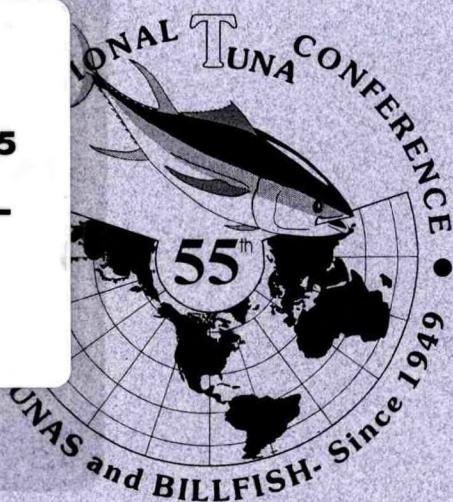


SH
11
.A2
S6625
55th
2003-
2004



National Marine Fisheries Service
Southwest Fisheries Science Center

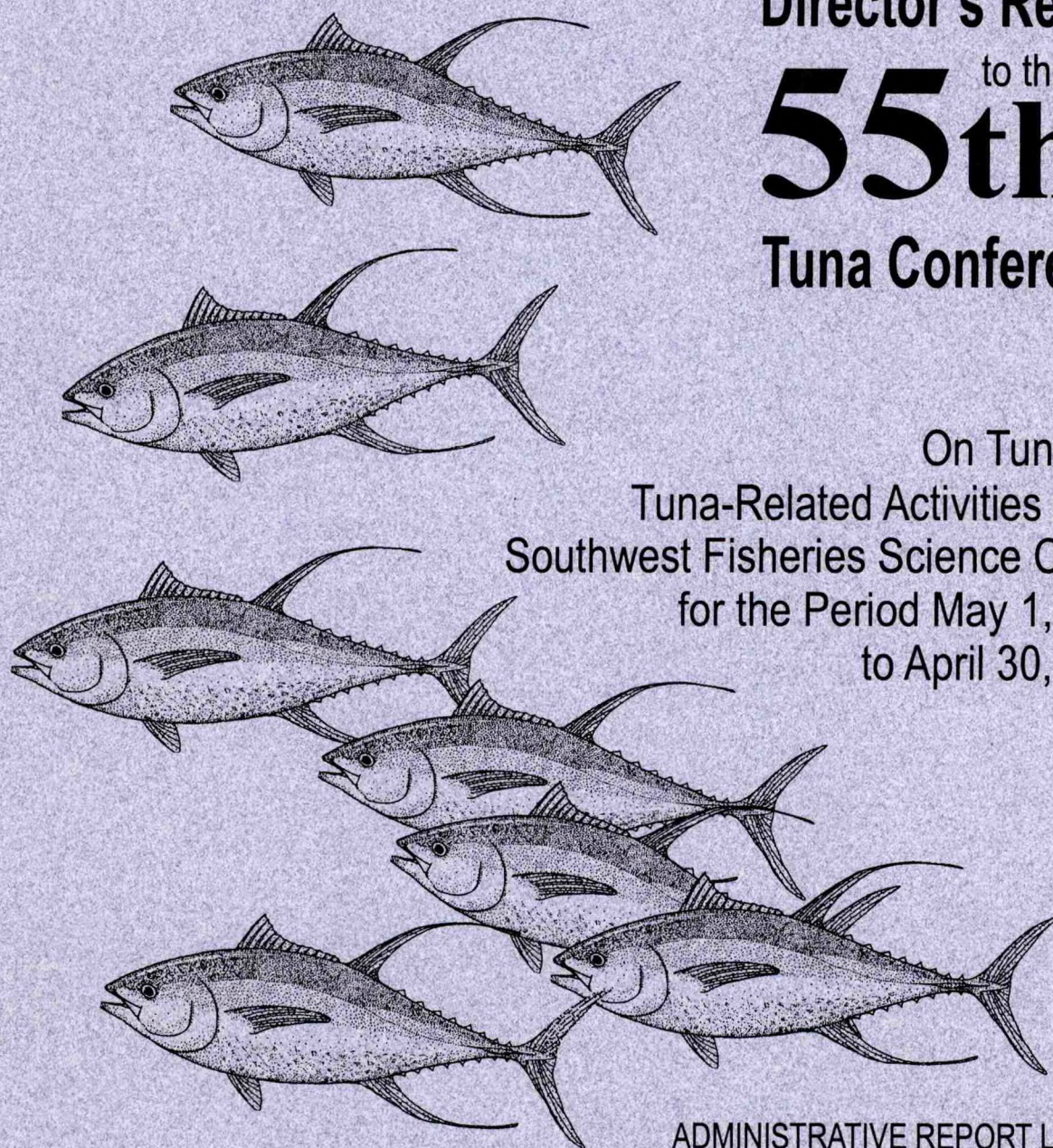
Department of Commerce
National Marine Fisheries Service

