Annex 4

REPORT OF THE SHARK WORKING GROUP WORKSHOP

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

November 19-26, 2014
Puerto Vallarta, Mexico

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-day meeting in Puerto Vallarta, Jalisco, Mexico, November 19-26, 2014. The primary goal of the workshop was to review all shortfin mako fishery and biological information (Cat 1, 2, and 3 data and abundance indices) and make plans for a shortfin mako shark assessment to be completed in the spring of 2015.

Suzanne Kohin, SHARKWG Chair, opened the meeting. Participants included members from Chinese Taipei, Japan, Mexico and the United States of America (USA) (Attachment 1). Dr. Gerardo Chavez Velazco, Director of the Centro Regional de Investigación Pesquera, Bahia de Banderas, Nayarit welcomed all participants and wished for all to have a productive meeting and some time to enjoy the city of Puerto Vallarta. He said he was very pleased for this opportunity for INAPESCA to host an ISC meeting in Mexico for the first time.

Dr. Javier Tovar-Avila presented an overview of the Centro Regional de Investigación Pesquera, Bahia de Banderas laboratory. He mentioned the diverse work that is going on at the laboratory which includes studies on many different species including sharks, shrimps, billfishes, reef fishes, marine mammals and aquaculture work. He invited participants to visit the laboratory which is located 30 km to the north of the meeting site.

2.0 DISTRIBUTION OF MEETING DOCUMENTS

Fifteen working papers and 4 information papers were distributed and numbered (Attachment 2). Several oral presentations were also made during the meeting. All working group papers were approved for posting on the ISC website where they will be available to the public with the exception of papers 06, 13, and INFO01.

3.0 REVIEW AND APPROVAL OF AGENDA

The draft meeting agenda was reviewed. Additional agenda items were suggested and the agenda was adopted with minor revisions (Attachment 3).

4.0 APPOINTMENT OF RAPPORTEURS

Rapporteuring duties were assigned to Mike Kinney, Javier Tovar-Avila, Hui-Hua Lee, Felipe Carvalho, Tim Sippel, Norio Takahashi, Oscar Sosa-Nishizaki, and Mikihiko Kai. The approved agenda (Attachment 3) indicates the rapporteurs for each item in parentheses.

5.0 REPORT OF THE SHARKWG CHAIR

The Chair of the SHARKWG provided a summary of the work on the blue shark assessment over the past year and its review at the ISC Plenary Meeting and the WCPFC Science Committee meeting. The assessment was conducted by the ISC SHARKWG using two modeling platforms: a Bayesian Surplus Production model and the fully integrated Stock Synthesis model. The assessment was a collaboration among working group members including the SPC. Catch and CPUE time series used in the assessment were improved relative to those used in the 2013 assessment. The models were sensitive to the initial catch conditions and the stock recruitment relationship. "Reference case" models, believed to best represent the dynamics of the stock, were selected. The results of both models showed that the stock is in a healthy condition, and median annual fishing mortality in 2011 was roughly 33% of F_{MSY}. The assessment was reviewed and accepted by the Science Committee of the WCPFC as the best available information on the blue shark in the North Pacific. However, it was acknowledged that there remain uncertainties regarding the estimated catch and life history of blue sharks and that continued research and monitoring, through carefully designed observer programs, are needed in order to make improvements prior to the next assessment.

The Chair indicated that a desktop review by the Center for Independent Experts (CIE) has been planned for the blue shark assessment, as has been done with other ISC assessments over the past 5 years. The review will likely take place in the spring and the Chair will be in touch with the lead modelers for their help preparing the assessment files and supporting documentation for the review.

The Chair described and distributed a spreadsheet that lists the titles and authors of all past Working Group papers and information documents. The spreadsheet also contains a very brief description of the contents of each paper and is meant to help WG members keep track of past work. Several papers had previously been submitted and discussed regarding national fisheries and their catch of shortfin makos, as well as papers on the distribution of shortfin makos and aspects of their life history that are relevant to the current meeting's objectives. The spreadsheet will be updated after each meeting and is available from the Chair upon request.

6.0 REVIEW OF SHORTFIN MAKO CATCH, CPUE AND SIZE INFORMATION

6.1 Japan

6.1.1. *Distribution, body length and abundance of blue shark and shortfin mako in the Northwestern Pacific Ocean based on longline research vessels from 2000 to 2014 (ISC/14/SHARKWG-3/04)*

<u>Summary</u>

National Research Institute of Far Seas Fisheries has been conducting longline surveys since 2000 using chartered commercial longline vessels in the Northwestern Pacific Ocean. In each year, two cruises were conducted in offshore areas to the northeast of Japan from mid April to mid June. Each cruise is designed to collect data related to bycatch species such as seabirds, sea turtles and sharks, with special interest in testing the effectiveness of various seabird mitigation measures. In each longline set of the survey, on-board scientists collected detailed biological information of species caught, size and sex.

This study summarizes the information of blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*) obtained by the survey cruises conducted in the period between 2000 and 2014. Both sharks have eurythermal distributions, and the data indicated that the sea surface temperature for positive catch sites of shortfin mako was warmer than for blue shark. The level of nominal catch rate of blue shark was more than 10 times larger than shortfin mako. The standardized catch per unit effort (CPUE) of both species was calculated using a generalized linear model (GLM) with negative binomial errors or delta-lognormal GLM. The standardized CPUE of blue shark peaked in the mid 2000s, decreased then increased since 2012, and the CPUE values of shortfin mako have increased with fluctuations.

Discussion

A question was raised about whether data presented here from fishery-independent surveys could corroborate the data from the commercial fleet. Unfortunately the commercial fleet is not at the same scale as this study and so a direct comparison is not possible at this time. There were questions about the increasing CPUE from 2012-2014 and how it might be related to changes in the survey effort or the area where fishing was taking place. The authors believe the jump is a result of a generally decreasing trend in Japanese longline fishing pressure in recent years which has allowed better recruitment of makos, but there has also been a shift in the fishing area which may have caused the increase. A northern shift in the fishing area, into an area that is likely more productive, might be related to this increase in CPUE. The main result of an analysis of mako CPUE vs. sea surface temperature indicated that makos preferred higher temperatures despite recent data showing a shift in the higher catch areas to higher latitudes with cooler waters. There is some evidence from other studies that salinity and depth of the thermocline might be important, but more work will need to be done to check this, perhaps with some CTD profiling.

The point was raised that for several years (e.g. 2014) the model confidence interval was quite large which might mean the model was not effectively estimating CPUE. **It was suggested that change in temperature across an area, a proxy for currents or fronts, could be introduced into the model.** This might help explain the 2014 catch where makos were seen to congregate in more northern waters of the survey area where the Oyashio and Kurashio currents converged with a well-defined front.

A question was raised about whether the scale of the survey is too small to be of value. The characteristics of all the indices will be compiled in a table to be used to make decisions about which indices are most appropriate given the modeling approach. Since this was a fishery-independent survey, it has high accuracy but limited scale. Due to catch rates being very low in this study (as is often the case with fishery-independent surveys done on a small scale) slight changes in catch can greatly affect trends in CPUE, but may not be representative of the overall population. The study was conducted in a core area for the Japanese fishing ground, so will be useful for that sector. It is important to consider the time frame of each data set since small scale, short time period studies like this one which have large shifts in CPUE can greatly affect any modeling efforts.

6.1.2 *CPUE standardization for shortfin mako, Isurus oxyrinchus, of the Japanese Longline Fishery in the North Pacific Ocean (ISC/14/SHARKWG-3/14)*

Summary

This paper estimated a historical population trend of shortfin mako in the North Pacific Ocean using a large amount of Japanese longline data from 1994 to 2013. CPUE was standardized using a negative binomial model, a zero-inflated Poisson model and a zero-inflated negative binomial model. The full zero-inflated negative binomial model was selected as the best model after comparing AIC and BIC. Annual changes in the CPUE suggested that the historical population trend of shortfin mako had slightly increased since 1990s until 2010, after which it has been stable.

Discussion

Since this index used data from a large area and several different sectors of the Japanese longline fishery, there were several questions about how comparable the operations were in space and time. For example, the number of hooks through time declined but it was asked if this was true for both deep and shallow-set sectors. This was not something that was looked at but it was thought that this decrease over time is mostly related to the shallow set fishery; the deep set fishery that targets tunas is likely more stable. Differences in catch between this study and the previous one on the fishery-independent survey show that the fisheries logbooks do not appear to accurately reflect the total catch of makos. Apparently not all catch is recorded in the logbooks, an issue which still needs to be resolved. The data are being verified with Training Vessel logs and research trips.

The area stratification chosen in this analysis is based on that used for blue sharks. This area stratification may not be best for makos and should be revisited and improved. Nominal CPUE calculated for smaller areas could be examined to help understand the regional aspects of the data. The high catch from the previous study seems in conflict with this study, but the two are on greatly different scales. In the area close to Japan where the fishery-independent survey is conducted, trends should be more similar.

This study is combining catch/effort data from fisheries using a variety of gear (steel vs. mono leaders), targeting different species, and having different retention rates for makos. In the case of blue sharks, this kind of shift in fishing practices was dealt with by producing separate models for different fishery types and periods of time when fishing practices changed. **The WG recommended that the data be divided into several subsets, each of which represents fishing activities that have more similar operations.** Even for makos, which are not a target species and are caught in relatively low numbers compared to the blue shark and tuna targets, fishing operations that change over such a large area could result in different catchabilities. **The index is considered preliminary since the data are still being verified using Training Vessel**

and research data, so further thought will be put into defining different areas or subsetting the data into several fishery sectors.

6.1.3 *A Comparison of Japanese RTV CPUE with the Hawaii deepset longline fishery (oral presentation)*

Summary

CPUE of shortfin mako shark caught by Japanese research and training vessels around the Hawaiian Islands was standardized using a comparable model structure as that applied for the CPUE standardization of the Hawaiian deep-set longline fishery to explore the possibility for its use for the stock assessment as an abundance index. Data for the period between 1992 and 2007, when the level of mis-reporting was apparently low based on the questionnaire survey given to skippers. Standardized CPUE largely fluctuated until the late 1990s when it started to show a slight increasing trend with smaller fluctuations. The level and trend of the standardized CPUE of Japanese research and training vessels for the period between 2002 and 2007 was comparable to that of the Hawaiian deep set longline. This may indicate that the magnitude of mis-reporting of shortfin mako sharks in the logbooks of Japanese research and training vessels was negligible and that the data can be used for estimating an abundance index. More detailed comparisons with the Hawaiian deep-set fishery data should be conducted to confirm this hypothesis.

