

INTER-AMERICAN TROPICAL TUNA COMMISSION
SCIENTIFIC WORKING GROUP

SWORDFISH STOCK ASSESSMENTS

La Jolla, California (USA)
7-8 May 2001

Chair: Pablo Arenas

CHAIR'S REPORT

AGENDA

1. Welcome, introductions, consideration of agenda
2. Introduction and objectives
3. Description of fisheries and data by area
4. Swordfish assessment in the eastern Pacific
5. Recommendations
 - a. Data
 - b. Research
6. Other business
7. Adjournment

DOCUMENTS

Status of swordfish in the eastern Pacific Ocean

Actualización de la información científico técnica disponible sobre la flota comunitaria (española) de palangre de superficie dirigida al pez espada (*Xiphias gladius*) en el Pacífico S.E. con especial referencia a los años 1998, 1999 y 2000 (Spanish only)

Datos preliminares a partir de observadores científicos a bordo de palangreros de superficie (U.E.-España) durante 1998, 1999 y 2000 en el Océano Pacífico Este (Spanish only)

Estudio de la pesquería mexicana de pelágicos mayores que opera red y palangre de superficie en el Océano Pacífico oriental (Spanish only)

Brief review of swordfish catch by Japanese longliners in the eastern Pacific

Preliminary analysis of swimming behavior of a swordfish using an archival tag

1. WELCOME, INTRODUCTIONS, CONSIDERATION OF AGENDA

A meeting to collate information on swordfish and to assess swordfish stocks in the eastern Pacific Ocean was held in La Jolla, California, USA, on May 7-8, 2001. The attendees are listed in Appendix 1. The meeting was called to order by Dr. Robin L. Allen, Director of the Inter-American Tropical Tuna Commission (IATTC). He thanked everyone for coming, and introduced Dr. Pablo R. Arenas of the

IATTC, who would serve as Chairman of the meeting. Dr. Arenas asked for comments about the provisional agenda. After a few comments, it was adopted without change.

2. INTRODUCTION AND OBJECTIVES

Dr. Arenas said that billfishes, especially swordfish, had been of great interest to the IATTC for many years. The objectives of the present meeting were to discuss the data that are available and the analyses that have been conducted on them, to identify the deficiencies in the data, and to suggest types of research and analyses that might yield further information useful for the assessment of swordfish. The discussions and recommendations at this meeting would be considered by the IATTC staff in preparing its recommendations for the 68th meeting of the IATTC, to be held on June 19-21, 2001.

3. DESCRIPTION OF FISHERIES AND DATA BY AREA

Dr. Arenas called upon Dr. Michael G. Hinton of the IATTC to review the fisheries for swordfish in the eastern Pacific Ocean (EPO). Dr. Hinton showed data on distributions of catches and catches per unit of effort (CPUEs) by area. The data furnished by the National Research Institute of Far Seas Fisheries (NRIFSF) of Japan are particularly useful for this purpose because large amounts of effort are exerted in nearly all areas in which swordfish occur and because the effort is not directed at swordfish in any part of the EPO. The catches and CPUEs of swordfish are greatest in a large area off Peru and Chile and in smaller areas off Central America and off California and Baja California. He showed length-frequency histograms of fish caught inshore north of 10°N (Area 2), offshore north of 10°N (Area 2), between 10°N and 5°S (Area 3), inshore south of 5°S (Area 4), and offshore south of 5°S (Area 5) during the 1970s, 1980s, and 1990s. Fish less than about 100 cm in length made up larger proportions of the catches in the northern offshore area than in the other areas, and this proportion increased from the 1970s to the 1990s. The sex ratios in the catches differed from area to area and quarter to quarter. The ensuing discussion dealt with stock structure, boundaries between areas, length-frequency data, the effects of gear configuration on the CPUEs, the effects of environmental conditions on the distribution of fishing effort and on the CPUEs, and other matters.

