacific SFM shark based on the available catch, CPUE, length composition, and life history data compiled by the ISC WG. A sex-specific model was implemented in order to allow for observed differences in growth between sexes. A Beverton-Holt stock recruitment relationship was assumed. Natural mortalities at age were fixed at an independently estimated value (0.128). A two-stage data weighting approach was implemented. Reference points obtained from the SS3 model indicated that the recent annual fishing intensity (1-SPR; 2013-2015) was estimated to be 0.16 (CV=38%) and was 62% (CV=38%) of fishing intensity at MSY (0.26). In 2016, the number of adult females was estimated to be 860,200 (CV=46%) (Table 1) and was 36% (CV=30%) higher than the estimated number of adult females at MSY. By the standard terminology, this would indicate that the stock is not in an overfished state, and that overfishing is not occurring.

Discussion

The WG discussed the life history information and assumptions used to develop the “base case”. The WG asked the author to clarify the data sources for the grid analysis. The author clarified that the models in the grid analysis only included catch and abundance index data from 1994 – 2016. The authors have only shown the results from the model fitting to the S4 index (JP shallow-set LL for 1994 –2016). Some models using other indices alone did not converge, and those that did had results similar to that shown by models using the S4 index.

The WG also noted that the S4 index, which showed an increase of more than three times over approximately 20 years, appeared to be inconsistent with the analysis of WP-04 (Mondragón-Sánchez et al. 2018), which suggested that the stock was not highly productive.

The WG discussed the appropriate stock-recruitment relationship to use – Beverton-Holt model (BH) or the low fecundity stock-recruitment model (LFSR). **The WG agreed that there was not enough biological information available to parameterize the LFSR and so decided to use the BH for the “base case” model and the LFSR as a sensitivity run**.

The WG also agreed on the general structure of the “base case” model. The catch time series should incorporate the early catch time series estimated by Kai and Liu (2018), and **the modelling period should be 1975-2016**. The WG acknowledged the uncertainty in the S9 index (JP shallow-set LL for 1975 –1993). However, given the lack of another informative index for that period, **the WG decided to include the S9 index for the “base case” model**.

The WG requested that more model runs be conducted using different combinations of the indices in the 1994-2016 period to determine the "base case" scenario.

8.0 VIRTUAL POPULATION ANALYSIS (VPA) MODELING OF NORTH PACIFIC SFM

ISC/18/SHARKWG-2/05*: *Stock analysis of Mako Shark in the North Pacific Ocean by virtual population analysis, Minoru Kanaiwa and Yasuko Semba

Summary

In this paper, estimation of stock abundance in each year and age for female of SFM in North Pacific Ocean was provided by using virtual population analysis. The purpose of this paper was to address the initial biomass of stock and the annual trend of selectivity of catch at age. Classic VPA and tuned VPA were conducted by using ridge penalty. The results of initial biomass by both models were similar and about 600kMT. The selectivity was stable before late 1990s with both model and changed after early 2000s.

Discussion

The WG acknowledged the consistency of the results (e.g. initial conditions and biomass time series) between the VPA and the Stock Synthesis model. The biomass time series was very similar to those found in the SS model. The author highlighted that the VPA showed some misfitting between the size composition data and the selectivity might be occurring in the SS model. As observed in previous runs using the SS model, the VPA showed some peaks in the size-at-age in 1990s, which can probably be explained by an increase in recruitment.

9.0. SELECT CONSENSUS MODELING APPROACH (SS) AND RUN(S) FOR BEST SCIENTIFIC INFORMATION ON NORTH PACIFIC SFM

1. Discussion of model sensitivities and diagnostics, and selection of the "base case" scenario

The WG examined the R0 profiles and model diagnostics for the models with different late period indices (1994-2016) to study how informative each index was on the estimation population scale. The WG had initially decided at the data prep. meeting that the S4 index (Japanese shallow-set LL for 1994 –2016) would be the highest priority and four indices (S1, S3, S5, S8) be second priority (ISC 2017b), where S1 is US-Hawaii shallow-set LL, S3 is Taiwanese Large LL, S5 is Japanese offshore and distant water deep-set LL (Research and Training Vessels), and S8 is Mexican commercial LL.

