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Pelagic Fisheries Research Program

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Knowledge of the condition of pelagic fish stocks in the Pacific is critical for the continued development of sustainable fisheries. This knowledge will become increasingly important when negotiations to create an international fishery management organization for highly migratory species in the Pacific conclude in 2000.

This issue of the PFRP newsletter features two articles that address questions of stock status. Michael Hinton of the Inter-American Tropical Tuna Commission presents an up-to-date analysis of Pacific blue marlin stocks using environmental data to "standardize" fishing effort data from the Japanese longline fishery between 1955 and 1997.

John Sibert, PFRP program manager, summarizes some of the information presented to the 1999 meeting of the Standing Committee on Tuna and Billfish on the status of the major tuna stocks in the South Pacific.

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Status of South Pacific Tuna Stocks

The Standing Committee on Tuna and Billfish (SCTB) is made up of scientists from all over the Pacific who have met annually for the past 12 years. The committee is divided into a working group on statistics, research groups for the four major tuna species and a newly created research group on billfish and bycatch. These groups discuss current developments in the fisheries, receive scientific presentations and attempt to evaluate the condition of the stocks. During its June 1999 meeting, SCTB participants represented about 25 different fisheries departments and organizations.

Skipjack—The Mainstay of the Industrial Tuna Fishery in the Pacific

The estimated skipjack catch in the western Pacific in 1998 was 1.17 million metric tons (mt), the highest catch since 1991. The bulk (76%) of this catch and most of the increase over 1997 was taken by purse seine.

Indicators of stock status, based on pole and line and purse seine statistics, were variable in time and place. More importantly, there was no detectable downward trend in catch rates. Spatial variability in apparent abundance and fishing success appears to be strongly influenced by environmental factors.

(continued on page 2)

In 1998, purse seiners accounted for the bulk of the increases in skipjack, yellowfin, and bigeye catches in the Pacific. (photos above and below by Thomas Kazama; courtesy of NMFS Honolulu Lab)

Fishermen releasing skipjack out of the bottom of the bailer.

CONTENTS

Status of South Pacific (continued from page 1)

The skiff has just been released and the purse seiner is beginning its circle to lay out the net.

The best indicators of the status of skipjack stocks are based on tagging studies conducted by the Secretariat of the Pacific Community (SPC, formerly the South Pacific Commission) in the early 1990s. At that time, the exploitation rate was considered to be relatively low. Current catch levels are similar to those achieved in the early 1990s. The lack of clear trends in catch rates suggests the current catch levels are sustainable.

Our ability to assess the condition of skipjack stocks needs to be improved. Statistical coverage is poor in some critical regions where large catches are achieved, for example in Indonesia and the Philippines. Stock assessment models need to be developed for skipjack that would provide better indicators of stock size. The effects of environment on productivity and distribution and the causes of regional variation in abundance need further research.

Yellowfin—The Runnerup in Total Harvest

The estimated catch of yellowfin in the western Pacific has been increasing since the 1980s and was a near record 407,000 mt in 1998. Purse seine catches contributed most of the increase while catches by longline and by pole and line decreased.

Catch rate indicators from the different purse seine fleets show no consistent trend, and "standardized" longline catch per unit of effort (CPUE) is relatively flat. A state-of-the-art assessment model for western Pacific yellowfin developed at the SPC with PFRP funding shows regionally variable exploitation rates but moderate to low exploitation on the stock as a whole. Current yellowfin catch levels are considered sustainable, and the yellowfin stock appears to be in good condition.

Bigeye—A Small but Valuable Catch

The total Pacific catch of bigeye in 1998 was estimated to be about 170,000 mt, of which 100,000 mt were taken in the western Pacific. In spite of this relatively low catch, the bigeye resource was extremely valuable due to high prices in the sashimi market. The annual landed value was approximately $1 billion.

Changes in purse seine fishing practices on both sides of the Pacific have caused increases in catches of juvenile bigeye. In the western Pacific, catches by both purse seine and longline increased. In contrast, longline catches in the eastern Pacific have decreased as purse seine catches of bigeye have increased.

The results of attempts to compute standardized indices of CPUE for bigeye indicate a decline in abundance since the 1970s in the western Pacific and since 1990 in the eastern Pacific. In spite of poor knowledge of key population parameters, the Inter-American Tropical Tuna Commission (IATTC) has conducted a cohort analysis of bigeye populations that also suggests a decline in adult biomass. There is general concern that adult bigeye biomass is declining, and the IATTC may act to decrease the level of exploitation on bigeye by the purse seine fleet in 1999.

Bigeye has not received research attention comparable to that of the other tunas. The PFRP has generated a research proposal that calls for Pacific-wide efforts. This proposal has been strongly endorsed by the SCTB but has not been successful in attracting the necessary funds. The IATTC is planning a major research effort on bigeye to begin in early 2000. The PFRP has just allocated funds to the development of a Pacific-wide bigeye assessment model in collaboration with

Fishermen using the brailer to scoop out the fish catch. (photos top and bottom by Thomas Kazama; courtesy of NMFS Honolulu Lab)

After the fish have been removed from the net, the purse seiner elongates the net to assist the release of the remaining fish. (photo by Thomas Kazama; courtesy if NMFS Honolulu Lab)

scientists from the SPC, IATTC and the National Research Institute for Far Seas Fisheries in Japan. So while the status of the bigeye stock is uncertain, our knowledge of bigeye biology and population dynamics will increase in the next few years and our assessments in the near future will be more certain.