MAY 27 2004

Southwest Fisheries Science Center
La Jolla, California

Director's Report to the **55th** Tuna Conference

On Tuna and
Tuna-Related Activities at the
Southwest Fisheries Science Center
for the Period May 1, 2003
to April 30, 2004



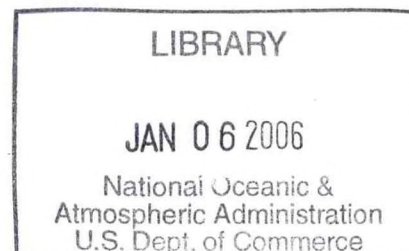
ADMINISTRATIVE REPORT LJ-04-04



"This report is used to ensure prompt dissemination of preliminary results, interim reports, and special studies to the scientific community. The material is not ready for formal publication since the paper may later be published in a modified form to include more recent information or research results. Abstracting, citing, or reproduction of this information is not allowed. Contact author if additional information is required."

SH
11
AZ
S6625
55th
2003-2004

**DIRECTOR'S REPORT TO THE 55th TUNA CONFERENCE
ON TUNA AND TUNA-RELATED ACTIVITIES
AT THE SOUTHWEST FISHERIES SCIENCE CENTER
FOR THE PERIOD MAY 1, 2003-APRIL 30, 2004**



Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA
8604 La Jolla Shores Drive
La Jolla, California 92037-1508

William W. Fox, Science Director

May 2004

ADMINISTRATIVE REPORT LJ-04-04



U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Marine Fisheries Service

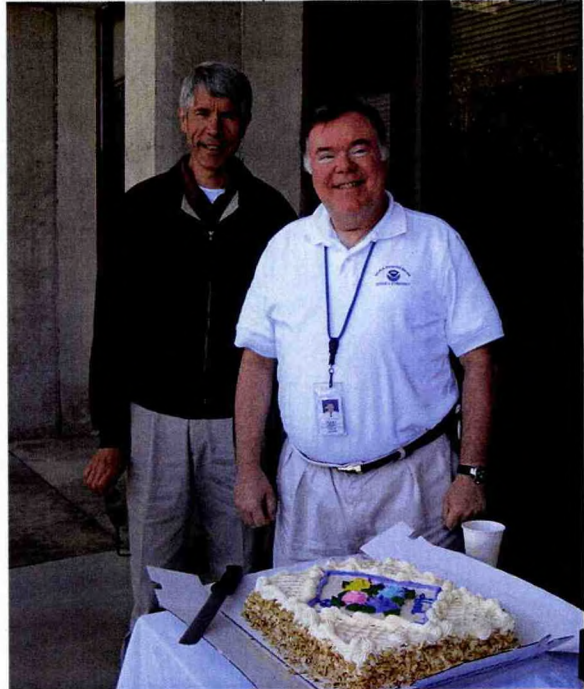
Table of Contents

Introduction	iii
I. U.S. Fisheries for Large Pelagics in the Central and Western Pacific	1
II. Standing Committee on Tuna and Billfish	2
III. Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean	2
IV. Advances Made in Highly Migratory Species Data Coordination	4
V. Pacific Albacore Fisheries	4
VI. Eastern Tropical Pacific Ocean Tuna Fisheries	9
VII. Pelagic Shark Research	10
VIII. Billfish Angler Catch Rates and Movements	15
IX. Pacific Council Highly Migratory Species Activities	17
X. Other	18
XI. SWFSC Publications on Tuna and Tuna-related Subjects	19

INTRODUCTION

To begin on a personal note, I am pleased to introduce myself as the new Director of the Southwest Fisheries Science Center. My distinguished predecessor, Mike Tillman, retired from federal service in January 2004. Dr. Tillman's outstanding leadership and guidance during the past 11 years helped to make the Southwest Fisheries Science Center the world-class fisheries research center that it is today. Mike set high standards of excellence and achievement during his tenure, and I am excited and honored to take on the challenges that lie ahead for the Center. Congratulations to Mike on his retirement, and best wishes from all of us here at the Center.