The next presentation was made by Dr. Yuji Uozumi of the NRIFSF, who reviewed a background paper prepared by Dr. Kotaro Yokawa, also of the NRIFSF. The two principal areas where swordfish are caught by Japanese vessels are off Peru and Chile and off Japan. The catches off Peru and Chile are made entirely by longliners that direct their effort at other species, particularly bigeye tuna. The catches off Japan are made by longliners, gillnetters, and harpoon vessels, many of which direct their effort at swordfish. The catches and CPUEs of swordfish have shown no upward or downward trends in the EPO during the 1963-1999 period. However, the catch and CPUE in the equatorial area east of 100°W were inexplicably much greater in 1969 than in any other year. The discussion that followed dealt with gear configuration and speculation concerning the high catches and CPUEs in the equatorial area in 1969.

Dr. Arenas then called upon Dr. Pierre M. Kleiber of the U.S. National Marine Fisheries Service (NMFS) to review the report of a meeting of the Swordfish Working Group of the Interim Scientific Committee for the Tuna and Tuna-like Species in the North Pacific Ocean, held in Honolulu, Hawaii, USA, on January 15-16, 1999. This report includes reviews of the fisheries, fisheries statistics, summaries of progress in studies of biology and oceanography, reviews of the status of the stocks, and plans for future research. Research on swordfish in the central Pacific is especially difficult because the population harvested by the Hawaiian fishery is not homogeneous. Swordfish research at the Honolulu laboratory of the NMFS has recently been curtailed in order to perform more research on sea turtles, albatross, and blue sharks. Longline fishing with gear configured to catch swordfish is now prohibited in Hawaii, and longline fishing for other species has been considerably restricted. It was reported that some of the tasks listed in the report had been completed, that some were partially completed, and that little or no progress had been made on some. The subsequent discussion dealt with the disposition of the vessels that could no longer fish in Hawaii and the quality of catch, effort, and CPUE data. Some of the vessels previously involved in the fishery are likely to be displaced to the EPO.

The next presentation was made by Dr. Uozumi, who reviewed Document 11-A (2000) of the Standing Committee on Research and Statistics of the International Commission for the Conservation of Atlantic Tunas, describing research on swordfish in the Atlantic Ocean. Three stocks, two in the Atlantic Ocean, one north and one south of 5°N, and one in the Mediterranean Sea, are recognized. A virtual population analysis performed in 1999 indicated that the stock in the North Atlantic was below the level that would support the average maximum sustainable yield (AMSY). Fortunately, two or three strong year classes will soon enter the fishery, and recovery is expected within 5 years. A similar analysis indicated that the stock in the South Atlantic is at the AMSY level. Regulations are contemplated, however, to prevent increases in fishing effort. Insufficient data for performing stock assessments are available for the Mediterranean Sea stock. The fishery for swordfish in the Indian Ocean was mentioned in the ensuing discussion.

Dr. Arenas then called upon Mr. Pedro Ulloa of the Instituto Nacional de Pesca (INP) of Mexico to review a report on the swordfish fishery of Mexico and research on swordfish done by the INP. The fishery has been conducted off the west coast of Baja California and near the entrance to the Gulf of California since about 1980. It started as a longline fishery, and then it became predominantly a gillnet fishery. In recent years it has switched back to being predominantly a longline fishery. During the last two years observers have made 26 trips aboard Mexican longline vessels. Swordfish made up 19 percent of the catches of these vessels. The remainder of the catch consisted of 10 other species, including sharks, mahi mahi, and yellowfin tuna. Most of the swordfish were between about 180 and 240 cm in length. The ratio of females to males was 1.6:1. Most of the fish were caught in waters with sea-surface temperatures of 17° to 23°C. The catch rates ranged from about 1 to 24 fish per 1000 hooks. The project will be continued for at least one more year, and observers will be placed on gillnet boats, in addition to longliners. In addition there are plans to tag swordfish and to study their population structure, age structure, and sexual maturity and spawning. The discussion that followed dealt mostly with the accuracy and precision of the catch statistics of FAO, Mexico, and other nations, and the fishing regulations of Mexico that designate the area within 50 nm of the coast of Mexico as a billfish sportfishing reserve.