Albacore—Two Stocks in the Pacific

For historical reasons, statistics on South Pacific albacore are reviewed by a special SCTB research group and those on North Pacific albacore are reviewed by an ad hoc working group. The 1998 catch of southern albacore was 41,000 mt, the highest in the last 10 years. Longline took the bulk (88%) of the catch, and the troll fleet took the rest. Active domestic longline fleets targeting albacore have developed over the past few years in American Samoa, French Polynesia and Samoa. The 1998 catch of these three fleets totaled 9,700 mt, nearly 25% of the total South Pacific catch.

Southern albacore population dynamics and the success of longline fisheries for albacore appear to be strongly influenced by environmental factors such as El Niño, but there is little information on the mechanism by which this influence acts. A stock assessment model similar to that currently applied to western Pacific yellowfin was applied to data from the southern albacore fishery for the period 1962–93. The results indicate that current albacore catches in the South Pacific are sustainable.

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Tagging and Tracking Symposium to be held February 2000 in Honolulu

Symposium on Tagging and Tracking Marine Fish with Electronic Devices

February 7–11, 2000
East-West Center
Honolulu

Marine fishes are tagged and tracked with electronic devices of varying degrees of sophistication. In the past five years, these devices have yielded an impressive amount of information. The Symposium on Tagging and Tracking Marine Fish with Electronic Devices will review this information and identify future research challenges. The symposium proceedings will be published in the distinguished international journal *Reviews in Fish Biology and Fisheries*. State-of-the-art hardware for tagging and tracking will be on display at a trade show. For further information, please refer to http://www.soest.hawaii.edu/PFRP/ or contact Dodie Lau, Pelagic Fisheries Research Program, University of Hawaii, JIMAR, 1000 Pope Rd., Honolulu, HI 96822, United States; fax (808) 956-4104, or e-mail dlau@soest.hawaii.edu.

Pacific Blue Marlin Stock is Healthy, Says New Analysis

For the past two decades, analyses have indicated that blue marlin (*Makaira nigricans*) in the Pacific were being overfished or, at least, would react unfavorably to any increase in fishing effort. Now, the results of a new analytical model are painting a brighter picture.

"The blue marlin stock in the Pacific is in a healthy condition," says M. G. Hinton of the Inter-American Tropical Tuna Commission. "The current levels of biomass and fishing effort are near the levels required to maintain the average maximum sustainable yield (AMSY)," which is the most common objective for fishery management.

Given the importance of the blue marlin catch in the Pacific, Hinton says, it is important to understand not only the stock's present status but also how its perceived status has varied over time and why.

The Japanese longline fishery is the only fishery with catch data on blue marlin in the Pacific over the large area and long period time required for stock assessment analysis. (photo circa 1960; courtesy of NMFS Honolulu Lab)

Stock Assessment Problems

Fishery scientists face several difficulties when trying to determine the status of blue marlin in the Pacific. First, there is no means to estimate the condition of the stock using fishery-independent methods. Exacerbating this problem are constant modifications to fishing gear and methods to improve their success. Such changes lead to difficulties in standardizing estimates of catch rates, which serve as measures of relative abundance.

Second, scientists believe the blue marlin found in the Pacific forms a single stock, or population. Hence, the harvests in each fishery in which blue marlin in the Pacific are taken should be considered when evaluating the status of the stock. The species provides the focus of major game fish tournaments. However, the fishery that takes the most individuals is comprised of longline vessels targeting tunas.

Third, individual blue marlin live for a relatively long time, so scientists should collect data used to estimate the effects of fishing over a period of decades.

The only fishery that provides coverage of the blue marlin population over the required large area and long period is the Japanese longline fishery.

Catches and Early Stock Assessments

In 1951–52, the annual catch of blue marlin in the Pacific Ocean was about 11,000 metric tons (mt). As the fisheries for tunas expanded during the following years, the catches of blue marlin rapidly increased, reaching about 23,000 mt by 1956–57 and 38,000 mt by 1962–63. Following this period of rapid increase was a period of rapid decrease, to about 11,000 mt by 1971. During the 1971–75 period the average annual catch of blue marlin was about 12,300 mt. The catches then began to increase slowly, reaching about 19,000 mt in 1980 and then averaging about 18,400 mt annually during the 1980s. From 1987 to 1997, the estimated average annual harvest of blue marlin in the Pacific by all fisheries was 20,000 mt.

Under what is considered the most likely scenario, the total annual standardized effort averaged about 41 million standardized hooks during 1955–56. By 1959, it had reached about 60 million standardized hooks, and during the 1959–63 period, it averaged about 61 million standardized hooks annually. During the 1964–69 period the average annual standardized effort dropped to about 48.8 million standardized hooks, which was still about 18 percent greater than during 1955–56. The annual standardized effort during the 1970s and the 1980s averaged about 44.5 million and 37.4 million standardized hooks, respectively.

