Annex 6

REPORT OF THE SHARK WORKING GROUP WORKSHOP

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

19-21 April 2011
Keelung, Chinese Taipei

1.0 INTRODUCTION

An intercessional workshop of the Shark Working Group (SHARKWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened in Keelung, Taiwan from 19-21 April 2011. The goals of this workshop were to 1) review and discuss provisional fisheries data and research, 2) develop a work plan to conduct shark stock assessments, and 3) elect a SHARKWG Chairperson.

Gerard DiNardo, Chairman of the ISC, welcomed participants from Chinese Taipei, Japan, and the United States of America (USA) (Attachment 1). Rapporteuring duties were assigned to Dean Courtney, Hua-Hsun Hsu, Suzanne Kohin, Kwang-Ming Liu, Yasuko Semba, Wen-Pei Tsai, and Kotaro Yokawa. Dean Courtney served as the lead rapporteur. Working papers were distributed and numbered (Attachment 2), and the meeting agenda adopted (Attachment 3). Most authors who submitted a working paper, agreed to have their papers posted on the ISC website where they will be available to the public. The authors of working papers ISC/11/SHARKWG-1/01, ISC/11/SHARKWG-1/07, and ISC/11/SHARKWG-1/08 declined posting on the ISC website.

2.0 REVIEW OF RECENT SHARK DATA AND RESEARCH

2.1. Stock Structure and Migration Models

2.1.1 Update on recent studies relating to the life history of shortfin mako sharks in the Northwest Pacific, presented by Yasuko Semba (oral presentation)

This presentation reviewed existing information on the life history parameters of *Isurus oxyrinchus*. Growth parameters, size at maturity, seasonality of mating, gestation period, and fecundity were introduced and traits with high uncertainty were discussed. Regarding age and growth, the paucity of large sharks in the age and growth study influences the estimation of L_∞ and thus the estimates of longevity and natural mortality. Additionally, growth band pair periodicity may need review. Regarding reproductive traits, the gestation period is uncertain because of large variation between studies. In this context, it is important to collect more pregnant females in various developmental stages, especially early stages. Additionally, the occurrence of large adult females is rare, and, as a result, the investigation of gear selectivity and the research of female migration using PAT were suggested.

Discussion

It was noted that the range of values presented for a number of life history traits including gestation period, longevity, and growth rates, exhibit high levels of uncertainty and will present a challenge when making decisions regarding stock assessment assumptions and parameterization. Some of the uncertainty could be addressed by combining research efforts and data within the SHARKWG in order to increase sample size and cover a wider range of sizes and areas. As an example, larger sharks than those presented have been collected adjacent to Taiwan by scientists at the National Taiwan Ocean University and these data may help fill in gaps to improve estimations. It was also suggested that specialists on certain aspects of the biology of pelagic sharks be identified who can prepare a summary of life history characteristics for all species so that the information will be available for use in stock assessments or ecological risk analyses.

2.1.2 Preliminary analysis of sex-specific distributional pattern of shortfin mako, Isurus oxyrinchus, in the western and central North Pacific, presented by Yasuko Semba (ISC/11/SHARKWG-1/1)

Shortfin mako, *Isurus oxyrinchus*, is a large pelagic shark with wide distribution from the tropical to temperate oceans. This species has marked difference in size and life history traits between the sexes, but the distributional pattern of each sex has not been investigated in detail. This document presents the result of preliminary analysis of distributional patterns by sex and ontogenetic stage for *I. oxyrinchus*, based on the fishery and research data. In the juvenile stage, both males and females frequently occurred in the northwestern part (higher than 30°N and west of the dateline), while the ratio of females was higher than that of males. In the adult stage, males exclusively occurred in the southeastern part (lower than 30°N and east of the dateline) with some seasonal fluctuation, while females, both pregnant and non-pregnant, were caught widely across the North Pacific from subtropical and temperate areas. The results of this study suggest an ontogenetic change in the distributional pattern and possible sexual differences in the distributional pattern at each ontogenetic stage. Further research and effort to collect size data by sex are necessary to verify the complex distributional pattern of *I. oxyrinchus* by sex and ontogenetic stage.

Discussion

It was noted that the proposed migration model provides a provisional depiction of shortfin mako stock structure in the North Pacific Ocean, and may help decide if a sex specific model will be needed. However, additional research will be required before any migration model can be accepted. The paucity of data for large sharks was noted, and the SHARKWG discussed the need to combine data from many studies in order to obtain information on large sharks. Additional samples of large sized sharks may be required and the utility of industry based incentive programs should be explored to obtain specimens of the largest sharks.