The next presentation was made by Ms. Gladys Cárdenas Quintana of the Instituto del Mar del Perú. The landings of swordfish in Peru have been sporadic. The greatest catch, about 5,500 tons, was made in 1950. Since 1974 the catches have ranged from 0 to about 500 tons. The principal ports of landing during the 1970-1984 period were Mancora and Zorritos. During the 1996-2000 period the principal gears used to catch swordfish have been longlines, gillnets, and hook-and-line gear. Peru wishes to diversify its fisheries, which in the past have been directed mostly toward anchovies and sardines. The subsequent discussion dealt with the influence of El Niño events, the completeness and accuracy of the catch statistics, particularly for the countries of South and Central America, and collection of data for Japanese vessels involved in joint ventures with Peru and Ecuador.

Dr. Arenas then called upon Dr. Javier Ariz of the Instituto Español de Oceanografía (IEO) to present two papers prepared by his colleagues at the IEO, Drs. Jaime Mejuto and Blanca García-Cortes, and by Mr. F. Gonzalez, an observer. The first report described data collected by observers on Spanish longliners fishing in the EPO during 1998, 1999, and 2000. The boats fished in two areas, off southern Mexico and Central America and off Peru and Chile. Catch, effort, and length and sex composition data were collected by the observers. Most of the fish were between about 100 and 210 cm in length. There were more males than females in the northern area, but more females than males in the southern area. Nearly all of the females were immature. The second report described updating of the scientific data for the Spanish fleet fishing for swordfish in the southeastern Pacific Ocean. The results were as follows:

Year	Boats	Numbers of swordfish		Observer coverage (percent)
		Caught	Sampled	
1998	8	22,500	9,000	9.2
1999	4	16,400	3,600	16.4
2000	4	22,000	4,180	10.5

The catch and effort data were summarized by 5-degree rectangles and months. The CPUEs were about

600 kg per 1000 hooks during the 1990-2000 period, except in 1992 and 1993, when they were only about half that. Most of the ensuing discussion was related to the data on gonad indices presented in the first paper. Dr. Hinton explained the difference between the gonad indices used in the first report and those calculated by a new method described by him and a co-author in a recent paper.

The next presentation was made by Dr. Uozumi, who summarized the behavior of a swordfish tagged with an eternal archival tag, as described in a preliminary report by Mio Takahashi, Makoto Okazaki, Hiroshi Okamura, and Kotara Yokawa, all of the NRIFSF. The fish was released at about 37°N-142°E in July 1999 and recaptured at about 35°N-142°E in June 2000. It was at its greatest distance from the release and recapture area in February 2000, when it was at about 8°N-175°E. At night the fish remained close to the surface, and during the daytime it was usually about 500 m below the surface. On some days, however, it spent some time basking at the surface. It spent nearly all of its time at the surface for several days prior to its recapture, perhaps as a consequence of cooler water temperatures in the area. In the discussion that followed it was pointed out that a fish might bask at the surface to overcome an oxygen debt that had accumulated, and that an examination of data on dissolved oxygen in the ocean might be useful in analysis of the behavior of the fish.

Dr. Arenas then called upon Dr. Oscar Sosa-Nishizaki of the Centro de Investigación Científica y de Educación Superior de Ensenada (Mexico), who reviewed genetic studies that have been made on swordfish in the Pacific Ocean. The most recent study included the hypothesis that there are three stocks, in the northwestern, southwestern, and eastern Pacific. Some scientists, however, think that there may be two stocks in the eastern Pacific, one in the north and one in the south. He emphasized that there is considerable uncertainty as to the stock structure. In the subsequent discussion it was pointed out that biological data are useful in the study of stock structure, and that mitochondrial DNA data do not necessarily give much information on mixing rates. It was also mentioned that local depletion could be a problem, even if a stock was not overfished.