Discussion

This analysis showed strong overlap in fishing effort between the Japan Research and Training Vessels and the Hawaii deep-set longline fishery. Trends in abundance were similar between the Hawaii and Japan indices. However, the spatial analysis of sex ratio and sizes suggest both indices should be estimated with different area stratifications. **The WG concluded that the US and Japan should collaborate on developing these indices and provide updates at the SHARKWG webinar in February 2015.** The similarities in indices might provide the opportunity to use Japanese data to understand the Hawaii CPUE further back (before 2001) when the Hawaii observer program did not have high coverage.

6.2 Chinese Taipei

6.2.1 *CPUE standardization and catch estimate of shortfin mako shark by Taiwanese large-scale tuna longline fishery in the North Pacific Ocean (ISC/14/SHARKWG-3/11)*

Summary

In the present study, the shortfin mako shark catch and effort data from the logbook records of Taiwanese large-scale tuna longline fishing vessels operating in the North Pacific Ocean from 2005-2012 were analyzed. Due to the large percentage of zero shortfin mako shark catch, the CPUE of shortfin mako shark, as the number of fish caught per 1,000 hooks, was standardized using a delta lognormal model. Both nominal and standardized CPUE of shortfin mako sharks showed slightly decreasing trends. Estimated shortfin mako shark bycatch in weight from the Taiwanese large-scale tuna longline fishery ranged from 0 metric tons (MT) in 1973 to 154 MT in 2006 and it decreased thereafter. The results obtained in this study can be improved if longer time logbook data are available and environmental factors are included in the model.

<u>Discussion</u>

Logbook data and observer data were in agreement for makos, thus for the purposes of this study the logbook data were used since they are more extensive than the observer data set. Logbook data can be biased if discards are high and not recorded, however in Taiwan the price of mako is high, so discards are low. **It was requested that the comparison between the logbook data and the observer data be shown. Because spatial analyses of other fishery data have shown that the size of sharks is more affected by longitudinal changes than latitudinal ones, using smaller areas separated longitudinally should be considered.**

Due to the number of zeros in the catch **it might be useful to use a zero inflated model.**

It was noted that the mako catch may include both longfin and shortfin mako. This may be true of fisheries for the other nations as well, however it is believed that the vast majority of the catch is shortfin mako, particularly away from the tropical areas.

The WG requested that confidence intervals or CVs be provided. In order to improve the model it was suggested that factors such as SST and latitude and longitude along with region be added. Plots of the nominal CPUE by quarter and areas were requested to help determine that appropriate factors have been accounted for.

The WG did not review the CPUE and catch estimates **for the small scale longline** which has a large amount of catch of blue shark and likely shortfin mako in the North Pacific. **The WG requested that those data be provided.** The data will be provided by the Jan 1 deadline and a paper provided in the upcoming meeting.

6.3 USA

6.3.1 *Description of the Hawaii Longline Observer Program (ISC/14/SHARKWG-3/01)*

<u>Summary</u>

Due to the expansion of pelagic longline fisheries based out of Hawaii in the 1980s and concerns about interactions with protected species, an observer program was initiated in the early 1990s to monitor the fishery's catch and bycatch. The scope of the program has changed through time, including a shift from voluntary to mandatory participation, increased levels of observer coverage, and improvements in sampling design. The observer program operates in both the shallow-set, swordfish targeting longline fishery as well as the deep-set, tuna targeting longline fisheries. This paper focuses on the deep-set fishery observer coverage since an index of abundance based on the observer data for this fishery was used by the SHARKWG in the ISC North Pacific blue shark stock assessment in 2013. The distribution of observer coverage in the deep-set fishery has changed through time: prior to 2001 coverage was approximately 4%, but has since been very close to 20% with the spatial footprint of observer coverage being more representative of the entire fishery since 2001. However, the probability sampling design used by the observer program is not statistically robust to ignore the data collection process because of its hierarchical design and unequal distribution of sampling probabilities throughout the year. Sampling probabilities vary through time because of logistical aspects such as availability of funding and observers. As all sets and hooks are sampled when a trip is selected for observer placement, trips can be viewed as clusters whose elements are all sets and hooks deployed during the trip. While some mis-reporting of data in logbooks was identified in this analysis, and other previous studies, the level of compliance with logbook submission requirements is still considered to be high. This paper is an update to a prior version, (Sippel et al. 2014; ISC/14/SHARKWG-1/05) prepared for the January 2014 SHARKWG meeting.

Discussion

None.

6.3.2 *Catches of mako sharks from U.S. commercial and recreational fisheries in the North Pacific Ocean (ISC/14/SHARKWG-3/03)*

Summary

US fisheries for highly migratory species (HMS) in the Pacific operate from both the West Coast of the mainland and out of Hawaii. Although shortfin mako sharks are not commonly targeted, the meat does command a decent price in domestic markets and can be considered a welcome catch for both commercial and recreational fishers. Much of the mako commercial catch is retained, but as a non-target species in tuna and swordfish fisheries, it is also occasionally discarded. The maximum number of recreational dead removals (both from charter and private vessels) was nearly 22,000 animals in 1987, and since 2007 has been less than 1000 animals annually. Annual catches from the US west coast drift gillnet fishery were highest in the early 1980s (at about 300 mt) and have been steadily declining, now at around 10 mt. The commercial hook and line fishery had greatest catches in the late 1980s to early 1990s (~100-200 mt), but catch has declined to under 10 mt since the mid-1990s. Catch in other minor west coast fisheries has amounted to under ~20 mt for the last 20 years, with the exception of an anomalous peak catch of ~60 mt in 1980. Catches in the Hawaii deep-set longline fishery have steadily increased from 2001-2013, doubling over that time (from ~2000 to ~4000 animals). Within the Hawaii-based shallow-set longline fishery, catches were mostly stable from 2005-2010 (~1000 animals), but have declined sharply recently.

Discussion

A suggestion was put forward that **the gap in the recreational catch (1990-1992) could be estimated by applying an average catch from several years before and after the gap.** The US will update the recreational catch to fill the gap. The recreational catch estimates are quite uncertain, since many private boats dock at private access ramps that can't be sampled. However, the fluctuations in catch have been substantiated by other reports and they are currently the best estimates available for this fishery. For the HI longline fisheries, total catch right now is estimated from 2005 for the shallow set and 2002 for the deep set since prior observer coverage was so low. However, **the US will use another method to estimate the earlier catch and provide those data for the working group.** A question was raised about how catch for the longline fisheries was estimated from the observer data. The method involves analyzing the observer data and applying a statistical algorithm based on temporal and spatial coverage to raise the observed catch to total catch. There is an internal NOAA report describing the methods that will be shared with other members of the group since the document is not yet available online. There is little information on the survival rate of discarded makos released from longline and gillnets, but based on the opinion of the group the survival of discarded makos is lower than the survival of discarded blue sharks due to the intense fight they put up when being caught. One way to deal with this is to have a high and a low catch time series with the high catch assuming that all discarded makos died while the low catch would assume all survived.

6.3.3 *Standardized catch rates of shortfin mako shark in the U.S. West Coast drift gillnet fishery (ISC/14/SHARKWG-3/09)*

Summary

A U.S. west coast large-mesh drift gillnet fleet (DGN) has been through a series of regulations to manage the catch and bycatch since California started managing the fishery in 1980. The increasing regulatory pressure and limitations to areas available for fishing have led to dramatic changes to the DGN fleet resulting in a 90% reduction in the number of DGN vessels in 2011 from the peak in 1985. The objectives of this paper were to evaluate factors affecting shortfin mako shark catch in the DGN fishery and to develop standardized CPUE indices using set-by-set logbook data. The data set was examined, filtered, and divided into strata based on available factors in the logbook for the use of developing CPUE indices. We used a delta approach to model the annual CPUE index because there were a large number of sets with zero mako catch. We further used a step-wise regression procedure to determine the set of spatial, temporal, fishing and oceanographic factors and interactions that explained the observed variability. Two time periods (before and after implementation of a 2001 closure of the Pacific Leatherback Conservation Area) were analyzed to reflect changes in management. The resulting abundance indices were relatively flat during 1985-2000 and 2001-2012. We note that the catchabilities for both indices were likely to be non-constant because of the increasing number of time-area closures as well as the unknown consequences of other management measures such as pingers and net extenders. Given current limited participation along with the limited spatial extent of the fleet, the representativeness of these data as a proxy for shortfin mako shark stock abundance in the North Pacific is questionable.

Discussion

It was noted that this fishery covers a small, coastal area, especially since 2001, so is not likely representative of the whole North Pacific stock. This fishery operates in a "nursery area", so it may provide useful information about juveniles. This index alone cannot serve as a recruitment index since there appear to be pupping areas on both sides of the Pacific.

There was a question about the size of animals caught. It was mentioned that in paper ISC/14/SHARKWG-3/03 the average weight of sharks caught in this fishery is less than 24 kg because the catch is mostly juveniles, so there is a relatively large number of individuals caught.

The group asked whether there was any change in the length of the soak time or net length over time, since these can affect mako catch. Fishing practices have been relatively consistent, with the exception of the time and area fished throughout the period, but both soak time and net length were explored as factors in the model to account for their effects, but found to be negligible and not used in the final model.