2.1.3 Genetic population structure of shortfin mako (Isurus oxyrinchus) inferred from mitochondrial DNA on inter-oceanic scale, presented by Mioko Taguchi (ISC/11/SHARKWG-1/2)

Genetic population structure of the shortfin mako on an inter-oceanic scale was examined using partial control region sequences of mitochondrial DNA from 106 shortfin makos caught in the North Atlantic, eastern and western Indian Ocean, central North Pacific, and eastern and western South Pacific. The spatial analysis of molecular variance estimated genetic structuring of shortfin mako between the North Atlantic and Pacific Ocean groups with a genetic break in the Indian Ocean, which was also supported by pairwise φ_{st} estimates and the geographical distribution of haplotypes. Moreover, the observed high haplotype diversities compared to nucleotide, as well as the star-like genealogy in minimum spanning network, were associated with a recent population growth of the shortfin mako.

Discussion

Although sample sizes may have been too low to identify significant differences between subpopulations in the Pacific, the results showed that genetic divergence was larger between the North and South Pacific than within the South Pacific. Shortfin mako shark stock structure will be one of the more important traits to examine for the stock assessment. If information is not yet conclusive, it may be necessary to begin by assuming a single North Pacific-wide stock, and if stock differentiation is later identified, a two- or multi-stock model would then be implemented.

Recommendations

- Stock structure analyses for shortfin mako sharks should be completed as soon as possible. Preliminary genetics and tag recapture analyses conducted by U.S. scientists at the NOAA Fisheries, Southwest Fisheries Science Center point toward a single northern Pacific Ocean stock of shortfin mako shark, distinct from southeastern Pacific and southwestern Pacific substocks. Analyses should be completed and published as soon as possible.

- Blue shark genetic and tagging studies should be reviewed, and if not adequate to address stock structure, further studies should be prioritized.

2.2 Catch and Size Composition Data

2.2.1 The size composition and age structure of shortfin mako (Isurus oxyrinchus) caught by Japanese commercial fisheries in the North Pacific, presented by Mioko Taguchi (ISC/11/SHARKWG-1/03)

This study examined the size composition and age structure of shortfin mako sharks caught by Japanese commercial fisheries in the North Pacific for use in stock analyses. Length composition data were available from a total of 96,000 shortfin mako caught by Japanese commercial fisheries, including the coastal, offshore, and distant-water longline and coastal drift net fisheries in the North Pacific Ocean during the years 2005 – 2009. Length frequencies from the offshore longliners were depicted by quarter and area, as offshore longliners represented most of the available size data. Overall, length frequencies from offshore longliners were not very different among years and quarters, but did differ among areas, suggesting that shortfin mako in the

eastern North Pacific are larger than in the western North Pacific. The length frequencies from offshore longliners were converted to age compositions with a length at age relationship to examine the age structure of catch by the offshore longliners. The results suggested that shortfin makos caught by Japanese offshore longliners were composed primarily of juveniles aged 1 and 2 years, and that few adult females were captured.

Discussion

The SHARKWG discussed the need for collaboration to evaluate alternative hypotheses for the size composition structure of the shortfin mako population in the North Pacific and the need to collect sex size data.

2.2.2 The analysis of length-weight relationship of commercial catch for blue shark (Prionace glauca) in Kesen-numa, presented by Minoru Kanaiwa (ISC/11/SHARKWG-1/04)

Blue shark (*Prionace glauca*) has one of the highest stock abundances among pelagic sharks and is relatively productive. For longline and drift net fisheries based out of the Kesen-numa fishing port, blue sharks have had a high market value. As a result, longline and drift net vessels unload large numbers of blue sharks at one time in the Kesen-numa fishing port, and they are often put up for the wholesale auction as a mound categorized by size and freshness. Under these circumstances, development of an easy and effective way to obtain accurate size sampling of blue sharks is required in order to estimate reliable catch at size data for input in stock assessment. One of most important factors to consider for improving the representativeness of catch at size data is the length relationship with weight (L-W). This study developed and implemented a new sampling design for the collection of blue shark size composition data in Kesen-numa. The new sampling design was used to compare fishery dependent and fishery independent L-W relationships for blue sharks delivered to the Kesen-numa fishing port with linear models and the Akaike information criteria (AIC). Results of the analysis of these data indicate the necessity of fishery dependent L-W relationships, and the use of the fishery specific L-W relationships are recommended for the estimation of landed weight of blue shark from length measurements and for the estimation of length frequency from the processed weight data recorded by the wholesale market.

