INTER-AMERICAN TROPICAL TUNA COMMISSION

SECOND TECHNICAL MEETING ON SHARKS

LA JOLLA, CALIFORNIA (USA)
13-14 MAY 2011

PREPARATORY WORKSHOP ON DATA AND MODELING FOR A STOCK ASSESSMENT OF SILKY SHARK IN THE EASTERN PACIFIC OCEAN

MEETING REPORT

The objectives of the workshop were to continue to develop a stock assessment model for silky sharks in the eastern Pacific Ocean (EPO), identify collaborators and data sources, and collate data. The meeting was attended by scientists from many of the IATTC's member countries and other interested parties (Appendix I). On the first day, the IATTC staff gave several presentations describing the stock assessment model, available data, and modeling and data assumptions (Appendix II). The remainder of the meeting focused on identifying useful data sources which could potentially be available from collaborators.

The available catch data for silky sharks are incomplete, and assumptions have to be made to reconstruct the total catch. The available data differs among nations and fleets within nations, and so different assumptions have to be made . The assessment model commences in 1993, when catches of sharks began to be recorded in the IATTC purse-seine data base; however, species identification was an issue in the early years of shark catch reporting. Effort data for the purse-seine fleet prior to 1993 are available, and could be used to reconstruct catch prior to 1993. At a minimum, catch needs to be reconstructed back to 1993 for all fleets. The stock assessment accommodates the fact that the population was exploited prior to 1993 through a series of assumptions and estimated parameters.

Various fleets operate throughout the EPO and the vulnerability of silky sharks differs among these fleets. A single nation may have multiple fleets that catch silky sharks, and fleets may differ by fishing method, size of vessel, area fished (*e.g.* costal versus offshore), or whether they target silky shark. Coastal nation fleets are often described as 'artisanal', but this is misleading since there are a variety of fleets, including industrial fleets. Information is needed about each fleet to appropriately model the stock dynamics. Catch needs to be expanded to total catch by gear type (fleet), region, and gender. If the catch from a nation is a minor component of the total catch, it may not be necessary to obtain details from each of their fleets.

Auxiliary data used in the stock assessment such as size composition, biological information (*e.g.* growth and maturity), and indices of relative abundance are also available, but differ among countries and fleets. The meeting participants identified several data sources not currently used in the assessment that would improve the quality of the assessment. Many of the coastal nations have recently introduced their Plans of Action for sharks that include the collection of data. The available data are described in Table 1.

Two sub-populations of silky sharks, north and south of the equator, have been identified in the EPO based on CPUE trends, size composition, and genetics data. These areas are currently considered the basis for two separate stock assessments. However, there may be an interaction with these stocks and those of the central Pacific, and the northern sub-stock may be comprised of two or more sub-stocks. Few small silky sharks are caught in the southern area, and it is not clear where recruits to this sub-stock originate.

The meeting participants noted concern over the status of the oceanic whitetip shark. The IATTC staff

decided to initially concentrate on the silky shark, due to the more abundant data for this species. Lessons learned from the silky shark assessment can be applied to the assessment of oceanic whitetip that is planned for the future. Meanwhile, bycatch mitigation measures should be considered for oceanic whitetip sharks.

A new stock-recruitment relationship that is more appropriate for modeling shark populations has been developed. The stock-recruitment relationships included in general fish stock assessment programs have to this date been inadequate to represent species of low fecundity like sharks. The new stock-recruitment relationship is now included in Stock Synthesis.

The IATTC staff will correspond with participants during late summer and fall in order to prepare the data identified in Table 1 for the assessment. The next meeting is planned for early December 2011. An updated stock assessment that contains the additional data identified in Table 1 will be presented and further refined, based on comments from the participants. A final assessment is planned for the third meeting of the IATTC Scientific Advisory Committee (SAC3), which will probably be held in May 2012.