By way of introduction, my previous positions with the National Marine Fisheries Service (NMFS) have included Director of the Office of Science and Technology from 1996 to 2004, Director of the Office of Protected Resources from February 1993 until October 1996, and Director of NMFS from January 1990 until January 1993. Other public service has included the State of Florida Marine Fisheries Commission (1983-1990) and the U.S. Marine Mammal Commission (1983-1990), with terms as chairman of both commissions. Before returning to public service in 1990, I was a Professor of Marine Biology and Fisheries and Director of the Cooperative Institute for Marine and Atmospheric Studies at the University of Miami's Rosenstiel School of Marine and Atmospheric Science (1982-1990). Before that I spent 12 years with NMFS and its predecessor agency, the Bureau of Commercial Fisheries. I have authored or co-authored more than 60 scientific publications and am a Member of the American Fisheries Society, a Fellow of the American Institute of Fishery Research Biologists, and a Member of Sigma Xi, the Scientific Research Society. My formal education includes a B.S. in zoology and an M.S. in marine science from the University of Miami, and a Ph.D. in fishery science from the University of Washington.



Mike Tillman (left) and Bill Fox (right).

Getting back to the purpose of this report, the following pages contain highlights of research conducted by the Southwest Fisheries Science Center during the past year that was related to Pacific tunas, billfishes, oceanic sharks, and protected species associated with their fisheries. The aim of the data collection and analysis is to maintain healthy U.S. and world fisheries, populations of protected marine species, and fish habitat, and to ensure that the most effective fishing regulations and international treaties are carried out.

William W. Fox Jr., Ph.D.

Science Director, Southwest Region
National Marine Fisheries Service
La Jolla, California

I. U.S. FISHERIES FOR LARGE PELAGICS IN THE CENTRAL AND WESTERN PACIFIC

U.S. fisheries for pelagic fishes in Pacific Ocean continue to be important components of local and regional economies. Most of the fish stocks targeted by these fisheries appear to be healthy, unlike many exploited fish populations around the world. Recent assessments indicate that the stocks of bigeye, yellowfin, skipjack, and albacore tunas targeted by U.S. fisheries in the Pacific are not overfished. The aggregate catch from some tuna stocks, however, may be approaching the maximum sustainable yield. Likewise, recent assessments for North Pacific swordfish and Pacific blue marlin, while preliminary, indicate that these stocks are not overexploited. The high level of cooperation among scientists of Pacific island nations and distant-water fishing interests enhances the prospects for maintaining healthy fisheries for tunas and billfishes in the region, along with regular data sharing and stock assessments and rapid progress toward implementation of a multinational conservation and management arrangement for highly migratory fish stocks in the western and central Pacific.

U.S. Tuna Purse Seine Fishery in 2003 –The National Marine Fisheries Service (NMFS) monitors the U.S. purse seine fishery for tropical tunas in the central and western Pacific Ocean as part of U.S. obligations under the South Pacific Regional Tuna Treaty between the United States, 16 Pacific island nations, and one territory. The NMFS Pacific Islands Regional Office in Pago Pago, American Samoa, collects information from the fishery as vessels unload their catches. The data are transmitted to the Southwest Fisheries Science Center (SWFSC) in La Jolla, California, where scientists computerize and analyze logbook, landings, and biological data from the fishery to evaluate the fishery's performance and to assess the health of Pacific tropical tuna stocks. A background paper prepared by SWFSC scientists for the 2004 annual meeting of treaty participants reviewed data collected from the 2003 fishery and the fishery's impact on the skipjack, yellowfin, and bigeye tuna stocks in the area. Highlights of the paper are given below. The paper also was presented at the VI Foro Nacional sobre el Atun in Mazatlan, Mexico.

The U.S. fleet size in 2003 decreased to the lowest level since the start of the treaty in 1988. Only 27 vessels obtained licenses in 2003 and of those only 26 vessels actually fished. The decrease in fleet size in 2003 also contributed to the lowest recorded catch (87,900 metric tons, t) since the beginning of the treaty. The 2003 catch decreased 26% from levels reported in 2002 (119,200 t). As is typical in the central-western Pacific, skipjack tuna dominated the 2003 catch (72%), followed by yellowfin tuna (24%), and bigeye tuna (4%).

Non-El Niño conditions affected fishing in 2003. These conditions caused the fleet to fish further west than in 2002, when El Niño conditions existed. Sets on free-swimming schools of tuna were dominant at 53% of all sets, a decrease from 65% of all sets recorded in 2002. Logs (floating debris) were more abundant in the western areas, and the occurrence of log sets went from less than 5% of the sets in 2002 to 29% of the sets in 2003. With the high abundance of logs in the west, the use of fish aggregation devices (FADs) decreased from 33% in 2002 to 18% in 2003.