In 1980, the status of blue marlin in the Pacific was estimated using data obtained from longline fisheries obtained during 1952–75. Indications from that analysis were that the stock was being overfished and that the fishing effort in 1975 was about twice that which would maintain the stock at AMSY.

Subsequent analysis of longline data for 1952–85 indicated that, in contrast to the earlier report, determination of the status of the stock with respect to any arbitrary management objective or level, such as AMSY, was not possible. However, the study recommended that an increase in fishing effort beyond the earlier levels "would not be favorable to the blue marlin stock," because the nominal (or non-standardized) catch rates showed further declines during the 1975–85 period.

Why the Big Change in Results?

Individual blue marlins spend the majority of their time in waters near the surface in waters within 1° to 2°C of the local sea-surface temperature. Bigeye tuna, on the other hand, swim in cooler, deeper waters.

In the early 1970s, longlines that set in these deeper waters appeared in the western equatorial Pacific. By 1980, they were the predominant longline throughout the equatorial Pacific Ocean.

While the new gear was more effective for bigeye, the use of deeper fishing longlines resulted in relatively fewer hooks being in the warmer, shallower portion of the water column where blue marlin are found. Thus, much of the fishing effort was no longer as effectively "fishing" for marlin or other surface oriented fishes and the methods being used for "standardizing" fishing effort began to give questionable and ambiguous results. A new approach to standardization was necessary and eventually developed.

The Solution

The solution combines information on the habitat limitations of a species (herein blue marlin), the distribution of fishing effort (herein hooks in the water column) and the distribution of habitat (herein temperatures in the Pacific).

The procedure went something like this:

- Summarize data for the Japanese longline fishery for 1955–97, on 5-degree latitude by 5-degree longitude grids, in two-month periods by hook depth.
- Standardize these estimates of nominal fishing effort using the temperature preference distributions for blue marlin and the distribution of relative water temperature in each area of the Pacific.
- Create an estimate of annual effective effort for blue marlin by the Japanese longline fishery using the summed standardized estimates of local effort. (Figure 1)

(continued on page 6)

Upcoming Events

November 15–17
Use of Property Rights in Fisheries Management
Western Australia
telephone (61) 8-9482-7333
e-mail RMetzner@fish.wa.gov.au, Ross.Shotton@fao.org

November 18–20
Fish Expo
Seattle, Washington
www.fishexpo.seattle.com

February 14–17, 2000
International Pelagic Shark Workshop
Pacific Grove, California
bbabcock@wcs.org, epikitch@wcs.org,
mcamhi@audubon.org

March 23–26, 2000
Conference in Regards to Interannual, Decadal and Interdecadal Scales of Variability in the Pacific from the Tropics North to the Arctic
La Jolla, California
telephone (1-250) 363-6366
fax (1-250) 363-6827
e-mail pices@ios.bc.ca

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Pacific Blue Marlin (continued from page 5)

· Divide this new, standardized measure of total hooks effectively targeting blue marlin into the respective annual catch by the Japanese fishery.

The results provide annual standardized catch rates of blue marlin caught per effective hook. A population dynamics model used this and other data—such as total annual catches and growth and natural mortality rates—to examine the status of blue marlin in the Pacific.

So Where are We Today?

During the last five years the average total catch of blue marlin has been about 21,000 mt and has ranged from 17,300 to 24,000 mt. The annual average effort is 30.2 million standardized hooks with a range of 22.5 to 38.5 million standardized hooks.

The averages of the estimates of the AMSY from fitting the population dynamics model ranged from about 17,400 mt to 19,100 mt, with AMSY-efforts of about 34.5 million to 65.0 million standardized hooks, respectively. The ratio of the estimated 1997 biomass of blue marlin to the biomass that would be expected at AMSY ranged about 1.1–1.7 for the most likely scenarios and about 0.8–1.7 across all fittings from these models.

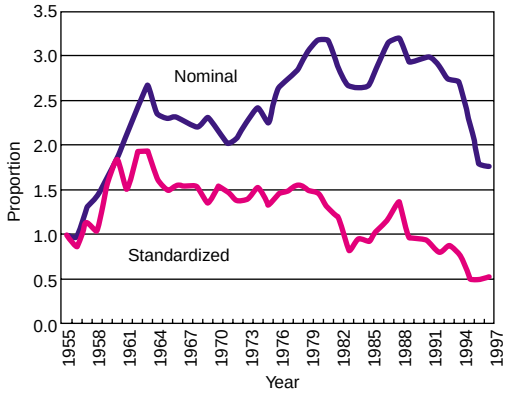

Figure 1. Nominal (non-standardized) and standardized hooks fished by the Japanese longline fishery relative to 1955 levels.

As improvements are made in the data and models required to understand the dynamics of pelagic fish stocks, these analyses will be updated so managers have the information necessary to act in a timely manner.

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