6.3.4 *Standardized Catch Rates of Shortfin Mako Shark (Isurus oxyrinchus) caught by the Hawaii-based Pelagic Longline Fleet (2002-2013) (ISC/14/SHARKWG-3/10)*

Summary

Catch and effort data from the Hawaii-based pelagic longline fishery operating in the North Pacific Ocean were analyzed to estimate indices of abundance for the shortfin mako shark between 2002 and 2013. The data come from the records of the Pacific Islands Regional Observer Program (PIROP) submitted to the Pacific Islands Fisheries Science Center (PIFSC). Nominal CPUEs were calculated separately for shallow-set (target: swordfish) and deep-set (target: bigeye tuna) sectors, and standardized with Generalized Linear Models (GLM), separately for each sector. In the GLM, two different modeling approaches were tested and compared, the delta method and Tweedie model approach. Model validation was carried out with residual analysis. The explanatory variables included year (12), quarter of the year (4), region (8), and the interaction quarter of the year*region. Overall, the standardized CPUE for the deep-set sector showed a stable trend from 2002 to 2013, while the standardized CPUE in shallow-set sector showed a slight decrease up to 2012, followed by an increase in 2013.

Discussion

The WG raised the question of how the current CPUE estimates compared to the previous estimates by Walsh (2011; ISC/11/SHARKWG-2/2). Both studies show similar trends in general with a discrepancy in 2004, which this study did not include for the shallow-set sector analyses, as there was no shallow-set fishing activity for most of that year.

It was clarified that the Tweedie model approach explained model deviance better than delta-lognormal model approach, although there was a small discrepancy of the CPUE trend in recent years for the deep-set sector.

The WG discussed how the deep-set sector and shallow-set sector were separated compared to the Japanese longline fishery. It was clarified that both the Japanese longline fishery and Hawaii-based longline fishery used hooks-per-float (HPF) to classify shallow-set operation as using ≤ 15 HPF and deep-set operation using > 15 HPF. It was further shown that the number of HPF for the deep-set sector of the Hawaii-based longline fleet has been stable since 2002 and has been consistent throughout the 8 regions considered in the CPUE standardization model.

It was discussed that the potential increasing trend of shortfin makos released alive from both deep-set and shallow-set sectors might be due to the decrease of finned makos due to a ban on finning and lower market demand for sharks in Hawaii.

The WG noted that CPUE generated from deep-set sector has a longer time series and covers a larger spatial area than shallow-set sector; however, fishing effort in number of hooks has been more stable for shallow-set sector.

The WG raised concerns about the effect of gradual increase of bigeye tuna catch since 2002 on the mako shark catch. It had been presented to the ISC Plenary that the number of vessels participating in the deep-set sector has been stable. The authors followed up with further analyses to help explain the increasing bigeye tuna catch. There has been an increase in the number of hooks fished in the deep-set sector since 2002, and that increase appears to have been in area 5 where relatively more bigeye tuna are caught. This helps explain the increasing bigeye catch ratio. With the area stratification used in the standardization, there does not appear to be an increase in targeting that is expected to affect the standardized CPUE. **Some members of the WG suggested investigating the species composition in the data set and considering using species composition in the CPUE standardization in future.**

6.3.5 *Standardized abundance index of juvenile shortfin mako shark (Isurus oxyrinchus) based on a fishery-independent survey in the Southern California Bight (1994-2013) (ISC/14/SHARKWG-3/08)*

Summary

An annual fishery-independent longline survey of juvenile pelagic sharks in the Southern California Bight (SCB) was used to estimate the local relative abundance of juvenile shortfin mako sharks (*Isurus oxyrinchus*) from 1994 to 2013 (with the exception of 1998 and 1999). The design of the survey was based on catch data from an experimental commercial shark longline fishery that operated in the SCB during the years 1988 - 1991. We used a generalized linear model to standardize CPUE of shortfin mako sharks from the survey data, and the bootstrapping method was used to determine the confidence intervals. We found that the standardized abundance index trend was similar to the nominal CPUE trend, with a decline prior to 2000, maintaining low levels through 2011 followed by an increase in 2012 and 2013. In addition, ancillary longline sets were conducted during the annual survey cruises and those data were included in a separate juvenile shortfin mako abundance index analysis to examine potential variability when using different fishing methods. The standardized CPUE index with all data collected during survey cruises showed a similar CPUE trend as the survey data. We suggest that the working group treat this index as an alternative index for sensitivity runs or as a recruitment indicator because of the limited scope of the survey.

Discussion

The WG noted that the shortfin makos caught by this juvenile survey in the Southern California Bight are smaller in size than shortfin makos caught by the Hawaii-based longline shallow-set sector. The WG suggested to **further examine the locations where small shortfin makos are caught to identify the nursery ground on a finer scale** and potentially develop a recruitment index. The authors explained that this survey operates in the same area and catches roughly the same size class of sharks as the large mesh drift gillnet fishery. The drift gillnet fishery is tightly regulated with gear, time and area restrictions and there is increasing pressure to further restrict or eliminate the fishery in favor of “cleaner” gears. Given that, **the WG recommended this fishery-independent survey be continued in order to obtain information on juvenile makos for this area.**

6.4 Mexico

6.4.1 *Catch data for shortfin mako shark reported by fishery observers from Mexican shark longline and driftnet fisheries in the North Pacific in 2006-2014 (ISC/14/SHARKWG-3/02)*

Summary

Data from the 2006-2014 activities of the Mexican Shark Scientific Observer Program (SSOP) indicated that the shortfin mako, *Isurus oxyrinchus* is an important component by number in the shark catches from pelagic, offshore and coastal fisheries in the northern Mexican Pacific. The present working paper provides general insight on the mako catches obtained from 11,316 sets (73.9% longline and 26.1% driftnet sets) during 670 commercial fishing trips from the fleets of Ensenada (EN), Mazatlán (MZ), San Carlos (SC), Puerto Peñasco (PP), Salina Cruz (SZ) and Topolobampo (TB), during June 2006 through April 2014. During the first five years (2006-2010) the number of fishing trips with observers were > 50, reaching a peak in 2007 with 132 trips. Sharks as a group comprised 94.3% of the numerical catch in the total observed longline sets during 2006-2014 in all the fleets, meanwhile in the driftnet sets sharks accounted for 97.4%. A total catch of 11,190 shortfin makos was reported during 2006-2014, 73% from longline sets (8,357) and 27% caught in driftnets (3,019). The largest numerical catches were observed in the Ensenada and Mazatlán fleets, with both fishery gears. The highest numerical mako catches were observed in the Ensenada (EN) longline fleet with 1.7 – 4.9 sharks per set during the third and fourth quarters of the year. The catch/set rates from the longline Mazatlán-based fleet were 0.9-2.4 mako shark per set.

Discussion

The WG requested the size distributions of shortfin makos caught by longline and driftnet fishery by area. These data were provided by the end of the meeting. **Since this fishery caught juvenile shortfin makos and small adults, the WG recommend to compare the size data to the USA drift gillnet fishery.** It was recognized that the observer program is still being improved to provide the best data. The WG encouraged continued work on the design of the observer program and improved data collection, including collection of biological samples for life history studies, because with the US fisheries, these data are very important for characterizing the shortfin mako shark catch in eastern Pacific waters.

6.4.2 *Standardized catch rates for mako shark (Isurus oxyrinchus) in the 2006-2014 Mexican Pacific longline fishery based upon a shark scientific observer program (ISC/14/SHARKWG-3/16)*

Summary

Abundance indices for mako shark (*Isurus oxyrinchus*) in the Mexican Pacific for the period 2006-2014 were estimated using data obtained through a pelagic longline observer program. Individual longline set catch per unit effort data, collected by scientific observers, were analyzed to assess effects of environmental factors such as sea surface temperature and time-area factors. Standardized catch rates were estimated through generalized linear models by applying two generalized linear models (GLMs). The first model (using a binomial likelihood and a logit link function) estimates the probability of a positive observation and the second one estimates the mean response for non-zero observations, using gamma and lognormal error distributions. Variance weight was considered in the GLM analysis. Sea surface temperature, year, area fished and quarter were all significant factors included in the model using gamma and lognormal error distributions.

Discussion

The WG requested the authors provide the diagnostics from the standardized models. Some members of the WG suggested including fleet as a factor, or recalculating results for just the Ensenada fleet which fishes in the core area where most of the makos are caught. Another suggestion is to develop a combined index for the recent Mazatlán-based fleet and historical large longline fishery.

Mexican delegates presented an update of the Mexican standardized CPUE index, based only on data from the Ensenada fleet. Diagnostic plots showed some patterns demonstrating uneven sampling across years and space. The group recommended that Mexico continue the collection of data though observer programs, and to improve the sampling design and coverage. The WG also suggested that other factors be considered for future use in improving the standardization including interaction terms and providing dispersion estimates. Also, it was suggested to look at the trends in standardized CPUE with and without the zero catch to see if they are consistent and to explore the use of other models to address zero catch.

6.4.3 *Estimations of the Shortfin Mako Shark (Isurus oxyrinchus) catches by Mexican Pacific fisheries (1976-2013) (ISC/14/SHARKWG-3/17)*

Summary

This document presents estimates for the shortfin mako shark catches landed at four states from northwestern Mexico, for the period of 1976 to 2013. Mexican shark catch statistics by species were not available until recently, so past shortfin mako shark catches were estimated using the different sources of information, assuming different proportions of the species in total catches that have been published in the scientific literature or estimated using more detailed local statistics. In Mexico, shortfin mako sharks are caught mainly by the artisanal and middle size longline fisheries that target pelagic sharks or swordfish. Catches that were landed in the past by the large size vessel longline fisheries and the drift gillnet fisheries were taken into consideration to construct the historical series. Shortfin mako shark was not an important species in the catch until the 1980s when the catches increased from a level of around 60 metric tons to around 250 mt. With the development of the longline fishery in Mazatlán, Sinaloa, during the second half of the 1990s, today catches have reached a level of around 700 mt. Estimates indicate that shortfin mako sharks are caught mainly in the western coast of the Peninsula of Baja California, and waters off the southern end of the Gulf of California.

Discussion

Some members of the WG enquired about the joint venture fishery between Japan and Mexico in 1990s. These data are believed to be reported with the Japan fishery data, so are not included in this time series.

6.4 Secretariat of the Pacific Community (SPC) and other data holdings

6.4.1 Preliminary overview of the SPC Data holdings in the North Pacific with respect to mako shark caught by NON-ISC members, and ISC members in the North Pacific EEZs (excluding USA) (ISC/14/SHARKWG-3/INFO-03)

Summary

The SPC provided a summary of their data holdings for shortfin mako sharks from non-ISC member nations in the NWPO.

