INTER-AMERICAN TROPICAL TUNA COMMISSION

WORKING GROUP TO REVIEW STOCK ASSESSMENTS

8TH MEETING

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DOCUMENT SAR-8-15

PROPOSAL FOR A COMPREHENSIVE ASSESSMENT OF KEY SHARK SPECIES CAUGHT IN ASSOCIATION WITH FISHERIES IN THE EASTERN PACIFIC OCEAN[1]

1. BACKGROUND

Resolution C-05-03 on the conservation of sharks requires that the IATTC, in cooperation with scientists of CPCs and, if possible, the Western and Central Pacific Fisheries Commission, shall propose a research plan for a comprehensive assessment of key shark stocks.

The silky shark (*Carcharhinus falciformis*) and the oceanic whitetip shark (*C. longimanus*) are the species most commonly taken, as bycatch, by the purse-seine fishery in the eastern Pacific Ocean (EPO). Both species are also taken in pelagic longline fisheries in the EPO, and are believed to be taken in artisanal fisheries in many countries around the EPO. The blue shark is the shark species most commonly taken in the longline fishery.

Standardized catch-per-unit of effort (CPUE) data for the silky shark from purse-seine sets on floating objects show a clear decreasing trend since 1994 for all sharks (not shown) and for sharks ≥ 90 cm total length (TL) (Figure 1); only unstandardized data are available from unassociated sets and dolphin sets, but these data also show decreasing trends. Unstandardized data for the oceanic whitetip shark (pooled over size intervals) also show decreasing trends since 1994 for all three purse-seine set types. The implications of these decreasing CPUE trends are unclear, because the stock structure of the both shark species in the Pacific Ocean are not known. It has been proposed that the silky shark is much more abundant near land than in the open ocean; however, longline and purse-seine CPUE data suggest a widespread distribution across the Pacific. The oceanic whitetip shark is believed to be widely distributed in tropical waters.

Analysis of standardized CPUE data for the silky shark and oceanic whitetip shark from the western Pacific longline fishery show no decreasing trends, suggesting stable populations. The difference between these trends in CPUE in the eastern and western Pacific highlights the need for information on the stock structure of these species.

Given the contrasting trends in standardized catch rates, the potentially widespread distributions of these species and their ecological importance, the life history characteristics of these and other shark species, and the fact that sharks are taken in fisheries targeting species, such as tunas, with faster growth rates and higher fecundities, there is a clear need for a comprehensive assessment of key shark species taken in fisheries in the EPO. Unfortunately, little is known about the current population status and stock structure of most species encountered in these fisheries, and in fact, the key species affected by these fisheries remain to be identified. Thus, much preliminary work is needed before comprehensive stock assessments can be performed.

[1] Updated from Document SAR-7-11 (http://www.iattc.org/PDFFiles2/SAR-7-11-Shark-research-plan.pdf), presented at the meeting of the Working Group in May 2006

2. NECESSARY COMPONENTS OF A STOCK ASSESSMENT

2.1. Identification of key species

The first step in a comprehensive stock assessment is to define the key species to be investigated. Factors that may determine the key species include representation in pelagic fisheries, both now and in the past, potential vulnerability to the impact of fishing due to life history characteristics, availability of data, and the impact of their predation on tunas. The available data suggest that currently the oceanic whitetip shark, silky shark, blue shark, shortfin mako shark, and bigeye thresher shark are the key species involved in the purse-seine and longline fisheries in the EPO. Other species may be added to this list because of their historical involvement in fisheries, involvement in artisanal fisheries, and vulnerability because of life history characteristics.

2.2. Compilation of available life history data

Life history data are essential for population dynamics modeling because they provide information on the natural potential of the population to sustain itself in the absence of fisheries. Particularly important is information that will permit the definition of appropriate units for stock assessment. Necessary life history information includes data on distribution of species by age and sex, genetic structure of the population for stock identification, data on movement rates, data on rates of growth and natural mortality, and data on reproductive rates and age/size at sexual maturity. Such information can be obtained from data on the spatial distribution of CPUE, genetic analysis of tissue samples, and tag-recapture data. For each of the key species, a compilation of available life history data is needed.