TABLE 1: Available data for silky shark in the EPO

Fishery	Fisheries	Catch	Index of abundance	Composition	Contacts/References
Purse seine	Three fishery types: 1) dolphin associated, 2) unassociated, 3) floating objects, by vessel size (small: ≤ 363 t; large: >363 t).	Annual 1993-2009, by fishery and shark size class.	Standardized CPUE 1994-2009 (large vessels only), by fishery and shark size class.	Size-class composition 1993-2009 (<90cm, 90-150cm, >150cm), by fishery (large vessels). Length frequency by sex, 2005-2009 (by fishery for large vessels).	Cleridy Lennert-Cody clennert@iattc.org
Distant water longline					
Japan	Tuna longline	Logbook catch data for main species since 1997, however, silky is included as "other sharks." Training and research vessel CPUE data since 1992, but area of coverage shrinking and possible under-reporting since 2000.	Possibly from 1992 (based on the data from training and research vessel), but qualified as for catch.	Training and research vessel data since 1992, but area of coverage shrinking and possible under-reporting since 2000. Observer program just starting.	Yasuko Semba senbamak@fra.affrc.go.jp
China	Tuna longline	Logbooks started in 2009, the coverage is less than 100% and some logbooks sent out have not been returned yet. May be possible to use observer catch rates since 2003 to roughly estimate silky catch.	Not available.	Size compositions were available since 2003 by observer trips (but not observed for the whole year in each trip; no sampling coverage in some years).	Jiangfeng Zhu jfzhu@shou.edu.cn
Chinese Taipei	Tuna longline	Before 2003 just one shark category in logbooks; silky shark recorded since 2003.	Possibly since 2003.	Observer program started in 2002, but need to check how much data available for EPO.	Kwang-Ming Liu kmliu@mail.ntou.edu.tw
Korea	Tuna longline	Just one shark category in logbooks. Use	Not available.	Observer program. Needs to be confirmed if	Hawsun Sohn sohn.hawsun@gmail.com

		observer catch composition to scale total shark catch, if possible.		data exist for the EPO.	Sung Il Lee silee@nfrdi.go.kr
Spain	Swordfish longline		Possibly nominal CPUE, 1990-2005, from landings data and fishing effort.		Jaime Mejuto jaime.mejuto@co.ieo.es Blanca García blanca.garcia@co.ieo.es Mejuto *et al*. 2007
Chile	Swordfish longline	Does not catch silky shark.			Enzo Acuña
United States	Tuna longline (Hawaii only; no catches in California drift gillnet and longline fisheries).	1995-2009. Very low silky shark bycatch rates overall. Significant under-reporting of catch. (Walsh *et al*. 2009; Walsh and Courtney 2010).	Nominal CPUE 1990-2005 (Walsh and Courtney 2010).	Size-class composition 1994-2010 from onboard observer program. Very small sample sizes (Courtney, unpublished data).	Suzanne Kohin suzanne.kohin@noaa.gov
Mexico					
Gulf of California	During the shrimp closure in the Mexican Pacific, shrimp vessels based in Mazatlan target sharks using gillnets and longlines. Gillnets were prohibited since 2009 by the NOM-029. The Onboard observer program has collected data from those vessels catching sharks (2006-2010)	There exist published fishery statistics (but not by species). Catch and effort data of shrimp vessels could be converted to shark catches using observer data of FIDEMAR-CONAPESCA-INAPESCA.	Not available.	Onboard observer program (medium-sized vessels).	Fernando Márquez fermqz@yahoo.com José Castillo ptiburon@yahoo.com.mx
Mexican Central Pacific	A shark medium sized fleet operates in the Port of Manzanillo, Colima targeting sharks in open sea (more than 50 nm from the coast). The CRIP of Manzanillo has a monitoring program	The CRIP monitoring program onboard those vessels has a coverage less than 10% of the total fishery trips per year.	Not available	Detailed data of catch composition and effort from those trips monitored from the CRIP-Manzanillo	Dr. Heriberto Santana hsantanah@gmail.com