Fishing in the western areas also affected fleet performance. Days at sea per trip in 2003 were the highest recorded since the start of the treaty and 7% higher than in 2002, as vessels had to travel farther to find fish. The average number of trips per vessel was also the lowest recorded since 1988 and 24% lower than in 2002. The overall catch rate declined slightly from 19 t per day fished in 2002 to 18 t per day fished in 2003, a decline of 5%.

During the year, samples taken of the tuna catch provided estimates of total landings on a species-by-species basis. Logbooks and landings data were collected from 100% of the U.S. purse seine fleet in 2003, and length measurements and species composition samples were taken from 35,000 yellowfin, skipjack, and bigeye tunas.

II. STANDING COMMITTEE ON TUNA AND BILLFISH

The sixteenth meeting of the Standing Committee on Tuna and Billfish was held in Mooloolaba, Queensland, Australia, in July 2003. At the meeting, SWFSC researchers presented an update of a paper that investigated factors that may have affected catch rates of U.S. purse seiners fishing in the central-western Pacific. The study tracked various performance factors of 13 vessels that fished continuously from 1988 to 2002. The researchers found that the use of FADs enhanced catch rates for the fleet. During the period of low FAD usage (1989–1995), catch per set was 25 t per set, and during the period of high FAD usage (1996–2000), catch per set increased to 34 t per set. FAD use returned to low levels in 2000–2002 and catch rates also returned to lower levels. The researchers also found that vessels using FADs made more trips of shorter duration, spent less time fishing, and were more successful than vessels that did not use FADs.

SWFSC researchers presented another paper that evaluated differences between log and FAD sets from logbook data in 1997 to 2002 for the U.S. purse seine fishery in the central-western Pacific. The researchers did not find statistical differences in the geographical distributions, fishing success, species composition, or size of fish caught in log or FAD sets from year to year. One factor that may have affected the results was the low sample size for log sets in 1999–2002. Also, biases in the reporting of log and FAD sets may exist. Logs are sometimes tied to FADs, beepers are attached to logs, and logs may be enhanced with netting. The logbook reports do not differentiate these situations from those of purely log or FAD sets.

The results of a contract to assess the accuracy of NMFS port samplers in American Samoa in identifying yellowfin and bigeye tunas were also presented at the meeting. Yellowfin and bigeye tunas are landed together and labeled yellowfin tuna by canneries. To separate the landings of these two species, port samplers take samples of the landings for species identification. Key to the accuracy of these samples of bigeye and yellowfin tuna landings is the sampler's ability to differentiate the two species, especially for small size fish. A tuna identification specialist was contracted to assess the accuracy of the samplers. Results indicate that the samplers were very accurate in differentiating the species (100%). The contractor suggested that the experiment be rerun on fish less than 40 cm in size, as these were unavailable during this study. He also suggested periodic reviews of the port sampling program to maintain accuracy and developed a manual as a training tool for samplers.

III. INTERIM SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

The fourth meeting of the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was held in Honolulu, Hawaii, during February 2004. The purpose of this international meeting of fishery scientists was to review fisheries for tuna, swordfish, and other tuna-like species and to discuss research on the status of the fish stocks. SWFSC researchers participated in ISC working group sessions for statistics, bluefin tuna, swordfish, and marlin. After the ISC meeting, an intersessional meeting of the North Pacific Albacore

Workshop was held, and SWFSC researchers participated in that meeting as well. The researchers exchanged data for North Pacific fisheries and evaluated research activities in preparation for an albacore stock assessment meeting in December 2004.

U.S. Catches of North Pacific Bluefin Tuna Estimated – North Pacific bluefin tuna catch estimates from U.S. fisheries were summarized from various sources and made available to the ISC for stock assessment research. Annual catch estimates were provided for the period 1918 to 2002 and quarterly catch estimates were provided for the period 1928 to 2002. Fishing gear identifiers were commercial and sport for 1918 to 1980. A finer division of commercial catch estimates by gear type (pole and line, purse seine, longline, gillnet, troll, and hand line) was provided for 1981 to 2002. Since 1918, total North Pacific bluefin tuna landings peaked at 15,920 t in 1966, with most of the catch made by purse seine vessels. Commercial fishing for North Pacific bluefin tuna has been low in recent years, and only 63 t was landed by U.S. commercial fishers in 2002. Some of this catch was sold to bluefin tuna pen-rearing operations in Baja California, Mexico. Conversely, recreational fishing for bluefin tuna has increased over the past five years, and approximately 348 t was reported caught by U.S. recreational fishers in 2002. Port sampling of bluefin tuna landings for length composition has been conducted by the Inter-American Tropical Tuna Commission since 1987. Annual and quarterly length-frequency summaries also were provided to the ISC for inclusion in the North Pacific bluefin tuna stock database.