Discussion

The WG noted that the data holdings do not have many records for makos relative to the blue shark data provided by SPC. It is not clear whether there will be representative information from these data for any of the non-member nations in order to provide useful fishery indicators, but the WG welcomes all the data in order to have the most complete information on shortfin mako sharks.

It was requested that the Chair ask for data from IATTC as well, and if IATTC does not have the data for the Spanish fleet operating in the EPO, those data will be requested from the Spanish scientists directly. **The Chair will also follow up with Korea and China to obtain any of their data on shortfin mako shark.**

6.5 General discussion on all fishery data and indices

The WG summarized the abundance indices presented at this meeting in the following table and figure. It was agreed that there is quite a lot of information on relative abundance and size trends in many regions but that the catch time series are not yet complete. Most of the data do not go back before around 2000 and there is no single abundance index that covers the full range of the stock. **The WG members are requested to continue to develop the total catch estimates so that they can be reviewed at the upcoming meeting.**

Table 1. Characteristics of the relative abundance indices discussed at the meeting.

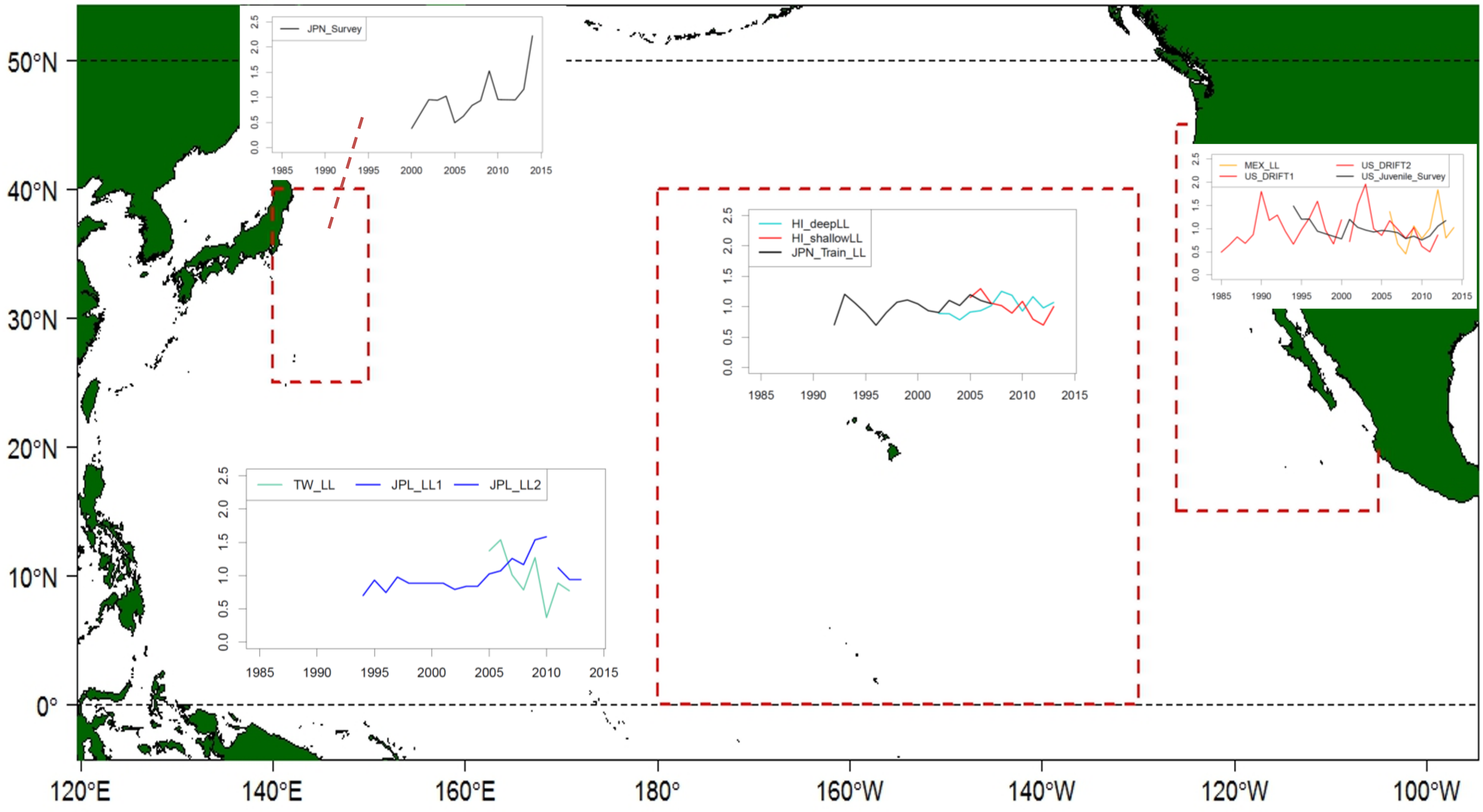
Source	USA	USA	USA	USA	Mexico	Taiwan	Taiwan	Japan	Japan	Japan
Gear	**Hawaii longline - Deep set**	**Hawaii longline - shallow set**	**West Coast large-mesh drift gillnet**	**Southern California Bight fishery-independent longline survey**	**Medium size Longline**	**Large-scale longline**	**Small-scale longline**	**Offshore & distant water**	**Fishery-independent longline survey**	**Longline Training Vessels**
Quality of Observations	Good because using observer data and has 10-20% coverage and discards recorded.	Good because using observer data with 100% coverage and discards recorded.	Good because using logbook data with good coverage and discards are recorded. Verified with observer data since 1990.	Research survey with good data collection but sample size is low (total 460 sets).	Observer data, but coverage varies in space and time.	CPUE is based on the logbook data. Size data is based on the observer data.	CPUE based on the VMS and landings data. Size data are from port samples of landings in weight.	CPUE is based on the logbook data. Data are verified with research survey for the NW part.	Research survey with good data collection, but sample size is low. Total 650 mako sharks were caught.	Research survey with good data collection but sample size is low.
Spatial distribution	Relatively small 0 - 40 N, 130 - 180 W	Relatively small 10 - 40 N, 130 - 180 W	Relatively small 30 - 45 N, 116 - 126 W	Very small 32 - 34 N, 117 - 120 W	Relatively small 15 - 32 N, 105 - 120 W (including gulf of CA)	Large geographic area 0 -50 N, 120 E - 90 W		Large geographic area 0 - 45 N, 130 E - 70 W	Relatively small 25 - 40 N, 140 - 150 E	Relatively small 0 - 40 N, 130 - 180 W
95 percentile size (PCL)	(F) 218; (M) 206	(F) 155; (M) 181	(F) 145; (M) 146	(F) 145; (M) 146	(F) 171; (M) 178	(C) 194	(C) 205	(M)190; (F) 180	(M) 180; (F) 200	(M) 222; (F) 250
Median size (PCL)	(F) 168; (M) 164	(F) 73; (M) 114	(F) 96; (M) 99	(F) 96; (M) 99	(F) 114; (M) 115	(C) 133	(C) 150	(M) 100; (F) 92	(M) 115; (F)112	(M)170; (F) 177
5 percentile size (PCL)	(F) 128; (M) 127	(F) 37; (M) 39	(F) 68; (M) 69	(F) 67; (M) 69	(F) 71; (M) 70	(C) 102	(C) 105	(M) 140; (F) 130	(M) 62; (F) 60	(M) 132; (F) 133
Statistical soundness	Yes. Reasonable based on diagnostics provided.	Yes. Reasonable based on diagnostics provided.	Yes. Reasonable based on diagnostics provided.	Yes, reasonable based on residuals.	Not yet. Strong patterns observed in the binomial residuals requiring further exploration.	No. Strong patterns in residuals and departure from normality in qq plot.		Yes, reasonable based on residuals.	Yes, reasonable based on residuals.	Yes, reasonable based on residuals.
Temporal coverage	2002-2013	2005-2013	1985-2000, 2001-2012	1994-2013	2006-2014	2005-2012		1994-2010, 2011-2013	2000-2014	1992-2007

Q Changes (due to management, fishing practices, etc.)	No major regulatory and fishery changes after the ban on finning in 2000. Slight increase of effort for region 5 (20-30 N, 135 - 160W).	Likely due to the regulatory requirements to avoid reaching turtle take caps in 2006 and 2011.	Continuing regulation (Q probably change through time)	No change in operation of survey. If population distribution is correlated to the environment, the Q may vary.	Gillnet closed in 2009 and may affect the longline effort and size structure. Summer time shark closure since 2012.	Q is relatively stable.		Likely due to the Great East Japan Earthquake in 2011. It is addressed by breaking time series.	No change in operation of survey. If population distribution is correlated to the environment, the Q may vary. Standardization includes location information so should account for that.	No change in operation of survey. If population distribution is correlated to the environment, the Q may vary. Standardization includes location information so should account for that.
Relative catch contribution				Low				Large	Low	Low
Comments	Diagnostics are reasonable. Coverage area is relatively small in the North Pacific.	Diagnostics are reasonable. Coverage area is relatively small in the North Pacific and the fishery has some regulatory changes that may affect CPUE.	Large change in fishing area over time and covers a relatively small area in the North Pacific. Fishery operates in a nursery area. Time series is quite long compared to other indices.	Survey operates in a nursery area and is very small in spatial scale. Survey design is up for review.	The index with just the Ensenada fleet was recalculated. Diagnostics were provided. Second index with Mazatlán fleet and historical large longline may be possible.	Covers a relatively large area in the central Pacific. The index is being revised for further improvements and diagnostics will be provided.	Index not yet provided for review.	Covers a large area and time period. Data are being further verified with RTV and survey data.	Small area but operates in Japan's core mako fishing ground.	

Supporting Working Papers or Publications - from this meeting only. Further documentation has been provided at past meetings and will be listed in future versions of this table.