Initial model runs using the S4 index showed strong signs of model misspecification, specifically a strong pattern in the recruitment deviations. **The WG therefore decided to exclude S4 from the "base case" model and instead use the S4 index for sensitivity runs.** In order to explain why S4 was not included in the "base case" model, the WG agreed to provide further statistical analysis on the recruitment deviations of the sensitivity models that used the S4 index.

Based on the R0 profiles and model diagnostics, **the WG decided to fit to four indices (S1, S3, S5, S8) in the late period (1994-2016)**. These four indices were considered by the WG to be more internally consistent with the other data provided. However, those indices were relatively uninformative on estimated population scale.

In addition to R0 profiles, the WG examined preliminary models for fits to the length composition data and estimated selectivities. The WG decided that the model fits were generally adequate. The WG noted that the length compositions were not raised to the catch. Therefore, the length compositions should not be heavily weighted and it may not be appropriate to add substantial model process to improve model fits. Therefore, **the WG agreed to keep the selectivities and weighting as in the preliminary models, noting that there were some minor tweaks to make in the selectivities and weighting, and would leave it to the modelers**.

Results from models that combined the early index from Japan (S9) with different late indices (S1, S3, S5, S8) one at a time, showed no impact on overall model results when compared to the "base case". However, when all four late indices were fit in the model, the initial equilibrium catch was estimated at an implausible value. **Therefor the WG decided to fix (i.e. fit) the initial equilibrium catch, so that the model treats it as data and does not freely estimate it.**

The WG agreed that sensitivity runs assuming higher and lower catch in the early (1975-1993) and late (1994-2016) periods should be conducted.

The retrospective and jitter analysis indicated that the "base case" model was stable.

The WG investigated changing sigma R to 0.3 from the "base case" which had sigma R set at 0.1. The idea was to improve the fit to some of the indices, however, this led to patterns appearing in the recruitment deviations and indicated that misfit of indices was simply being shifted to inappropriate patterns in the recruitment deviations. **Therefore, the WG agreed to keep sigma R at 0.1 instead of introducing patterns in the recruitment deviations.**

After reviewing the sensitivity analysis and all model diagnostics, **the WG decided that the finalized "base case" run provided the best scientific information on the dynamics and current status of the North Pacific SFM stock.**

2. Formulate conservation information considering model uncertainties and future projections

Based on the results of the finalized "base case" run and the key uncertainties on the catch and CPUE for the early period, and the shape of the stock-recruitment relationships, the WG created a summary on the stock-status. In addition, the WG created a summary on the conservation information based on the future projection.

10.0 ROUTINE ASSIGNMENTS FOR THE ISC PLENARY

The SHARKWG Chair reminded WG members that an election for a new WG vice Chair will occur in July. Each nation in attendance at the July meeting may nominate an individual and vote. Only members present can be nominated and elected vice Chair. The US delegation nominated Michael Kinney from NOAA SWFSC USA as vice Chair. There were no other nominations. Michael Kinney was elected as the vice chair.

11.0 FUTURE SHARKWG MEETINGS

A tentative schedule for upcoming WG meetings was adopted:

July 8, 2018 Yeosu, South Korea	Finalize SFM stock assessment information for the Plenary; conduct work for the Plenary; finalize future assessment work plan
November, 6-12, 2018 (tentative) Kaohsiung, Taiwan	Improvement of fisheries data and biological parameters for pelagic sharks (Blue shark and SFM are better but other sharks can be accepted)

12.0 OTHER MATTERS

The WG discussed a way of re-evaluating the stock structure of blue shark in the Pacific to deal with the request from the WCPFC 14 (WCPFC 2018).