Marlin Research Highlighted – A paper presented to the first meeting of the Marlin Working Group of the ISC described the SWFSC Billfish Research Program's support of conservation and management of billfish resources in the Pacific Ocean. The SWFSC Angler Survey has provided a 33-year time series of recreational catch and effort by species in the Pacific and Indian oceans, particularly in areas where the effort is highest (i.e., Hawaii, Southern California, and Baja California). Area-specific catch per unit effort (CPUE) for striped and blue marlins has been calculated from survey responses in the areas where recreational fishing pressure is highest and shows mostly stable or increasing trends over the 33-year period. As of December 2003, the SWFSC Billfish Tagging Program has tagged and released 21,730 striped marlin and 334 of these have been recaptured. Most striped marlin were tagged in Southern California, Baja California, and Hawaii. Movement from California or Baja California tagging was predominately to the south or west. Movement from Hawaii tagging was generally dispersive in all directions from Hawaii. More than 6,000 blue marlin have been tagged by recreational fishers through the program and 71 tagged fish have been recaptured. Nearly half of these were released and recovered within 200 nmi of Hawaii. Three others tagged near Hawaii traveled great distances to the South China Sea, the Marquesas Islands, and New Caledonia. Blue marlin tagged in Southern California moved south into waters off Baja California Sur.

Researchers at the SWFSC also are analyzing historical catch records from Southern California recreational angling clubs. Striped marlin appear in the club catch records in the early 1900s, and combined club records indicate a decline in the average whole weight of striped marlin caught recreationally in Southern California. Cooperative efforts with the recreational anglers are also providing researchers with access to billfish that are caught for both conventional and electronic tagging. These efforts are designed to gain information on billfish migration and to access recreational catch and effort data which may be used in improved stock assessment models.

IV. ADVANCES MADE IN HIGHLY MIGRATORY SPECIES DATA COORDINATION

A data coordination team has been working since 2002 towards better coordination of highly migratory species (HMS) data collected and maintained at the NMFS Pacific Islands Fisheries Science Center, Pacific Islands Regional Office, Southwest Regional Office, and SWFSC. The team is co-chaired by staff from the SWFSC and Pacific Islands Fisheries Science Center. During September 2003, the team met to discuss progress on resolving issues that were identified at its first annual meeting and to identify any new issues. Significant progress has been made on establishing a data portal (<http://swfscdata.nmfs.noaa.gov>) for sharing information and for allowing public access to summary information. The site contains an HMS data catalog with metadata descriptions and summaries of each data set maintained by the members. Meeting minutes, data submission guidelines, minimum requirements for data collection, and data management policies are also available on the site, which is still under development. Special working groups currently are looking at data management and collection guidelines and are continuing work on completing a data catalog. The next annual meeting of the HMS data coordination team is scheduled for August 2004 in Honolulu.

The SWFSC's HMS data coordination team also has been working closely with the national Fishery Information System (FIS) project in Washington, D.C. With FIS financial support, the team has improved computer hardware and communication capabilities of facilities maintaining databases. An observer database developed at the Pacific Islands Fisheries Science Center and used by the Pacific Islands Regional Office is being adopted by the Southwest Regional Office for its observer data. A permits system developed by the FIS has also been adopted by the Pacific Islands and Southwest Regional Offices. The FIS also is assessing an SWFSC Oracle database for storage of logbook, size measurement, tagging, catch and landing, and other types of fishery-related data. Thirteen legacy datasets are being loaded to the system with assistance from FIS Oracle contractors. Many members of the HMS data coordination team participated in the first FIS meeting in November 2003 at Silver Spring, Maryland, and became members of working groups tasked to further develop the FIS.

V. PACIFIC ALBACORE FISHERIES

U.S. troll vessels have fished for North Pacific albacore since the early 1900s and for South Pacific albacore since 1986. North Pacific albacore fishing areas range from Vancouver Island to the Mexican border and from the U.S. West Coast to approximately 170°E longitude. The fishing season begins in late April and can last into early November. The size of the troll fleet ranges from 500 to more than 1,000 vessels. Approximately 804 U.S. troll vessels fished for North Pacific albacore in 2002.

South Pacific albacore fishing areas extend from the east coast of New Zealand to approximately 110°W longitude. This fishery begins in late December and continues until early April. The international troll fleet in the South Pacific consists of 20 to 60 vessels. Fourteen U.S. troll vessels fished for albacore in the South Pacific during the 2000–2001 season. Bycatch is sometimes reported in vessel logbooks, including skipjack, yellowfin, bigeye, and bluefin tunas.