Fishery description/ data description	ISC/14/SHARKWG-3/10, ISC/14/SHARKWG-3/1	ISC/14/SHARKWG-3/10, ISC/14/SHARKWG-3/1	ISC/14/SHARKWG-3/09	ISC/14/SHARKWG-3/08	ISC/14/SHARKWG-3/02	ISC/14/SHARKWG-3/11		ISC/14/SHARKWG-3/14	ISC/14/SHARKWG-3/04	
Analysis description	ISC/14/SHARKWG-3/10	ISC/14/SHARKWG-3/10	ISC/14/SHARKWG-3/09	ISC/14/SHARKWG-3/08	ISC/14/SHARKWG-3/16	ISC/14/SHARKWG-3/11		ISC/14/SHARKWG-3/14	ISC/14/SHARKWG-3/04	
Treatment of outliers or filtering	ISC/14/SHARKWG-3/10	ISC/14/SHARKWG-3/10	ISC/14/SHARKWG-3/09	ISC/14/SHARKWG-3/08						
Appropriate diagnostics	ISC/14/SHARKWG-3/10	ISC/14/SHARKWG-3/10	ISC/14/SHARKWG-3/09	ISC/14/SHARKWG-3/08		ISC/14/SHARKWG-3/11		ISC/14/SHARKWG-3/14	ISC/14/SHARKWG-3/04	

Figure 1. Plots showing the abundance indices discussed during the meeting and the approximate areas within the North Pacific for which each index applies. The Taiwan large-scale longline and the Japan longline indices shown in the bottom right graph cover most of the North Pacific while the others are from areas bounded by the red dashed boxes.



7.0 REVIEW OF BIOLOGICAL INFORMATION ON MAKO SHARKS

7.1 Age and Growth Update

The SHARKWG Chair provided a summary of the progress of the ISC shark age and growth specialists. The age and growth specialists met in January 2014 and reviewed existing age and growth information for shortfin mako and blue sharks. The group reviewed their progress since the first Age and Growth Workshop and agreed that uncertainty in ageing shortfin mako shark still remains. They established a revised work plan aimed at providing information to the SHARKWG regarding shortfin mako age and growth. The work plan addressed several goals.

Corroboration of vertebral band reading - One of the first steps is to verify that all readers visualize and count the same bands. Variation between labs/readers may be attributable to several things, but the group focused on 1) variation that is due to differences in the reading of band pairs by different individuals, and 2) variation that may be due to the different methodologies used among labs to enhance bands. In order to address variation that is due to differences in the reading of band pairs by different individuals, the group agreed to all read the images from the age validated samples analyzed by Wells et al. (2013) and corroborate on readings. The images from the Wells et al. (2013) paper were shared with all the age and growth specialists, and several labs have provided their counts. There were found to be differences in readings between groups, so the US team is helping to explain to several of the readers the criteria used for reading the images. A webinar will be held to further describe the criteria used to read the images and help the group come to agreement on reading the vertebrae.

Reading the reference vertebrae – The US processed the shortfin mako reference vertebrae using the same methodology as used for the validated vertebrae. Once each lab has demonstrated they count the same number of bands in the validated samples, all labs will read the reference vertebrae images. The group will then be able to produce size vs. band pair curves for the reference collection based on a single method. Several labs have read the images of the reference vertebrae produced by the US. Preliminary readings varied across labs, but that is likely attributable to the fact that not all labs had corroborated reading with the US on the validated vertebrae. Once corroboration of vertebral band reading is completed, each lab will again read the US processed reference collection images.

Examining variation across methodologies - Different methodologies used among labs to enhance bands may result in variation in the number of bands visible and thus counted. This variation will be addressed by having each lab process the reference vertebrae according to their lab's established method. Each lab's counts will be examined and if consistent differences between labs exist, that may be attributed to differences in enhancement methodologies, then conversions may be needed to derive counts similar to the standard counts. Some labs have made progress processing the reference vertebrae using their preferred methods.

The group discussed different hypotheses regarding band pair deposition for shortfin mako sharks. In the EPO, juveniles (up to about age 5) deposit two band pairs in their vertebrae each year. It is not known whether that deposition rate continues for life or whether there is a switch to a single band pair per year or deposition not based on an annual cycle. A number of studies were suggested that will help address the uncertainty in band pair deposition rates including recommendations on continued sample collection by size and sex across all regions of the North Pacific. See the January 2014 Age and Growth Workshop Report for more details.

The WG asked about marginal increment analysis for providing validated growth curves. The age and growth specialists have reviewed all the methods and existing growth curves and confirmed that the marginal increment and edge analysis methods are indirect methods of validation and can be very useful to corroborate growth curves. To be most useful though, given that band periodicity may change, the studies should be conducted for different age classes and sexes and have good sample numbers throughout the year. Comments on potential problems with bomb radiocarbon ageing, and Indian and Atlantic Ocean growth curves were also raised. (The age and growth specialists discussed these issues; see details in the January Age and Growth Workshop Report). The Working Group agreed that biologists and fisheries scientists should work together in order to have the best growth curves for the current and future stock assessments.

Discussion continued on which growth parameters scientists should concentrate on and how to generate a single best value for them. A meta-analysis approach developed for blue marlin in the Pacific Ocean (Chang et al. 2013) was suggested as an option to combine different data sources. The WG highlighted that the group needs to agree on a growth curve and that the meta-analysis approach could be valuable. In order to compare and combine studies for the meta-analysis, a template was developed and will be distributed to collect the raw band pair readings for each of the member's studies.

It will be good to compare the work on growth from the vertebrae analyses with growth determined from the size distribution data. Size data are usually only useful for growth for the first few years before length frequency modes become unclear.

7.1.1 *Evaluation of growth band counts precision in the vertebrae of shortfin mako sharks caught in the Mexican Pacific (ISC/14/SHARKWG-3/05)*

<u>Summary</u>

Isurus oxyrinchus vertebrae were collected from landings of the artisanal and industrial fleets operating along the North Pacific Mexican coast from 2007 to 2014. Due to de the difficulty to obtain vertebrae located below the first dorsal fin, particularly in the artisanal fishery, some samples were obtained from the cervical region once the shark was beheaded. The samples were preserved frozen until their preparation. A total of 66 vertebrae from sharks caught in Mexican waters were processed and analyzed, of which 47 were collected by INAPESCA and 19 by FACIMAR-UAS. Vertebrae from 58 sharks provided by SHARKWG-ISC were also processed. All vertebrae showed visible growth bands, including some vertebrae which presented only the birthmark and prenatal marks. The number of growth bands observed in the vertebrae varied from 0 to 16 for the research group 1 (average= 7.09), being the most common the group of vertebrae with seven growth bands, whereas for the research group 2 the number of growth bands varied from 0 to 15 (average= 7.34) being the most common the group of vertebrae with five and eight growth bands. The APE and CV for all vertebrae estimated by the first research group was 4.03% and 5.79% respectively, whereas the second research group estimated a higher

error with an APE of 5.7% and CV of 5.4%. The APE and CV estimated between the final counts of both research groups was 5.85% and 8.14% respectively.

Discussion

It was recognized that the corroboration of how to count bands is an important step before results can be compared between labs and readers. The WG mentioned that the standardization of growth band reading criteria prior to performing the counts is necessary to achieve comparable and unbiased estimations between different readers and research groups. Further analysis is needed to determine if the systematic biases detected between the research groups produced significant differences in the estimation of growth parameters. The study also presented a sample quality score 1-5 for readability which can be very useful if concerns are raised about individual readings or a threshold readability is chosen for excluding certain readings. **For the ISC reference collection, the US team will help to identify differences between readers of the OTC images and the reference collection images and try to explain reasons for the differences and demonstrate to each group how to define what will be a real band.** Photographs and projected images can be used to determine what should be counted as the birth band, reducing the differences among the readers.

7.1.2 *Oxytetracycline age validation of an adult shortfin mako shark after six years at liberty (ISC/14/SHARKWG-3/06)*

Summary

The age and growth of shortfin mako sharks has been studied since the early 1980s but gaps in our knowledge of this basic area of their biology still remain. Fundamental aspects of age and growth, such as growth band-pair periodicity, have been questioned in recent work, with indications that juvenile makos (< 200 cm fork length) in the northeast Pacific may undergo more rapid growth than previously thought, leading to a band-pair deposition rate of two band pairs per year rather than the more common one band pair per year. Unfortunately, a lack of recaptured adult makos has resulted in uncertainty as to whether this band-pair periodicity continues into adulthood (> 200 cm fork length) or not. This work presents findings on the recapture of a large adult male mako shark in the waters off of southern California after six years at liberty. Our results support the hypothesis that male mako sharks experience a change in band-pair deposition rate at or near maturity from two band pairs per year to one band pair per year.

Discussion

The WG noted that results for females are still lacking and **encouraged continued OTC tagging.**

7.1.3 *Growth and spatiotemporal distribution of juvenile shortfin mako, Isurus oxyrinchus, in the western and central North Pacific (ISC/14/SHARKWG-3/INFO1)*

Summary

This paper presents an estimation of growth curves and spatiotemporal distributions of juvenile shortfin mako shark, *Isurus oxyrinchus*, in the western and central North Pacific Ocean using port sampling data collected from 2005 to 2013. The monthly length compositions show a clear transition of three modes in the size range of smaller than 150 cm which were believed to represent growth of age–0 to age–2 classes, and they were then decomposed into age groups by fitting Gaussian mixture distribution. Simulation data of lengths at monthly ages were generated from the mean and standard deviation of each distribution, and fit with a von Bertalanffy growth function. Parameters of the estimated growth curves for male (female) were 274.4 (239.4) cm PCL and 0.19 (0.25) year^{-1} for $L\infty$ and k, respectively, and they indicate apparently faster growth than those reported previously. The juvenile shortfin makos locate their habitat in the Kuroshio–Oyashio transition zone which is known to have relatively higher productivity in the pelagic area, and here these shortfin makos conduct their seasonal, small–scale North–South migrations. Since no apparent seasonality has been observed in their growth, their migration pattern is suspected to take the best advantage of food in the transition zone.