2.3. Compilation and standardization of catch-per-unit effort data and length frequency data

Data on total catch, CPUE and length frequency provide information on the level and rate of removal by fisheries, and on the sizes (and hence ages) of animals that are being removed from the population. These data should be obtained from as many as possible of the fisheries in which key shark species are involved, because different gear types have different efficiencies with respect to species and sizes of sharks, and because population spatial structures may be such that, for example, fisheries in certain areas impact shark nurseries, whereas those in other areas impact only adult animals. Appropriate annual catch and size data for each fishery include standardized CPUE, an estimate of the total catch, and estimates of the length-frequency distribution of the catch. The analysis of length-frequency data will require an understanding of the sampling design, which may vary by fishery. Catch data may need analysis to estimate the uncertainty associated with both the estimate of total catch and of CPUE. Each of these processes entails bringing together analyses of various data sources.

2.4. Population dynamics modeling

Population dynamics modeling brings together life history information and fishery catch information in a model-based approach to determining the current status of a fished population (“stock assessment”). Possible methods for a stock assessment include surplus production modeling and age-structured modeling of catch at length. Inputs to both of these processes include time series of CPUE and catch data; the latter method also requires length-frequency data.

3. WHAT NEEDS TO BE DONE

3.1. Data: Identification of sources, processing and analysis

a. Identify and summarize existing life history data

All available sources of life history information for key shark species need to be identified and summarized. This work should be conducted by shark biologists.

(1 person-month)

b. Identify and summarize existing fisheries catch and length frequency data

All available sources of catch and length-frequency data need to be identified and summarized. This work will require a review of available literature on current and historical fisheries taking sharks in the EPO. This work should be conducted by a person familiar with artisanal fisheries and fisheries stock assessment methods.

(2 person-months)

c. Estimate total shark catch and standardize shark CPUE data

All available catch and effort data need to obtained and summarized. In addition, statistical analyses need to be performed to estimate total catch and standardize CPUE and, in both cases, provide appropriate measures of error.

(3 person-months)

d. Analyse shark length-frequency data

All available length-frequency data need to be obtained and summarized.

(2 person-months)

3.2. Stock assessment

a. For each fishery, define the appropriate scale for modeling, given distribution, genetic structure, movement rates, and fisheries. Given data potentially available, identify appropriate modeling approach for each key species. Also, identify constraints on assessment and additional data needed, *e.g*., stock structure definition, movement, migration, catch/effort data for artisanal fisheries.

b. Develop stock assessment for each key species.

(6 person-weeks per species)

3.3. Identify future research needs

Results of the literature searches, statistical analyses and stock assessment will identify future research needs. These needs, and their associated costs, should be outlined in a summary report. In particular, the report should address: i) whether the list of key shark species provided above should be modified after taking into consideration interactions with historical fisheries and life history characteristics; ii) the priorities of future research needs in terms of both their immediate benefit to future stock assessments and their costs; and iii) the need for recommendations regarding details of future stock assessments (assessment interval, assessment format, data handling and archiving). In addition, this summary report should detail the results of work performed under items 3.1 and 3.2 above for the preliminary assessment.

4. FUNDING AND RESOURCES REQUIRED FOR PRELIMINARY STOCK ASSESSMENT

Although there are several options for organizing and conducting the preliminary stock assessment outlined under items 3.1 and 3.2 above, the most efficient and effective would be to fund a temporary position at the IATTC in La Jolla to carry out the work in conjunction with existing IATTC staff. The appropriate term of the temporary position is estimated to be 14 months. In order for the person filling this position to properly assist IATTC staff with the analysis of catch and effort data, and the stock assessments, this position requires a Ph. D. –level background in fisheries.

The following resources are required to carry out the work outlined in items 3.1 and 3.2 above:

i) salary for a 14-month research (post-doctoral) position;

ii) any catch and effort data for fisheries that take sharks in the EPO;

iii) any unpublished life history data.