On 11 March 2011, the Eastern Japan Great Earthquake Disaster occurred and caused extensive and severe damage in the Pacific Ocean side of Tohoku region. Especially in the Kesen-numa fishing port, the fish processing plant suffered serious damage. In this deplorable situation, productive fishery assessment and managing are required to rebuild the shark fishery in Kesen-numa. A continuous monitoring program for the collection of landed blue shark length frequency data is important during the shark fishery rebuilding because Eastern Japan Great Earthquake Disaster will decrease the fishing effort of blue shark fishery which has never occurred historically.

Discussion

The SHARKWG discussed the benefits of the new sampling design and encouraged implementation of the program as soon as practical. The SHARKWG noted the extensive and

severe damage in the Kesen-numa fishing port and discussed its potential impact (reduction in fishing pressure) on blue shark populations in the North Pacific Ocean. To assess the impact of the reduction in fishing effort, the WG supported continuous monitoring of landed blue shark length frequency data during the shark fishery rebuilding phase.

2.2.3 Preliminary compilation and analysis of shark catch data from the Hawaii-based pelagic longline fishery, presented by Dean Courtney (ISC/11/SHARKWG-1/05)

This working paper presents preliminary statistical information about four shark species (blue shark, shortfin mako, oceanic whitetip, and silky shark) taken by the Hawaii-based pelagic longline fishery. All are expected to be species of interest for international-scale stock assessments in the foreseeable future. Nominal catch, catch rate and length measurements were reported from January 1995 into early 2010 by personnel of the Pacific Islands Regional Observer Program (PIROP) and summarized herein as examples of the types of shark data available at the NOAA Fisheries, Pacific Islands Fisheries Science Center. Results also include comparisons of fishery observer and commercial logbook data to elucidate typical patterns and biases associated with self-reporting of sharks taken incidentally or as bycatch.

Discussion

It was noted that the issue of discards is more serious for sharks than for billfish and tuna, and the ratio of live release and dead discards needs to be evaluated as well as the methods used to release captured sharks.

2.2.4 Catch and life history parameters of pelagic sharks in the northwest Pacific, presented by Kwang-Ming Liu (ISC/11/SHARKWG-1/06)

Annual landings (whole weight) of sharks at two major offshore shark landing fish markets caught in the northwestern Pacific fluctuated from 4,762 MT in 2001 to 4,794 MT in 2010 with a mean of 5,669 MT during this period. Blue shark was the dominant shark species comprising 44.54% of reported shark landings. The scalloped hammerhead and shortfin mako sharks were the other major species comprising 9.87% and 9.42% of shark landings, respectively. Life history parameters including age and growth, and reproductive biology of 11 pelagic sharks were provided. Recent stock assessments of pelagic sharks in Taiwanese waters were briefly reviewed. The recent stock assessments of the pelagic thresher and shortfin mako suggested these stocks are overexploited.

Discussion

The SHARKWG discussed the need for collaboration to compare and compile life history data of pelagic sharks among regions (western, central, and eastern) of the North Pacific. Four points of clarification were discussed: 1) most sharks landed in Taiwan come from these two ports, 2) blue sharks were processed on board; other sharks were not, 3) most sharks were captured in the offshore tuna longline fleet, and 4) catch differs by season. It was also noted that effort monitoring differed by fleet which may impact the results.

2.2.5 Notice of Preparatory Workshop on Data and Modeling for a Stock Assessment of the Silky Shark in the Eastern Tropical Pacific Ocean, presented by Suzanne Kohin on behalf of the IATTC (ISC/11/SHARKWG-1/07)

This document presented a brief description of the Inter-American Tropical Tuna Commission's 2nd Technical Meeting on Sharks which will take place May 13-14, 2011 in La Jolla, California, USA. ISC participants are encouraged to attend.

Discussion

The SHARKWG acknowledged the benefit of collaborations with RFMOs on pelagic shark assessments and noted that several members of the SHARKWG plan to attend the IATTC 2nd Technical Meeting on Sharks. The SHARKWG also noted that the IATTC stock assessment focus within the Antigua convention area does not take stock structure into account. The same holds true for the WCPFC which intends to limit its shark assessments to the WCPO.