Discussion

The Group highlighted that this study has a large sample size and data for 8 years. But in longline fisheries there is some belief that the largest and smallest sharks may not be accounted for in size samples. Smallest sharks may fall off during the haul-back, and the largest sharks may not be brought on board. The authors mentioned that recently, fishing technicians had been advised to slow the longline haul back operation in order to reduce the loss of small shortfin mako sharks. The Working Group agreed that the presented growth curve is very clear and represent the best available growth curve for 0 to 3 year old shortfin mako sharks in the western Pacific. Wells et al. (2013) compared the growth between two modes for NEPO sharks, however, it is still uncertain if that growth rate can be applied for all regions. Since a large amount of the shortfin mako catch comes from the area of this study, this might be the best estimates of growth to consider. The differences in growth observed in this study and others further highlight the **need to conduct further studies examining the spatial patterns by size for shortfin mako to fully understand growth throughout the range.**

7.2 Spatial distribution patterns by size and sex

7.2.1 *Spatial and temporal patterns in the size and sex of shortfin mako sharks from US and Japanese commercial fisheries: a synthesis to guide future research (ISC/14/SHARKWG-3/INFO-02)*

Summary

Within the western and central North Pacific there is some evidence of spatial structure of makos by sex and size based on observer records from Japanese longline fisheries. Overall, the proportion of females is greater in the WPO and lower in the central Pacific (CPO), but the sex ratio is roughly 1:1 in the western (WPO) and eastern Pacific (EPO). The mean size of females was lower in the WPO and EPO and they were on average larger south of 30 °N latitude as well. Along the US West Coast, smaller males and females are mostly found in the Southern California Bight, with larger animals found mostly north of the Bight. These data cover most of the NPO, providing a quite comprehensive look at stock structure by size and sex. The Japanese shallow-set longline fishery has the widest spatial coverage of data examined here, but this summary and analysis are missing data from the EPO (away from the US West Coast). Once the coordinates of Hawaiian observer data are matched to the size data included here, they should help fill in information gaps in the EPO. Spatially explicit size and sex data from Taiwanese longline and Mexico's fishing operations could also help fill in information gaps, and increase sample sizes in the CPO and EPO. Synthesizing these data can help target future research towards resolving key stock assessment uncertainties, such as the stock-recruitment relationship used in integrated assessments.

Discussion

These data show a large oceanic distribution and support the idea that combining information from different nations can assist to understand the spatial structure of shortfin mako shark in the North Pacific Ocean. Moving forward, **the group decided to summarize information in one by one degree by quarter, when possible and five by five degree blocks otherwise. Mexico and Taiwan also agreed to share size information.** The group discussed the possibility of analyzing these datasets to find spatial differences in growth by sex. The importance of a final agreement on conversion equations for the size data was highlighted but each nation should use conversion factors appropriate for their fisheries based on their research. The WG Chairsuggested that each nation should appoint one scientist to collaborate on the size data analyses and size data reporting. Correspondents identified at this meeting are Leonardo Castillo-Geniz, Seiji Ohshimo, Kwang-Ming Liu, and Tim Sippel.

In order to conduct an assessment, the WG discussed the need to stratify the NPO into regions. It was suggested that the data on size and sex patterns could be used to establish the stratification scheme**. It was suggested that each nation should propose spatial stratification based on their own knowledge, and should provide their time series data by spatial strata for use by the assessment modelers.**

The WG recommended basin scale conventional and electronic tag experiments and other research projects that might assist with answering questions regarding the stock structure of shortfin mako shark in the North Pacific. The WG Chair agreed to discuss coordination of such studies with the ISC Chair and pursue the possibility of conducting such studies under the PICES-ISC collaboration.

For the collaborative size/sex structure analyses and all other collaborative studies proposed, **WG members in attendance agreed that any shared data can be used only for WG analyses and they are not to be shared beyond the WG**. The Chair will work with the STATWG data manager to obtain secure space on the ISC data server for sharing these data. **Before other WG members can work with the data, they will also need to agree to the condition of not using the data for purposes beyond the WG analyses.**

7.3 Other biological information

The Chair of the SHARKWG explained the content of the Life History Matrix information file, which contains data of the life history of the shortfin mako shark worldwide as well as summaries for the North Pacific region specifically. The WG also received an Information Paper (ISC/14/SHARKWG-3/INFO-04) that summarizes studies conducted by Mexican scientists on the life history of shortfin mako sharks including relative abundance in Mexican waters, age and growth, reproductive biology, feeding habits and movements.

Discussion

The matrix was started at the November 2011 meeting, and it has been improved at prior meetings and during the Age and Growth Workshop of the ISC SHARKWG in January 2014. The group discussed the most relevant life history information necessary for stock assessments, and agreed that even if not directly included in the assessment model, information such as spatial segregation by size and sex can be used to split data into sub-regions.

Further discussion addressed the WG's previous decision to keep a single stock in the North Pacific. At that time, there was limited information on stock structure available. Recently, some progress was made on reviewing tagging data, and genetics information. Mitochondrial DNA analysis shows that in the Pacific there is differentiation between the north and south Pacific and further differentiation between the southeast and southwest Pacific (Michaud et al. 2011, Taguchi and Yokawa 2013a). Microsatellite data show no differentiation throughout the Pacific (Taguchi and Yokawa 2013b). Together these studies demonstrate no female gene flow but possibly limited male gene flow between the north and south Pacific. The WG suggested using a paragraph similar to the one from the blue shark report in the shortfin mako shark report for the stock structure explanation.

The need for a better understanding of the reproductive cycle data was discussed. A sample data template will be provided that can be used by the other nations to gather values for reproductive parameters for a type of meta-analysis.

It was reiterated that any parameters that rely on ageing shortfin mako sharks, such as longevity and age at first maturity, etc. are highly uncertain due to the incomplete understanding of shortfin mako age and growth.

The uncertainty about the stock recruitment relationship (SRR) and intrinsic rate of increase (r) was also discussed and it was recommended that further studies examine those parameters. As the basic life history parameter studies continue, understanding of the SRR and r should improve. It is considered a high priority since the SRR function was shown to be highly influential in the blue shark assessment and such relationships in sharks are not well known.

The summarized status of knowledge on shortfin mako sharks is presented below. The more detailed life history matrix which includes details from individual studies is available from the Chair.

Shortfin Mako Shark Life History Characteristics	A: Known with high confidence	B: Known with moderate confidence	C: Highly uncertain
Reproduction	Aplacental viviparity with oophagy - A mother gives birth to live young that initially develop in a yolk sac then feed on a continuous supply of uterine eggs after yolk is depleted.		
Gestation			9-25 months
Breeding frequency			2 or 3 years
Sex ratio at birth	1 to 1		
Litter size	range 4-25; average 12	increasing with female size	
Length at birth	70-74 cm TL		
Length at 50% maturity		Males: 180-210 cm TL	Females: 278-307 cm TL
Age at 50% maturity			Males: 5-9 years, Females: 17-21 years; depends upon band deposition periodicity
Maximum length		361 cm FL	
Longevity			Males 9-31 years, Females 18-41 years; depends on band deposition periodicity
Length conversions	TL=(FL+0.397)/0.913 AL=(FL-9.996)/2.402 TL=(PCL-0.784)/0.816 TL=(FL-0.952)/0.89		
Length-weight relationship *	All: Wt(kg)=1.103×10^{-5} $FL^{3.009}$ All: Wt(kg)=1.1×10^{-5} $TL^{2.95}$ M: Wt(kg)=2.8×10^{-5} $TL^{2.771}$ F: Wt(kg)=1.9×10^{-5} $TL^{2.847}$		
Growth models *			All: FL_t= 292.8[1-$e^{-0.072(t+3.75)}$] All: FL_t = 375.4[1-$e^{-0.05(t+4.7)}$] M: FL_t= 321.8[1-$e^{-0.049(t+6.07)}$] F: FL_t= 403.62[1-$e^{-0.040(t+5.27)}$] M: TL_t= 332.1[1-$e^{-0.056(t+6.08)}$] F: TL_t= 413.8-[(413.8-74)$e^{-0.05t}$] M: PCL_t=231.3[1-$e^{-0.156t}$] F: PCL_t=308.6[1-$e^{-0.090t}$]

* a number of studies have been conducted in the North Pacific and these will be compared to choose the appropriate ones for use by the SHARKWG.

8.0 REVIEW PRIOR ANALYSES INCLUDING INDICATOR ANALYSES

A number of studies that have used indicators in the past to determine the population status for sharks were discussed including Clarke et al. 2011, Clarke 2011, Aires-da-Silva et al. 2014, Hinton et al. 2014. Broadly speaking, trends in catch, effort, catch/effort, percent positive (presence/absence) by set or season, and size, by region and by age class could be considered in indicator analyses. Each time series will have an associated uncertainty, and the overall effects of each indicator can be tested using simulations to see if a simulation model that includes prior information on the productivity of the stock produces trends that match the trends seen in the indicator time series. A fisheries indicator analysis is a simpler approach compared to a full production or integrated assessment model and does not rely on accurate life history information, thus it can be a valuable modeling approach for data limited species.

9.0 MODELING APPROACHES TO USE FOR SHORTFIN MAKO SHARKS

9.0.1 *Developing and Testing a State-space Production Model for the Shortfin Mako Shark in the North Pacific Ocean (ISC/14/SHARKWG-3/13)*

Summary

For many fisheries, conducting formal stock assessments can be difficult due to data limitations. Under these circumstances, the use of fisheries indicators could be used to inform stock status. This paper describes an ongoing project to develop a simulation testing framework to examine the performance of standardized CPUE indices as fisheries indicators. The baseline of the framework consists on generating data using a statistical catch-at-age model and fitting these data to a Bayesian state-space surplus production model. The approach is fully implemented in R.

Discussion

A remark was made that both fisheries indicators and a full assessment model, like a Bayesian Surplus Production Model (BSPM) can provide useful information. However, running a full assessment model requires high quality data which may not be currently available for this assessment. Concerns were raised that an indicator model might lead to a dismissal of lots of life history data which has been collected over a long time. A general consensus was reached by the ISC SHARKWG that an indicator model was the best approach given the information currently available, with a longer term objective of using a fully data-integrated model in the future.

The WG considered concerns that the indicator analysis might provide inconsistent results. The WG discussed the importance of the configurations of the operating model (OM) and the data generation methods for the simulation. The WG asked about the evaluation method of the uncertainty in biological parameters. The WG discussed the methods of treating process error, because error varies by target species. The shortfin mako has a unique pattern of regional sex-segregation within the North Pacific but the lack of information within some areas can cause bias. The WG understands that the simulation study will be used for testing the performance of the indicator analysis, and the possibility of conducting the BSPM or a more complex model in the future. It was mentioned that work is currently being conducted with the IATTC to develop simulation models to validate the use of fishery indicators. The WG understands that the real OM could take a long time to give a clear message to managers. The WG agreed to develop a detailed work plan leading up to submission of the stock indicators for submission to the ISC Plenary in July 2015.