4. SWORDFISH ASSESSMENT IN THE EASTERN PACIFIC

Dr. Arenas called upon Dr. Hinton to describe how he calculated indices of swordfish abundance. Dr. Hinton said that he standardized the fishing effort of Japanese and Mexican longline vessels fishing in the EPO by general linear modeling, using the form

$$CPUE = \text{Year} + \text{Quarter} + \text{Area} + \text{Environmental Index} + \text{Gear} + \text{Interactions},$$

and described the areas, gear categories, and environmental indices. The environmental indices that he used were the Southern Oscillation Index and the Northern and Southern Extratropical Oscillation Indices. Preliminary analyses of the data indicated that the trends in abundance in Areas 2, 3, and the northern part of Area 1 are similar to one another, and that those in Areas 4 and 5 are similar to one another. (The areas are described in the first paragraph under Agenda Item 3.) This was followed by a presentation by Dr. Uozumi, from the report prepared by Dr. Yokawa. He also used general linear modeling, and he used all the variables that Dr. Hinton used, except that he did not use an environmental index. Both of the studies suggest that swordfish is not overfished in the EPO.

The ensuing discussion included a wide range of topics, including technical details of the modeling, selection of areas within the EPO, effects of movement of fish into and out of the EPO, and comparisons with the results obtained in the Atlantic Ocean. It was noted that the fishery area is very large, that few fleets are targeting specifically swordfish, that LFDs show mostly large fish, and that CPUEs are stable. Given these characteristics, exploitation rate is probably low. It was also noted that given this situation, the estimation of AMSY for swordfish in the eastern Pacific is very difficult.

5. RECOMMENDATIONS

Dr. Arenas introduced a discussion on recommendations for data collection and research.

5a. Data

It was agreed that better catch, effort, and CPUE data and biological data are needed. While some data can be collected in ports of landing, other data can be collected only by observers. Data could be collected by the national governments or by the IATTC staff on their behalf. At times the quality of the data collected has been variable. Further, the data from all sources to be standardized. For example, the catches may be reported as weights or numbers of fish. If they are reported as gilled and gutted or dressed weights these values must be converted to round weights. If they are reported as numbers of fish these must be converted to round weights. There are inconsistencies in the data for some countries, and data are needed on the artisanal fisheries of Chile, Colombia, Costa Rica, and Ecuador, and more detailed data are needed on the distant-water high-seas fisheries of nations that target swordfish. It was suggested that the IATTC staff prepare a detailed table, specifying the data that are needed, what it has collected, and the possible sources of the data. Separate tables for catches, fishing effort, and size-composition data would be useful. These tables would include tunas and other billfishes, as well as swordfish. It would then be made available to all of those concerned. Everyone agreed with this suggestion. It was noted that the IATTC staff collects data on swordfish in some locations, and will be reporting to the IATTC in June on a program to obtain data on the bycatches of longline vessels.

5b. Research

It was agreed that there is no evidence that swordfish are overfished in the EPO, but that local depletion can occur, and that large-scale transfer of vessels from one area to another is a matter of concern. If and when better catch, effort, and CPUE data and biological data are obtained the assessments can be improved. It was also recommended that swordfish be tagged with archival and/or pop-up tags in key regions.

It was agreed that carrying out EPO swordfish assessments is appropriate at this point, but stock structure is uncertain. It was pointed out that there must be at least some exchange of swordfish between the EPO and the central Pacific Ocean, and that consideration should be given to using data, and assessments, for the entire Pacific in addition to EPO analyses.

The priorities in the plan of work in the report of the meeting of the Swordfish Working Group of the Interim Scientific Committee for the Tuna and Tuna-like Species in the North Pacific Ocean, held in Honolulu, Hawaii, USA, on January 15-16, 1999 were noted.

6. OTHER BUSINESS

There was no other business to discuss.

7. ADJOURNMENT

Dr. Arenas thanked everyone for participating in the meeting, and declared it adjourned.

**INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISION INTERAMERICANA DEL ATUN TROPICAL
SWORDFISH STOCK ASSESSMENT WORKING GROUP
GRUPO DE TRABAJO SOBRE EL STOCK DE PEZ ESPADA**

**May 7-8, 2001 – 7-8 de mayo de 2001
La Jolla, California, USA**

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