Landings obtained from U.S. West Coast states, logbook data collected from cooperating fishermen, and length-frequency data obtained through port sampling from U.S. albacore troll and baitboat vessels operating in the Pacific Ocean are routinely processed by the NMFS for use in stock assessments and for fishery monitoring. Logbooks are provided by the

SWFSC to fishermen, who record fishing information and return the logbooks to the SWFSC. Length-frequency data are collected through a Pacific States Marine Fisheries Commission contract to Washington, Oregon, and California state fisheries agencies and from NMFS offices in American Samoa and Hawaii. Statistics from these sources were analyzed during the year by SWFSC staff and summarized in a report (SWFSC Administrative Report LJ-03-09) issued in August 2003. Highlights of the report are given below.

Summary of U.S. North and South Pacific Albacore Troll Fisheries – U.S. troll vessels landed 10,686 t of North Pacific albacore in 2002, compared to 11,210 t landed in 2001. Annual catches over the last 10 years averaged 11,000 t. The most productive fishing areas in 2002 were in waters off Washington and Oregon and offshore near 163°E and 168°E. U.S. catches of South Pacific albacore decreased from 2,128 t in the 2000–2001 season to 1,038 t in the 2001–2002 season. South Pacific catches averaged 1,700 t over the past 10 years.

CPUE in the North Pacific fishery has fluctuated greatly since 1995. CPUE increased from 68 fish per day in 2001 to 85 fish per day in 2002. Total effort decreased by 19%, from 25,414 days fished in 2001 to 20,662 days fished in 2002. CPUE for the South Pacific fishery decreased from 47 fish per day in 2000–2001 to 46 fish per day in 2001–2002, while days decreased from 6,194 days fished to 2,853 days fished during the same periods.

A total of 10,686 albacore were measured during the 2002 North Pacific season. The average fork length of sampled albacore in 2002 was 67 cm (13 lb or 6.5 kg), compared to 68 cm (14 lb or 7.0 kg) in 2001. Two size-class modes were evident at 63 cm (3 years old) and 75 cm (4 years old) fork length in the North Pacific length-frequency samples.

During the 2001–2002 South Pacific season, a total of 723 albacore were measured. The average fork length of South Pacific albacore that were sampled was 73.0 cm (17.5 lb or 8.8 kg), compared to 71.0 cm (16.2 lb or 8.1 kg) in the 2000–2001 season. Because of the low sample size, individual size-class modes were difficult to distinguish.

Cooperative Research with the American Fishermen's Research Foundation – SWFSC scientists are working in cooperation with the American Fishermen's Research Foundation (AFRF) on ongoing monitoring programs and other research efforts to improve knowledge of the biology of North Pacific albacore in the waters off the U.S. Pacific Coast. The cooperative research includes:

North Pacific Albacore Biological Data Sampling Program – Since 1961, a biological data collection program, or port sampling program, has been in place for collecting size data from albacore landings made by the U.S. and Canadian troll fleets at ports along the U.S. Pacific Coast. The biological data are collected by personnel from state fishery agencies (Washington, Oregon, and California) who follow sampling design and data processing instructions from the SWFSC, where the database is maintained. Roughly 170 fishing trips and 12,000 fish were sampled in 2002. In recent years, biological data have also been collected by fishermen during selected fishing trips to augment data collected through the port sampling program. After a training session, fishermen acted as biologists and provided a randomly selected length distribution for selected fishing trips which landed catches at ports in California, particularly northern California sites where no port sampling was in place. Although participation in this program has not been high to date, with fewer than 500 length measurements taken, the AFRF members and SWFSC scientists designed new measurement kits in 2003 for the

fishermen and began promoting increased participation in the coming seasons. The sample information provided by the fishermen was found to be generally similar to that collected through the port sampling program.

North Pacific Albacore Logbook Data Sampling Program – A logbook sampling program also has been in place since 1961, whereby albacore troll fishermen voluntarily submit their fishing records to the SWFSC. These data are primarily used to develop relative indices of abundance, which subsequently provide valuable auxiliary information for fine-tuning stock assessment models. Fishing records are submitted to state fishery agency staff or directly to the SWFSC. In 2002, 352 logbooks were submitted by the U.S. troll fleet. A database for logbook data is also maintained at the SWFSC.

North Pacific Albacore Archival Tagging Project – A long-term archival tagging project was undertaken during the 2001 albacore fishing season to document details regarding North Pacific albacore biology that are currently only generally understood (i.e., to determine exact migration routes of juvenile fish (3- to 5-year-old) and to determine time, temperature, and depth characteristics of the migrating fish). The project was structured as a five-year program that entails tagging approximately 120 fish in each of the years 2002–2005 for a total of 500 tags deployed by the end of 2005.