10.0 ESTABLISH ASSESSMENT WORK PLAN AND ASSIGNMENTS, TEMPLATES AND DEADLINES

Proposed work plan for shortfin mako assessment:

- Templates for size research, age and growth research, and reproduction research distributed to meeting participants by end of meeting
- Templates for catch and assessment size data distributed to meeting participants and all national WG contacts by end of the meeting
- **December 1-5**: Indicator simulation work carried out at the La Jolla lab (Felipe, IATTC, Kai-san, others invited)
- National modelers to subset their data and provide several standardized indices, if appropriate, based on fishery practices, fishery selectivity, size class, region, etc.
- **January 1**: deadline for submitting completed research templates, catch tables, revised standardized CPUEs with error measurement (CV or STD, etc), and completed size templates
- **No later than January 1**: Chair will communicate with WG specialty subgroups regarding the size, reproduction and ageing research
- **January and February**: work on the analyses
- **Week of February 2**: webinar for WG modeling specialists to discuss indicator analyses and brainstorm
- **March 9-17**: indicator analysis (assessment) meeting in Japan

Point contacts for the indicator analyses will be Leonardo Castillo-Geniz and Luis González-Ania, Seiji Ohshimo and Mikihiko Kai, Kwang-Ming Liu and Wen-Pei Tsai, Felipe Carvalho and Hui-Hua Lee.

Note: The simulation based on fishery indicators work is independent and being examined in parallel to the indicator analyses the group will prepare based on the fishery data.

Templates were developed for research on age and growth meta-analysis, reproductive biology meta-analysis, and Pacific-wide size/sex spatial structure. Templates for catch and assessment size data were also reviewed. All templates were distributed and **a deadline of January 1 was established for all nations to return completed templates to the Chair.**

11.0 SHARKWG RESEARCH PRIORITIES

For shortfin mako and blue sharks:

- Improve fishery data (catch time series, indices) for use in full stock assessments (production or length/size based models)
- North Pacific-wide coordinated tagging to understand movement rates and habitat use
- Continued and new fishery-independent research surveys
- Combined analysis of size/sex structure

- Meta-analyses of reproductive values and age and growth (especially for shortfin makos about which there is greater uncertainty)
- Improve fishery observer programs by re-evaluating temporal and spatial design and increasing coverage
- Continue work on age and growth including OTC validation studies and the other work identified in the 2014 ISC Age and Growth Workshop

For other sharks of ISC interest:
All members should provide updated information on the status of fishery and biological information on the other species at the July 2015 meeting in order to prioritize future research and assessment work. Updates on the following species are requested:
Bigeye thresher (*Alopias superciliosus*), Pelagic thresher (*A. pelagicus*), Common thresher (*A. vulpinus*), Silky shark (*C. falciformis*), Oceanic whitetip (*Carcharhinus longimanus*), Hammerhead Sharks (*Sphyrna sp.*), Longfin mako (*Isurus paucus*) Salmon shark (*Lamna ditropis*), and Crocodile shark (*Pseudocarcharias kamoharai*).

12.0 FUTURE SHARKWG MEETINGS

Week of February 2, 2015 **Webinar**	Discuss progress on indicator analyses
March 9-17, 2015 (tentative) **Shimizu, Shizuoka, Japan**	Shortfin mako assessment meeting
July 11, 2015 **Location TBD, USA**	Finalize conservation advice for shortfin mako; examine updated information on other sharks of interest to ISC; complete work for Plenary

13.0 CLEARING OF REPORT

The Report was reviewed and the content provisionally approved by all present. The Chair will make minor non-substantive editorial revisions and circulate a revised version to all WG members within 2 weeks. The report will be finalized within 30 days.

14.0 ADJOURNMENT

The WG acknowledged the Mexican delegation participants for organizing the meeting in Puerto Vallarta, as well as for the scientific contributions they provided. It was a very successful first meeting in Mexico and the Chair thanked all the Mexican participants for their meeting organization and generous hospitality. The Chair thanked all participants for their contributions toward a successful meeting.

The meeting was adjourned at 13:25.

LITERATURE CITED

Aires-da-Silva, A., Lennert-Cody, C., Maunder, M.N., and Román-Verdesoto, M. 2014. A stock status indicators for silky sharks in the Eastern Pacific Ocean. IATTC Document SAC-05-11.

Chang, Y.-J., Lee, H.-H., Brodziak, J., DiNardo, G. and Sun, C.-L. 2013. A Bayesian Hierarchical Meta-Analysis of Blue Marlin (*Makaira nigricans*) Growth in the Pacific Ocean. ISC BILLWG Document ISC/13/BILLWG-1/02.

Clarke, S. 2011. A Status Snapshot of Key Shark Species in the Western and Central Pacific and Potential Management Options. WCPFC Document SC7-2011/EB-WP-04.

Clarke, S., Harley, S., Hoyle, S. and Rice, J. 2011. An Indicator-based Analysis of Key Shark Species based on Data Held by SPC-OFP. WCPFC Document SC7-2011/EB-WP-01.

Hinton, M.G., Maunder, M., Vogel, N., Olson, R., Lennert, C., Aires-da-Silva, A. and Hall, M. 2014. Stock status indicators for fisheries of the Eastern Pacific Ocean. IATTC Document SAC-05-11c.

Michaud, A., Hyde, J., Kohin, S., Vetter, R. 2011. Mitochondrial DNA sequence data reveals barriers to dispersal in the highly migratory shortfin mako shark (*Isurus oxyrinchus*). ISC SHARKWG Document ISC/11/SHARKWG-2/03.

Sippel, T., Nasby-Lucas, N. and Kohin, S. 2014. Description of the Hawaii longline observer program. ISC SHARKWG Document ISC/14/SHARKWG-1/05.

Taguchi, M. and Yokawa, K. 2013a. Global genetic population structure and demographic history of shortfin mako (*Isurus oxyrinchus*) inferred from mitochondrial DNA. ISC SHARKWG Document ISC/13/SHARKWG-2/03.

Taguchi, M. and Yokawa, K. 2013b. Global population genetic structure of shortfin mako (*Isurus oxyrinchus*) inferred from microsatellite DNA markers. ISC SHARKWG Document ISC/13/SHARKWG-3/03.

Walsh, W.A. 2011. Ongoing and planned analysis of catch and catch rate data for blue shark *Prionace glauca* and shorfin mako *Isurus oxyrinchus* in the Hawaii-based pelagic longline fishery: 1995-2010. ISC SHARKWG Document ISC/11/SHARKWG-2/2.

Wells, R.D.J., Smith, S.E., Kohin, S., Freund, E., Spear, N. and Ramon, D.A. 2013. Age validation of juvenile shortfin mako (*Isurus oxyrinchus*) tagged and marked with oxytetracycline off southern California. Fishery Bulletin, 111(2).

Attachment 1: List of Participants

Chinese Taipei
Kwang-Ming Liu
National Taiwan Ocean University
2 Pei-Ning Road
Keelung, 20224 Taiwan
886-2-2462-2192 ext. 5018
886-2-24620291 (fax)
kmliu@ntou.edu.tw

Japan
Mikihiko Kai
Natl. Res. Inst. of Far Seas Fisheries
5-7-1 Orido, Shimizu
Shizuoka, Japan 424-8633
81-54-336-6045, 81-54-335-9642 (fax)
kaim@affrc.go.jp

Minoru Kanaiwa
Tokyo University of Agriculture
196 Yasaka, Abashiri
Hokkaido, Japan 099-2493
81-15-248-3906, 81-15-248-2940 (fax)
m3kanaiw@bioindustry.nodai.ac.jp

Seiji Ohshimo
Natl. Res. Inst. of Far Seas Fisheries
5-7-1 Orido, Shimizu
Shizuoka, Japan 424-8633
oshimo@affrc.go.jp

Norio Takahashi
Natl. Res. Inst. of Far Seas Fisheries
2-12-4 Fukuura, Kanazawa, Yokohama
Kanagawa, Japan 236-8648
81-45-788- 7517, 81-45-788-5004 (fax)
norio@affrc.go.jp

Kotaro Yokawa
Natl. Res. Inst. of Far Seas Fisheries
5-7-1 Orido, Shimizu
Shizuoka, Japan 424-8633
81-54-336-6016, 81-54-335-9642 (fax)
Yokawa@fra.affrc.go.jp

Mexico
José Leonardo Castillo-Geniz
Centro Regional de Investigación Pesquera (CRIP) Ensenada
Instituto Nacional de Pesca
Carr. Tijuana-Ensenada, km 97.5
El Sauzal de Rodríguez,
Ensenada, Baja California
México, C.P. 22760.
Ph/Fax: +(646) 174-6135
leonardo.castillo@inapesca.gob.mx

José Ignacio Fernández Méndez
Instituto Nacional de Pesca
Oficinas Centrales
Pitágoras 1320, Col. Santa Cruz Atoyac
C.P. 03310, México, D.F., México
Ph/Fax: +52 (55) 3871-9512
wecsg20@yahoo.com.mx

Carlos Javier Godínez Padilla
Centro Regional de Investigación Pesquera (CRIP) Ensenada
Instituto Nacional de Pesca
Carr. Tijuana-Ensenada, km 97.5
El Sauzal de Rodríguez,
Ensenada, Baja California
México, C.P. 22760.
Ph/Fax:+52 (646) 174-6135
carlosja_13@hotmail.com

Luis Vicente González-Ania
Instituto Nacional de Pesca
Oficinas Centrales
Pitágoras 1320, Col. Santa Cruz Atoyac
C.P. 03310, México, D.F., México
Ph/Fax: +52 (55) 3871-9512
luis.gania@inapesca.gob.mx

Raúl E. Lara-Mendoza
Facultad de Ciencias del Mar
Universidad Autónoma de Sinaloa,
Mazatlán, Sinaloa, México
Ph/Fax: + 52 (669) 180-9827
rlara.fish@gmail.com