	onboard those vessels since 2000 until date.				
Southern Mexico	Artisanal shark fisheries	Sampling at Gulf of Tehuantepec since 1996; catch sample and total effort.	CPUE estimates available for some fisheries.	Sampling in Gulf of Tehuantepec since 1996.	Sandra Soriano Velásquez Sandra.soriano@inapesca.sagarpa.gob.mx
Central America		Plans of action. Some data in 2009 and 2010 on landings by species in artisanal fisheries. Silky is third most important shark.			Manuel Pérez mperez@oirsa.org maper59@hotmail.com
Guatemala		Should have data from the mid-1990s.			Márquez-Farías y Ruiz 1997. Ruiz-Alvarado 1997. Ruiz-Alvarado 1998. Ruiz-Alvarado *et al*. 2000. http://www.flmnh.ufl.edu/fish/organizaciones/sg/sharknews/sn9/shark9news18.htm http://www.fao.org/DOCREP/003/X2097E/X2097E08.htm
El Salvador	Artisanal shark fishery: mainly gill nets, some longline; foreign longline; and tuna purse-seine.	Grouped as sharks since 1970s.			Numa Hernández Numa.hernandez@mag.gob.sv
Honduras	Permanent fishery closure				
Nicaragua					
Costa Rica	Coastal longline, domestic longline, and foreign longline.	1969-2005 grouped as sharks; from 2005 on disaggregated.		No data on size because landed as trunks. Observer data may exist.	José Carvajal carva77@gmail.com
Panama					
South America					
Colombia	Semi-industrial longline, driftnet (northern Colombia), artisanal fishery.	Official catches 2000-2009; may be possible to obtain earlier data. However, these data may be influenced by	To be confirmed (data may exist).	Possibly some data on carcass length; need conversion factors (data availability to be confirmed). (Could share	Vladimir Puentes zanclus0715@gmail.com vpuentes@minambiente.gov.co Adriana Sharez

		changes in institutions over the years.		selectivity with Ecuador.)	adrianamilenas@gmail.com
Ecuador	Artisanal longline, industrial longline, gillnet, purse seine.	There are catch statistics to family since 1986 (INP). Shark Plan began in 2007 and the monitoring program has specific information for each species (SRP).	Data from 2008 (SRP).	Biological data by species since 2004 (landings; EPESPO, SRP), and since 2008 (observer; EPESPO, SRP).	Jimmy Martínez jimmy.martinez@pesca.gov.ec
Peru		Catches appear to be low.			

BIOLOGICAL DATA FOR THE SILKY SHARK

Process	**Details**	**Contact/reference**
Length-weight	Mexico	Fernando Márquez
	OSPESCA	Manuel Peréz
	Ecuador. Length ratio, length - weight relationship (~ 6,000 samples).	Jimmy Martínez
	Colombia	Vladimir Puentes
	Spain. Length (FL) – weight.	García-Cortés and Mejuto 2002.
Growth	Baja California Sur	Felipe Galván galvan.felipe@gmail.com Sanchez-de-Ita *et al*. 2011.
	Southern Mexico. Masters thesis.	Felipe Galván
	Colombia. Based on length composition of 300 individuals.	Vladimir Puentes Acevedo, 1996.
	Northwest Pacific	Joung *et al*. 2008.
Natural mortality		
Reproduction	Southern Mexico. Maturity based on morphology and histology. Litter size.	Fernando Márquez Felipe Galván Galván-Tirado, 2007.
	Gulf of California and Baja California Sur. Maturity based on morphology and histology. Proportion females pregnant. Litter size.	Felipe Galván Cadena-Cárdenas, 2001
	Japan (Pacific Ocean, 1992-1999).	Oshitani *et al*. 2003.
	Ecuador. Size at maturity (males only).	Jimmy Martínez
	Spain. 1990-2011. Size at maturity, percent fertilized, litter size-length relationship, sex ratio of litter, embryo size –mother size relationship, sex ratios,	Blanca García García-Cortés *et al*. 2011.

	China. Size at maturity, litter size and sex ratios.	Jiangfeng Zhu
Stock structure	Genetics. N and S of equator in eastern part of EPO different. Not enough data in western EPO and in central Pacific. PhD thesis on genetics for Pacific.	Suzanne Kohin Felipe Galván
	Spain. Mark-recapture. No recaptures in the Pacific.	Mejuto *et al*. 2005.
	Pop-off tags off Costa Rica show extensive movement north, but less movement offshore.	Suzanne Kohin

References

Acevedo, G. 1996. Contribución al estudio de la biología y la dinámica poblacional de los tiburones de la familia Carcharhinidae (Chondrichyes: Lamniformes) en la Ensenada de Panamá. Tesis de Grado, Facultad de Ciencias, Universidad del Valle, Cali, 125 pp.

Cadena-Cárdenas, L. 2001. Biología reproductiva de *Carcharhinus falciformis* (Chondrichthyes: Carcharhiniformes: Carcharhinidae), en el Golfo de California. Tesis Biólogo Marino, Universidad Autónoma de Baja California Sur.