2.2.6 Outline of new available catch and effort data of pelagic sharks caught by the Mexican shark longline fishery in the North Pacific, Mexico was not able to attend (ISC/11/SHARKWG-1/08)

The National Fisheries Institute of Mexico collected, through on board scientific observers, catch and effort data of pelagic sharks caught as target species by the Mexican longline fleet in the Pacific Economic Exclusive Zone of Mexico during recent years (2006-2008 and 2010). Pelagic sharks are also commonly caught as bycatch species by other fleets including the tuna purse seine fishery. In this report, new information from the longline fleet is provided, in particular data for blue shark and mako sharks. The fishing area of the longline fleet includes all the Mexican EEZ mainly between 20° x 28°N. Although the use of driftnets was common until 2008, this fishery is now prohibited by law, and sharks are only caught with longline. Blue shark is the most common species caught by the longline fishery, with an average of 20 blue sharks caught per fishing set (N=6350 observed fishing sets), whereas mako sharks have lower catch rates, with less than one mako shark per fishing set. Although the collected catch data has information on the number of animals caught, weight transformation needs to be carried out as well as standardization of effort.

Discussion

The representative from Mexico was unable to attend the meeting, but did provide a working paper. The SHARKWG thanked Mexico for their contribution.

2.2.7 Summary of available catch statistics of pelagic sharks caught by Japanese offshore and distant-water longliners, presented by Kotaro Yokawa (ISC/11/SHARKWG-1/09)

Logbook information of some major shark species (blue, mako, salmon, oceanic whitetip and thresher sharks) caught by Japanese offshore and distant-water longliners are briefly summarized

to examine its quality as inputs for the stock analysis of these sharks. Catch number and processed weight data are available for blue, mako, and salmon sharks since 1994, and these are compiled by National Research Institute of Far Seas Fisheries. The same types of information are also available for oceanic whitetip shark and thresher sharks since 1998, but data have not been compiled yet. Total catch of shortfin mako sharks is stable while that of blue shark shows a steadily declining trend since the early 2000s. This catch decrease, however, would partially be due to the decrease of the number of offshore surface longliners. The trends of average weight of blue shark by region (east/west of dateline and north/south of 20N) are also declining steadily. Catch of salmon shark shows a sudden increase in 2004, but information from skippers of Japanese offshore surface longliners suggested that the some shift of their fishing ground occurred around 2004.

Discussion

The SHARKWG noted that there appeared to be relatively rich data sets for blue and shortfin mako shark stock assessment in the North Pacific, including regional life history information and fishery dependent data that covered a broad geographic range. However, the SHARKWG discussed that collaboration would be required to bring the regional life history and fishery dependent data sets together.

3.0 SHARKWG WORKPLAN

While the SHARKWG adopted species under its purview (Attachment 4), prioritization, in the short-term, was given to blue and shortfin mako sharks in the NPO. Assessments for both species will be completed within the next few years, first blue shark then shortfin mako. There is considerable uncertainty in the biological parameter estimates, and this will need to be addressed in the research plan. The SHARKWG will continue to monitor research and fishery activities relating to the other ISC SHARKWG species of interest. Below is the work plan developed to achieve these goals.

A. Fishery Statistics: Data Acquisition, Review, and Rectification

1. Assemble available fishery statistics – Category I, II, and III data
2. Assess extent of under reporting
3. Document observer programs
4. Convene data workshop in December 2011

B. Biological Research

1. Inventory available data and develop species-specific life history summary tables
2. Determine spatial extent of biological sampling programs
3. Develop research plan to advance the estimation of biological parameters

C. Ecological Research

1. Stock structure

a) Assemble available genetic information and assess utility for assessing stock structure
b) Assemble available tagging information and assess utility for assessing stock structure or including movement in assessment models
c) Integrate oceanographic information
d) Develop plausible stock structure scenarios for stock assessment
e) Identify potential research to advance stock structure

D. Shark Stock Assessment

1. Review 2009 blue shark assessment
   a) Conduct exploratory trials with alternative models using data from 2009 assessment to examine between model performance
2. Finalize decisions on fishery characterizations and assemble associated catch and size data; develop blue shark CPUE indices by Spring 2012
3. Complete blue shark assessment by Fall 2012
4. Complete mako shark assessment by 2013

4.0 OTHER BUSINESS

4.1 SHARKWG Chairperson Elections

Gerard DiNardo administered the elections and Suzanne Kohin of NOAA Fisheries, Southwest Fisheries Science Center was elected as Chairperson of the ISC SHARKWG.