Juan Fernando Márquez-Farías
Facultad de Ciencias del Mar
Universidad Autónoma de Sinaloa,
Mazatlan, Sinaloa, Mexico 82000
Ph/Fax: + 52 (669) 180-9827
fermqz@hotmail.com

Oscar Sosa-Nishizaki
Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE),
Fisheries Ecology Laboratory
Carretera Ensenada-Tijuana No. 3918
Ensenada, Baja California,
México, CP 22860.
Ph/Fax: + 52 (646) 1750500 ext. 24267
ososa@cicese.mx

Javier Tovar-Ávila
Centro Regional de Investigación Pesquera (CRIP) Bahía Banderas
Instituto Nacional de Pesca
Calle Tortuga #1, La Cruz de Huanacaxtle
Nayarit, México, C.P. 63732,
Ph/Fax: +(329) 2955630
javiertovar.mx@gmail.com

United States

Felipe Carvalho
NOAA/NMFS PIFSC
2570 Dole St.
Honolulu, HI 96822-2396
808-725-5605, 808-983-2902 (fax)
Felilpe.Carvalho@noaa.gov

Mike Kinney
NOAA/ NMFS SWFSC
8901 La Jolla Shores Drive
La Jolla, CA 92037
858- 334-2887, 858-546-7003 (fax)
Michael.Kinney@noaa.gov

Hui-Hua Lee
NOAA/NMFS SWFSC
8901 La Jolla Shores Drive
La Jolla, CA 92037
808-725-5352, 808-983-2902 (fax)
Huihua.Lee@noaa.gov

Tim Sippel
NOAA/NMFS SWFSC
8901 La Jolla Shores Drive
La Jolla, CA 92037
858-546-7070, 858-546-7003 (fax)
Tim.Sippel@noaa.gov

Suzanne Kohin
NOAA/NMFS SWFSC
8901 La Jolla Shores Drive
La Jolla, CA 92037
858-546-7104, 858-546-7003 (fax)
Suzanne.Kohin@noaa.gov

Attachment 2. Meeting Documents

WORKING PAPERS	TITLE AND AUTHORS	POST ON WEB?
ISC/14/SHARKWG-3/01	Description of the Hawaii Longline Observer Program. Tim Sippel, Nicole Nasby-Lucas and Suzanne Kohin (tim.sippel@noaa.gov)	Y
ISC/14/SHARKWG-3/02	Catch data for shortfin mako shark reported by fishery observers from Mexican shark longline and driftnet fisheries in the North Pacific in 2006-2014. Jose Leonardo Castillo-Geniz, Carlos Javier Godinez-Padilla, Hector Alejandro Ajás-Terriquez, Luis Vicente González-Ania (leonardo.castillo@inapesca.gob.mx)	Y
ISC/14/SHARKWG-3/03	Catches of mako sharks from U.S. commercial and recreational fisheries in the North Pacific Ocean. Tim Sippel, Felipe Carvalho, Steven L. H. Teo and Suzanne Kohin (tim.sippel@noaa.gov)	Y
ISC/14/SHARKWG-3/04	Distribution, body length and abundance of blue shark and shortfin mako in the Northwestern Pacific Ocean based on longline research vessels from 2000 to 2014. Seiji Ohshimo, Yuki Fujinami, Ko Shiozaki, Mikihiko Kai, Yasuko Semba, Nobuhiro Katsumata, Daisuke Ochi, Hiromasa Matsunaga, Hiroshi Minami, Kotaro Yokawa (oshimo@affrc.go.jp)	Y
ISC/14/SHARKWG-3/05	Evaluation of growth band counts precision in the vertebrae of shortfin mako sharks caught in the Mexican Pacific. Javier Tovar-Ávila, Darío A. Chávez-Arrenquín, J. Leonardo-Castillo-Géniz, David Corro-Espinosa, Carlos J. Godínez-Padilla, Gustavo Andrade-Domínguez, Amado Torres, J. Fernando Márquez-Farías, Raúl E. Lara-Mendoza, Jesús E. Osuna Soto, Allan Rosales Valencia and Luis Daniel Carrillo Collín (javier.tovar@inapesca.sagarpa.gob.mx)	Y
ISC/14/SHARKWG-3/06	Oxytetracycline age validation of an adult shortfin mako shark after six years at liberty. Michael J. Kinney, R. J. David Wells, Suzanne Kohin (michael.kinney@noaa.gov)	N
ISC/14/SHARKWG-3/08	Standaradized abundance index of juvenile shortfin mako shark (*Isurus oxyrinchus*) based on fishery independent survey in the Southern California Bight (1994-2013). Rosa M. Runcie, Yi Xu, James Wraith, Suzanne Kohin (Rosa.Runcie@noaa.gov)	Y

ISC/14/SHARKWG-3/09	Standardized catch rates of shortfin mako shark in the U.S.West Coast drift gillnet fishery. Hui-Hua Lee, Kevin Piner, Steven L.H. Teo, and Suzanne Kohin (Huihua.lee@noaa.gov)	Y
ISC/14/SHARKWG-3/10	Standardized catch rates of shortfin mako shark (*Isurus oxyrinchus*) caught by the Hawaii-based pelagic longline fleet (2002-2013). Felipe Carvalho and Gerard DiNardo (felipe.carvalho@noaa.gov)	Y
ISC/14/SHARKWG-3/11	CPUE standardization and catch estimate of shortfin mako shark by Taiwanese large-scale tuna longline fishery in the North Pacific Ocean. Wen-Pei Tsai and Kwang-Ming Liu (kmliu@mail.ntou.edu.tw)	Y
ISC/14/SHARKWG-3/13	Developing and Testing a State-space Production Model for the Shortfin Mako Shark in the North Pacific Ocean. Felipe Carvalho, Hui-Hua Lee, Yi-Jay Chang, and Gerard DiNardo (felipe.carvalho@noaa.gov)	N
ISC/14/SHARKWG-3/14	CPUE standardization for shortfin mako, *Isurus oxyrinchus*, of the Japanese Longline Fishery in the North Pacific Ocean. Mikihiko Kai, Yasuko Semba, Ko Shiozaki, Seiji Oshimo and Kotaro Yokawa (kaim@affrc.go.jp)	Y
ISC/14/SHARKWG-3/15	Counting of concentric bands in vertebrae of mako shark of the North Pacific Ocean. J. Fernando Márquez-Farías and Raúl E. Lara-Mendoza (fermqz@yahoo.com)	Y
ISC/14/SHARKWG-3/16	Standardized catch rates for mako shark (*Isurus oxyrinchus*) in the 2006-2014 Mexican Pacific longline fishery based upon a shark scientific observer program. Luis Vicente González-Ania, José Ignacio Fernández-Méndez, José Leonardo Castillo-Géniz (luis.gania@inapesca.gob.mx)	Y
ISC/14/SHARKWG-3/17	Estimations of the Shortfin Mako Shark (*Isurus oxyrinchus*) catches by Mexican Pacific fisheries (1976-2013) Oscar Sosa-Nishizaki, Luz E. Saldaña-Ruiz, David Corro-Espinosa, Javier Tovar-Ávila, José Leonardo Castillo-Géniz, Heriberto Santana-Hernández, J. Fernando Márquez-Farías (ososa@cicese.mx)	Y

INFORMATION PAPERS

ISC/14/SHARKWG-3/INFO-01	Growth and spatiotemporal distribution of juvenile shortfin mako, *Isurus oxyrinchus*, in the western and central North Pacific. Mikihiko Kai, Ko Shiozaki, Seiji Ohshimo and Kotaro Yokawa (kaim@affrc.go.jp)	Abstract Only

ISC/14/SHARKWG-3/INFO-02	Spatial and temporal patterns in the size and sex of shortfin mako sharks from US and Japanese commercial fisheries: a synthesis to guide future research. Tim Sippel, Seiji Ohshimo, Kotaro Yokawa, Yasuko Semba, Mikihiko Kai, Felipe Carvalho, Mike Kinney, and Suzanne Kohin (tim.sippel@noaa.gov)	Y
ISC/14/SHARKWG-3/INFO-03	Preliminary overview of the SPC data holdings in the North Pacific with respect to mako shark caught by non-ISC members, and ISC members in the north Pacific EEZ's (excluding USA) (joelr@spc.int)	Y
ISC/14/SHARKWG-3/INFO-04	Information on the existing knowledge on the life history traits of shortfin mako shark, *Isurus oxyrinchus* of the Pacific Ocean in Mexico. David Corro Espinosa, Felipe Galván Magaña, and Alfonso Medellín Ortíz (davidlce@yahoo.com)	Y

Attachment 3. Meeting Agenda

SHARK WORKING GROUP (SHARKWG)

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

INTERCESSIONAL WORKSHOP AGENDA

19-26 November, 2014
Holiday Inn Express
Blvd. Francisco Medina Ascencio 3974
Col. Villa Las Flores
C.P. 48356 Puerto Vallarta, Jalisco, Mexico

Meeting begins at 9:00 am on Wednesday, 19 November

1. Opening of SHARKWG Workshop
    - Welcoming remarks
    - Introductions
    - Meeting arrangements

2. Distribution of documents and numbering of Working Papers

3. Review and approval of agenda

4. Appointment of rapporteurs

5. Report of the Chair: Summary of the July 2014 Working Group and Plenary Meeting and WCPFC SC Meeting

6. Review of shortfin mako catch, CPUE and size information by nation and fishery (day 1 – Kinney & Tovar-Avila; day 2 – Lee & Carvalho; day 3 – Sippel & Takahashi)
    - Catch and discard data and total catch estimation procedures
    - Abundance indices
    - Size data

7. Review of biological information on mako sharks; update on age and growth work (Sosa-Nishizaki & Carvalho)
    - Chair update

- Life history matrix
- Stock structure
- Other biological information

8. Review prior analyses including indicator analyses (Kinney & Kai)

9. Modeling approaches to use for shortfin mako sharks (Kinney & Kai)

10. Establish work plan and assignments, templates and deadlines

11. Other matters

    - Past papers and website

12. Future SHARKWG meetings

13. Clearing of report

14. Adjournment

Meeting ends at 1:00 pm on Wednesday, 26 November