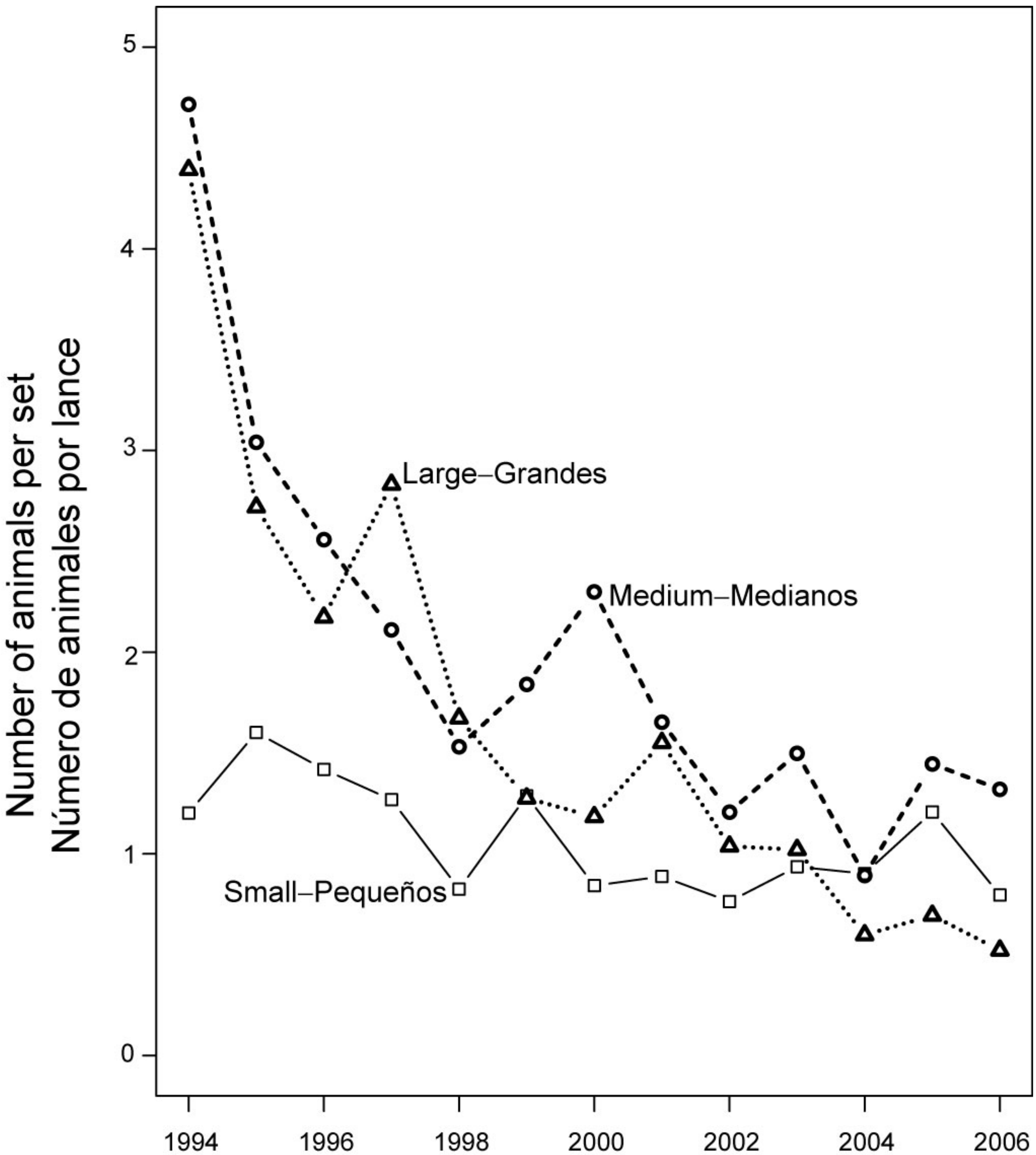

FIGURE 1. Estimates of the trend in standardized average silky shark bycatch per set, by size interval ('small', < 90 cm TL; 'medium', 90-150 cm TL; 'large', > 150 cm TL), based on IATTC observer data from the purse-seine fishery for tunas associated with floating objects. Bycatch per set was standardized using a zero-inflated negative binomial model, as outlined in: Minami, M., Lennert-Cody, C.E., Gao, W., Román-Verdesoto, M. 2007. Modeling shark bycatch: The zero-inflated negative binomial regression model with smoothing. Fisheries Research 84:210-221.