"*the commission agreed to task SC 14 to prioritize determination of whether the North Pacific blue shark is northern stock and applicable provide updated management advice and recommendations to WCPFC 15. To support the SC's consideration of these matters in 2018, the Scientific Service Provider and ISC were requested to provide to SC 14 papers that provide available information on the status of these stocks and the catch levels in their associated fisheries.*"

The WG proposed to launch a genetics study to consider whether the North Pacific blue shark is a northern stock. The WG mentioned that the MOU between Taiwan, China and Japan can be used to conduct a collaborative study. The WG also mentioned that the operational areas of longline fleets from China, Taiwan, and Japan include tropical areas, so that samples from both northern and southern hemispheres can be collected. The WG also proposed to work together with other countries such as the US and Mexico for collaborative studies. Since the WG has not agreed to a sampling design and the lead countries/person on this project, the WG agreed to continue the discussion at the next WG meeting.

Regarding the schedule of future stock assessments, the WG agreed to perform stock assessments of blue shark and SFM every three years. The WG agreed not to move forward with quantitative analyses of other shark species.

The WG informed that some WG member have a plan to submit a paper on the parameterization of the LFSR and its' impacts on the stock status to the international journal (Fisheries Research special issue). In this paper, authors used the data and parameters used in the SS stock assessment for the North Pacific blue shark. The WG agreed to use those data for the publication.

13.0 CLEARING OF REPORT

The Report was reviewed and the content was provisionally approved by all present. The Chair will make minor non-substantive editorial revisions and circulate a revised version to all WG members before finalization.

14.0 ADJOURNMENT

The Chair thanked all participants for attending and for their hard work resulting in a carefully conducted, collaborative assessment. He indicated that he will be in touch regularly over the coming months to finalize the assessment report and looks forward to seeing many of the participants in July at the SHARKWG and Plenary meetings in Yeosu, South Korea.

The meeting was adjourned at 16:00 on April 16, 2018.

15.0 LITERATURE CITED

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Attachment 1: List of Participants

A) Assessment meeting

Chinese Taipei
Kwang-Ming Liu
National Taiwan Ocean University
Keelung, Chinese Taipei
kmliu@mail.ntou.edu.tw

Wei-Ke Chen
Division of Marine Fisheries,
Fisheries Research Institute,
Council of Agriculture
Keelung, Chinese Taipei
d89310003@gmail.com

IATTC
Mark Maunder
Inter-American Tropical Tuna Commission
La Jolla, California USA
mmaunder@iattc.org

Japan
Mikihiko Kai
National Research Institute of Far Seas
Fisheries
Shizuoka, Japan
kaim@affrc.go.jp

Minoru Kanaiwa
Mie University
Tsu, Japan
kanaiwa@bio.mie-u.ac.jp

Mexico
Leonora Mondragón -Sanchez
Instituto Nacional de Pesca (INAPESCA)
CRIP- Bahía Banderas
La Cruz de Huanacaxtle, Nayarit, México
sharcussharcus@gmail.com

United States
Felipe Carvalho
NOAA Fisheries, Pacific Islands Fisheries
Science Center
Honolulu, Hawaii USA
felipe.carvalho@noaa.gov

Gerard Dinardo
NOAA Fisheries, Southwest Fisheries
Science Center
La Jolla, California USA
Gerard.Dinardo@noaa.gov

Kevin Piner
NOAA Fisheries, Southwest Fisheries
Science Center
La Jolla, California USA
Kevin.piner@noaa.gov

Michael Kinney
NOAA Fisheries, Southwest Fisheries
Science Center
La Jolla, California USA
michael.kinney@noaa.gov

Steve Teo
NOAA Fisheries, Southwest Fisheries
Science Center
La Jolla, California USA
Steve.teo@noaa.gov

Chile (Observer)
Enzo Acuña Soto
Universidad Católica del Norte
eacuna@ucn.cl

B) Small modelling WG meeting

<u>Japan</u>
Mikihiko Kai (ISC SHARK WG Chair)
National Research Institute of Far Seas Fisheries
Shizuoka, Japan
kaim@affrc.go.jp

<u>United States</u>
Felipe Carvalho
NOAA Fisheries, Pacific Islands Fisheries Science Center
Honolulu, Hawaii USA
Felipe.carvalho@noaa.gov

Michael Kinney
NOAA Fisheries, Southwest Fisheries Science Center
La Jolla, California USA
michael.kinney@noaa.gov