4.2 Work Assignments

The following assignments were adopted:

4.2.1 Chairperson Assignments

- Monitor activities of WCPFC and IATTC on shark assessments and collaborate as appropriate.

- Consider including specialists on oceanography in the SHARKWG to help address CPUE standardization, migration models and stock distribution (Recomm)

- Follow up with U.S. scientists at the NOAA Fisheries Southwest Fisheries Science Center to insure that stock structure analysis for shortfin mako sharks is completed as soon as possible and includes all available genetic and tagging data.

- Expand ISC biological research plan to include sharks.

- Query extent of Category I, II, and III data for sharks in the ISC Database – May 1, 2011.

- Request submission of Category I, II, and III data for sharks – May 15, 2011.

4.2.2 Working Group Assignments

- Review availability, content, and extent (coverage) of observer data for information on shark species, size and sex compositions of the catch, discards, and other fishery information

- Compile all available information from various regions within the North Pacific to develop a matrix of life history information for mako and blue sharks (and eventually the other species of interest to the SHARKWG) in order to help identify data gaps and research priorities.

- Available blue shark genetics and tagging studies should be assembled and reviewed. If deemed inadequate to address stock structure, further studies should be prioritized. (Recomm)

5.0 FUTURE MEETINGS

The next intercessional SHARKWG workshop is tentatively scheduled for early December 2011 in Honolulu, Hawaii, USA. Full participation from all member nations is encouraged.

6.0 ADJOURNMENT

The ISC SHARKWG intercessional workshop was adjourned at 2:30pm on 21 April 2011. The Chairman expressed his appreciation to Dr. Kwang-Ming Liu, National Taiwan Ocean University, for hosting the workshop, and to all participants for their contributions and cooperation in completing a successful meeting.

Attachment 1. List of Participants

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Attachment 2. Working Papers and Background Papers

WORKING PAPERS

ISC/11/SHARKWG-1/01	Preliminary analysis of sex-specific distributional pattern of shortfin mako, *Isurus oxyrinchus*, in the western and central North Pacific. Yasuko Semba and Kotaro Yokawa. (senbamak@affrc.go.jp)
ISC/11/SHARKWG-1/02	Genetic population structure of shortfin mako (*Isurus oxyrinchus*) inferred from mitochondrial DNA on inter-oceanic scale. Mioko Taguchi, Toru Kitamura, and Kotaro Yokawa. (tagu305@affrc.go.jp)
ISC/11/SHARKWG-1/03	The size composition and age structure of shortfin mako (*Isurus oxyrinchus*) caught by Japanese commercial fisheries in the North Pacific. Mioko Taguchi, and Kotaro Yokawa. (tagu305@affrc.go.jp)
ISC/11/SHARKWG-1/04	The analysis of length-weight relationship of commercial catch for blue shark (*Prionace glauca*) in Kesen-numa. Minoru Kanaiwa, Ritsuko Kuboi, Phalgi Chon, Mioko Taguchi, and Kotaro Yokawa. (m3kanaiw@bioindustry.nodai.ac.jp)
ISC/11/SHARKWG-1/05	Preliminary compilation and analyses of shark catch data from the Hawaii-based pelagic longline fishery. William Walsh and Dean Courtney. (William.Walsh@noaa.gov)
ISC/11/SHARKWG-1/06	Catch and life history parameters of pelagic sharks in the northwest Pacific. Kwang-Ming Liu and Wen-Pei Tsai. (kmliu@mail.ntou.edu.tw)
ISC/11/SHARKWG-1/07	Notice of preparatory workshop on data and modeling for a stock assessment of the silky shark in the eastern Pacific Ocean. IATTC. (alexdasilva@iattc.org)
ISC/11/SHARKWG-1/08	Outline of new available catch and effort data of pelagic sharks caught by the Mexican shark longline fishery in the North Pacific. Javier Tovar-Avila, Luis Vicente Gonzalez-Ania, Alejandro Liedo-Galindo, and Fernando Marquez-Farias. (javiertovar.mx@gmail.com)

ISC/11/SHARKWG-1/09	Summary of available catch statistics of pelagic sharks caught by Japanese offshore and distant-water longliners. Yuko Hiraoka and Kotaro Yokawa. (yhira415@fra.affrc.go.jp)

BACKGROUND PAPERS

WCPFC-SC6-2010/EB-WP-01	A proposal for a research plan to determine the status of the key shark species. Shelley C. Clarke and Shelton J. Harley. (shelleyc@spc.int)
WCPFC7-2010/16	SPC – Progress towards shark assessments. SPC.