In the pilot year (2001) of the project, 15 archival tags were deployed over a three-week period in October–November. Because of limited funding, only four archival tags were deployed in 2002. But in 2003, program objectives were met with the deployment of 43 dummy tags (similar to archival tags but without the internal electronics for recording data) and 97 archival tags during three tagging trips. Dummy tags were deployed to perfect tagging practices and enhance the chance of obtaining a quick tag return to confirm that tagging procedures caused minimal trauma to the fish. In total, 159 tags have been deployed in the first three years of the project. All deployments were made off the coasts of Southern California and northern Baja California during the months of July–November. The fish, ranging from 57 to 110 cm fork length, were captured near the surface on hand lines or rod and reel.

One archival tag has been recovered from a fish at large for 12 weeks. The fish remained in a relatively small area off the coast of northern Baja California and Southern California. During the latter eight weeks of the deployment period, the fish demonstrated a diurnal pattern of repetitive deep diving during the day while remaining near the surface at night. Dives routinely exceeded 150 m in depth.

The first three years of the tagging project have been very successful. The return of the first tag has confirmed the tagging team's success in capturing, implanting tags, and releasing healthy, active fish. As more tags are returned, the data are expected to assist in determining North Pacific albacore stock structure and habitat use patterns, information that is essential to improving stock assessments.

International Collaboration on North Pacific Albacore Research – The SWFSC hosted the eighteenth North Pacific Albacore Workshop in December 2002. Fifteen researchers from Japan, Taiwan, Canada, the NMFS Pacific Islands Fisheries Science Center, and the Inter-American Tropical Tuna Commission attended that workshop. Researchers from the SWFSC La Jolla Laboratory presented papers that addressed various topics, including formal stock assessments of the albacore population that inhabits the North Pacific Ocean, issues

surrounding the workshop's scientific information exchange and centralized databases, ongoing development of fishery statistics applicable to the U.S. troll and longline fisheries, potential biological studies that would generate critical information for addressing reproductive parameters generally assumed in modeling efforts, and recent developments with a recently implemented archival tagging program.

Results from VPA-based (ADAPT model) assessments presented at the workshop indicated that albacore population abundance remains at relatively high levels (roughly 500,000 t), particularly compared to levels observed during the late 1970s through the 1980s (Fig. 1). However, estimates of fishing pressure have been relatively high, and prolonged periods of elevated fishing pressure would likely lead to reduced abundance in the future (i.e., all estimates of projections resulted in decreased abundance, regardless of "productivity" assumptions (see below) concerning levels of recruitment in the future). Currently, the albacore population is being fished at a rate generally associated with minimum biomass thresholds for many fish populations (i.e., an exploitation level that could compromise the stock's ability to sustain its size over a long term). However, it is important to note that biological reference points (e.g., maximum sustainable yield-based statistics and minimum biomass thresholds) have not been formally identified for the tuna stocks in general, and further, albacore is likely a relatively productive fish stock that is able to sustain elevated levels of fishing pressure for short periods of time if recruitment remains relatively high in the near future.

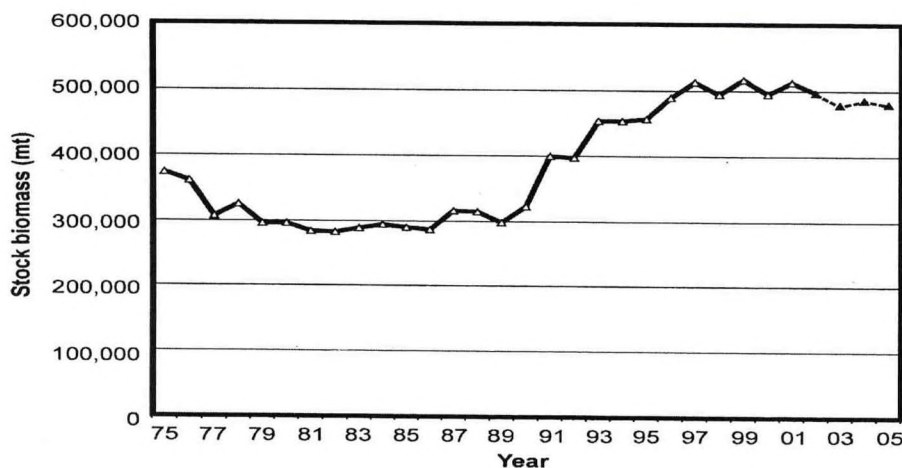


Figure 1. Estimated North Pacific albacore total stock biomass (metric tons) time series (1975–2005) generated from the "baseline" model (ADAPT Model Analysis) developed through consensus of the North Pacific Albacore Workshop (2002). Estimates for 2002–2005 represent forecasted values based on a high "productivity" assumption regarding recruitment levels in the near future (see Fig. 2).