Galván-Tirado, C. 2007. Biología reproductiva del tiburón aleta de cartón *Carcharhinus falciformis*, capturado en el Golfo de Tehuantepec. Tesis Maestro en Ciencias, Universidad Nacional Autónoma de México.

García-Cortés, B. and Mejuto, J. 2002. Size-weight relationships of the swordfish (*Xiphias gladius)* and several pelagic shark species caught in the Spanish surface longline fishery in the Atlantic, Indian and Pacific Oceans. Col. Vol. Sci Pap. ICCAT 54(4): 1132-1149.

García-Cortés, B., A. Ramos-Cartelle, J.Mejuto. 2011. Biological observations of silky shark (*Carcharhinus falciformis*) on Spanish surface longliners targeting swordfish in the pacific ocean over the period 1990-2011. Prepared for the IATTC Second Workshop on Sharks, May 13-14, 2011, La Jolla, California, USA.

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

Márquez-Farías, J.F. y C.L. Ruiz 1997. Evaluación de la pesquería del tiburón en aguas de ambos países. Guatemala. INP/DITEPESCA. 17 pp. (Informe del Grupo de Trabajo).

Mejuto, J., García-Cortés, B., Ramos-Cartelle, A. 2005. Col.Vol. Sci. Pap. ICCAT, 58(3): 974-1000.

Mejuto, J. García-Cortés, B., Ramos-Cartelle, A. and Ariz, J. 2007. Preliminary overall estimations of bycatch landed by the Spanish surface longline fleet targeting swordfish (*Xiphias gladius*) in the Pacific Ocean and interaction with marine turtles and sea birds: Years 1990-2005. Document BYC-6-INF A. IATTC Working Group on Bycatch, 9-10 February, 2007, La Jolla, California, USA.

Ruiz-Alvarado, C. 1997. Caracterizacón del tiburón en el Pacifico de Guatemala. Problema Especial. Guatemala, CEMA-USAC/DIGESEPE-DITEPESCA. 57 pp.

Ruiz-Alvarado, C. 1998. Contribución al conocimiento de la pesquería y biología del tiburón blanco *Carcharhinus falciformis* de las costas del Pacífico de Guatemala. Tesis de Licenciatura en Acuicultura. Guatemala, Universidad de San Carlos de Guatemala. Centro de Estudios del Mar y Acuicultura. 71 pp.

Ruiz-Alvarado, C., Ixquiac-Cabrera, M., Baldetti-Herrera, C., y Martinez, J. 2000. Evaluacion del potencial de explotacion del recurso tiburon en las costas del Pacifico de Guatemala, C.A. Fondo Ncional de Ciencia y Tecnologia. Centro de Estudios del Mar y Acuicultura, Unidad Especial de Pesca y Acuicultura. FONDECYT/CEMA/UNIPESCA 98 p.

Oshitani, S., Nakano, H., Tanaka, S. 2003. Age and growth of the silky shark *Carcharhinus falciformis* from the Pacific Ocean. Fisheries Science 69: 456-464.

Sánchez-de-Ita, J.A., Quiñónez-Velázquez, C., Galván-Magaña, F., Bocanegra-Castillo, N., Félix-Uraga, R. 2011. Age and growth of the silky sharks *Carcharhinus falciformis* from the west coast of Baja California Sur, Mexico. Journal of Applied Ichthyology 27: 20-24.

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

Walsh. W.A. and Courtney, D. 2010. Preliminary Compilation and Analyses of Shark Catch Data from the Hawaii-based Pelagic Longline Fishery. PIFSC Working Paper WP-11-007.

Appendix I: Meeting participants

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Appendix II:

1. Background on silky shark issues in EPO.
2. Silky shark Stock Synthesis model overview
3. Review of data sources and assumptions
   a. Catch:
      - Expand to total catch
      - By gear type, region, country
   b. Effort:
      - Total or index
      - By gear type, region, country
   c. Indices of abundance
      - Catch-per-unit-effort (CPUE)
   d. Composition
      - Age
      - Length
      - Weight
      - Length/weight categories
      - Stage/sex
   e. Biology
      - Length-weight
      - Growth
      - Natural mortality
      - Reproduction (maturity, fecundity, frequency)
      - Stock structure
      - Tagging
      - Genetics
4. Modeling discussion