Okamura, H., and Semba, Y. 2009. A novel statistical method for validating the periodicity of vertebral growth band formation in elasmobranch fishes. Canadian Journal of Fisheries and Aquatic Sciences, 66:771-780.

Semba, Y., Nakano, H., and Aoki, I. 2009. Age and growth analysis of the shortfin mako, *Isurus oxyrinchus*, in the western and central North Pacific Ocean. Environmental Biology of Fishes, 84:377-391.

Semba, Y., Aoki, I., and Yokawa, K. 2011. Size at maturity and reproductive traits of shortfin mako, *Isurus oxyrinchus*, in the western and central North Pacific. Marine and Freshwater Research, 62:20-29.

Walsh, W., Bigelow, K., and Sender, K. 2009. Decreases in shark catches and mortality in the Hawaii-based longline fishery as documented by fishery observers. Marine and Coastal Fisheries: Dynamics Management, and Ecosystem Science, 1:270-282.

Chang, J. H., and Liu, K. M. 2009. Stock assessment of the shortfin mako shark (*Isurus oxyrinchus*) in the Northwest Pacific Ocean using per recruit and virtual population analyses. Fisheries Research, 98:92-101.

Joung, S. J., Chen, C. T., Lee, H. H., and Liu, K. M. 2008. Age, growth, and reproduction of silky sharks, *Carcharhinus falciformis*, in northeastern Taiwan waters. Fisheries Research, 90:78-85.

Joung, S. J., and Hsu, H. H. 2005. Reproduction and embryonic development of the shortfin mako, *Isurus oxyrinchus* Rafinesque, 1810, in the northwestern Pacific. Zoological Studies, 44:487-496.

Joung, S. J., Liao, Y. Y., Liu, K. M., Chen, C. T., and Leu, L. C. 2005. Age, growth, and reproduction of the spinner shark, *Carcharhinus brevipinna*, in the northeastern waters of Taiwan. Zoological Studies, 44:102-110.

Attachment 3. Agenda

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

SHARK WORKING GROUP (SHARKWG)

INTERCESSIONAL WORKSHOP AGENDA

April 19 (Tuesday), 0930-1000 – Registration

April 19 (Tuesday), 1000-1700

1. Review of Fisheries Data and Research
2. Develop WG Work Plan

April 20 (Wednesday), 1000-1700

2. Develop WG Work Plan (Cont)
3. Chairperson Elections
4. Rapporteurs and Participants Complete Assigned Sections of Workshop Report

April 21 (Thursday) 1000-1200

5. Clearing of Report
6. Adjournment

Attachment 4. Species of Interest

Categorization of stocks of key shark species captured in the North Pacific by the ISC Shark Task Force Group (Annex_11_ISC10_SHARK_Jul10)[1].

Species	(1) Stocks whose stock assessments could be conducted under leadership of the ISC	(2) Stocks whose stock assessments are better conducted with ISC collaboration	(3) Stocks whose stock assessments are better conducted under leadership of an RFMO without ISC	(4) Stocks for which there is currently insufficient information
Blue shark *Prionace glauca*	**Category 1**			
Shortfin mako *Isurus oxyrinchus*	**Category 1**			
Bigeye thresher *Alopias superciliosus*	**Category 1 or 2**			
Pelagic thresher *A. pelagicus*	**Category 1 or 2**			
Silky shark *C. falciformis*		**Category 2**		
Oceanic whitetip *Carcharhinus longimanus*		**Category 2**		
Hammerhead Sharks *Sphyrna sp.*		**Category 2 or 3**		
(Common) Thresher shark *A. vulpinus*			**Category 3**	
Longfin mako *I. paucus*				**Category 4**
Salmon shark *Lamna ditropis*				**Category 4**
Crocodile shark *Pseudocarcharias kamoharai*				**Category 4**

[1] http://isc.ac.affrc.go.jp/pdf/ISC10pdf/Annex_11_ISC10_SHARK_Jul10.pdf