Steven Teo
NOAA Fisheries, Southwest Fisheries Science Center
La Jolla, California USA
steve.teo@noaa.gov

<u>IATTC</u>
Mark Maunder
Inter-American Tropical Tuna Commission
La Jolla, California USA
mmaunder@iattc.org

Haikun Xu
Inter-American Tropical Tuna Commission
La Jolla, California USA
hkxu@iattc.org

Attachment 2. Meeting Documents

WORKING PAPERS

ISC/18/SHARKWG-2/01	Estimation of initial equilibrium catch for North Pacific SFM. Mikihiko Kai and Kwang-Ming Liu. (kaim@affrc.go.jp)
ISC/18/SHARKWG-2/02	Standardized CPUE of SFM caught by Japanese shallow-set longline fisheries from 1975 to 1993. Mikihiko Kai and Minoru Kanaiwa. (kaim@affrc.go.jp)
ISC/18/SHARKWG-2/03	Stock-recruitment relationships of SFM, *Isurus oxyrinchus*, in the North Pacific. Mikihiko Kai (kaim@affrc.go.jp)
ISC/18/SHARKWG-2/04	Preliminary demographic analysis of SFM shark (*Isurus oxyrinchus*) in the Mexican Pacific Ocean. Leonora Fernanda Mondragón-Sánchez, Javier Tovar-Ávila, José Leonardo Castillo-Géniz, José Ignacio Fernández-Méndez and Luis Vicente González-Ania (leonora_fernanda@yahoo.com.mx)
ISC/18/SHARKWG-2/05	Stock analysis of Mako Shark in the North Pacific Ocean by virtual population analysis. Minoru Kanaiwa and Yasuko Semba (kanaiwa@bio.mie-u.ac.jp)

INFORMATION PAPER

ISC/18/SHARKWG-2/ INFO-01	The retrospective problem in sequential population analysis: An investigation using cod fishery and simulated data. R. Mohn.1999. ICES Journal of Marine Science, 56; 473-488.
ISC/17/SHARKWG-2/ INFO-02	Ridge virtual population analysis to reduce the instability of fishing mortalities in the terminal year. Hiroshi Okamura, Yuuho Yamashita and Momoko Ichinokawa. 2017. ICES Journal of Marine Science, 74; 2427-2436.

Attachment 3. Meeting Agenda

SHARK WORKING GROUP (SHARKWG)

INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC

SFM STOCK ASSESSMENT WORKSHOP AGENDA

April 9-16, 2018

NOAA Fisheries Southwest Fisheries Science Center
La Jolla CA

Meeting Hours: 9:00-17:00 (Monday, 9 April：Only SS modeller)
10:00-17:00 (Tuesday, 10 April)
09:00-17:00 (Wednesday, 11 April through Saturday, 14 April)
12:00-17:00 (Monday, 16 April)

1. Opening of SHARKWG Workshop
   a. Welcoming remarks
   b. Introductions
   c. Meeting arrangements
2. Distribution of documents and numbering of Working Papers
3. Review and approval of agenda
4. Appointment of rapporteurs
5. Summary of modelling working group (WG) meeting and current meeting objectives
6. Review and finalize all supporting SFM WG papers
7. Stock Synthesis (SS) modeling of north Pacific SFM
   a. Review output of grid methods (216 runs) and model diagnostics
   b. Compare performances of each scenario
8. Virtual Population Analysis (VPA) modeling of north Pacific SFM
   a. Review "base case" scenario and compare with that of SS to examine the effect of the initial conditions and selectivity of the SS.
9. Select consensus modeling approach (SS) and run(s) for best scientific information on north Pacific SFM
   a. Select the "base case" scenario
   b. Formulate conservation information considering model uncertainty
   c. Discuss scenarios of sensitivities and projections
   d. Develop/finalize assessment report (Report deadline June 10)
10. Routine assignments for the ISC Plenary – Vice Chair election in July but accept the

nominate

11. Future SHARKWG meetings
12. Other matters
13. Clearing of report
14. Adjournment