In terms of recent recruitment strength, the consensus from the workshop is that the albacore population is still in a period of "high productivity," which is illustrated in the estimated

time series of recruitment (Fig. 2). That is, generally speaking, all model configurations (hypothesized “states of nature”) suggested that recruitment, albeit variable over time, was generally lower during the mid-1970s through the late 1980s and subsequently has increased since then. In summary, albacore stock size will likely remain relatively constant over the next few years if recruitment remains at levels observed over the last decade. However, if recruitment levels decline to those observed during the 1970s–1980s, population biomass could decline markedly, given fishing pressure remains at its current, elevated level.

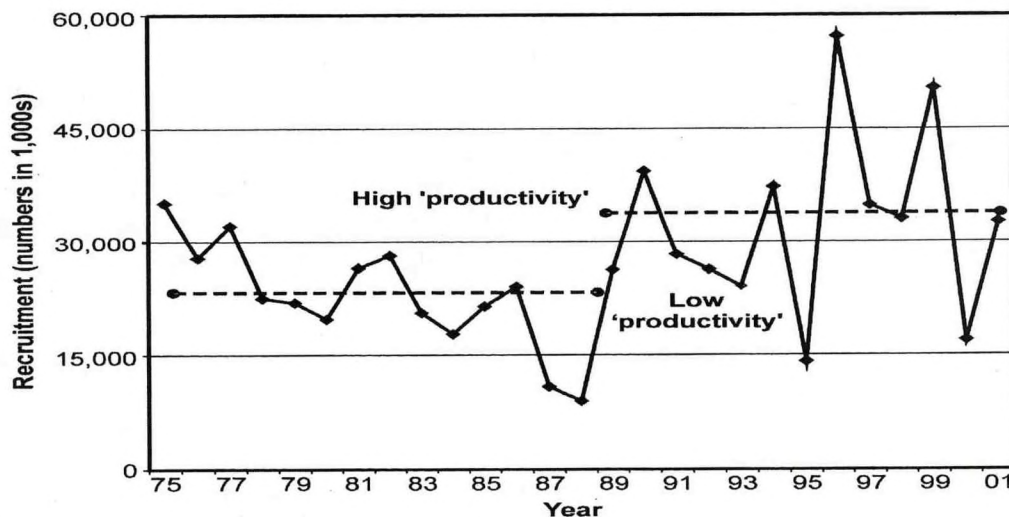


Figure 2. Estimated North Pacific albacore recruitment (age-1 fish in 1,000s) time series generated from the “baseline” model (ADAPT Model Analysis) developed through consensus of the North Pacific Albacore Workshop (2002). Two time spans are presented that generally illustrate high and low periods of recruitment “productivity.”

SWFSC researchers also presented preliminary results from statistical modeling research using MULTIFAN-CL software. The model is a length-based, age-structured analysis that allows much greater flexibility than the VPA-based analysis described above. That is, the MULTIFAN-CL model analysis is based on detailed evaluations of each fishery’s dynamics, including issues surrounding catchability and selectivity, which is not possible in the ADAPT model. Although substantial progress has been made with the MULTIFAN-CL model analysis, much work is needed in the future, including rigorous examination of the input data and inclusion of tagging-related information.

Researchers from Japan and the SWFSC are collaborating on development of a baseline model (MULTIFAN-CL), with results to be presented and reviewed by an international team of scientists at the next North Pacific Albacore Workshop, to be held in Canada this December. An intersessional meeting is also planned in July 2004 in Taiwan. These meetings will address

issues of sample data quality, development of necessary time series used as input data for the models, and continued research involving alternative statistical modeling approaches.

U.S.-Canada Albacore Treaty – A paper on the 2003 U.S. North Pacific albacore troll fishery was presented at the annual U.S.-Canada Albacore Treaty consultation in Vancouver, British Columbia, in April 2004. The SWFSC paper reviewed albacore landings, effort, CPUE, and fish size distribution in 2003, detailed U.S. catches in Canadian waters (<1%), and gave a brief status of the North Pacific albacore stock.

The NMFS has published proposed regulations necessary to implement treaty amendments agreed to by Canada and the United States to better regulate fishing for albacore tuna in the Pacific. The proposed rule would establish vessel marking, recordkeeping, and reporting requirements for U.S. albacore fishing vessel operators and vessel marking and reporting requirements for Canadian albacore fishing vessel operators under the treaty. The intended effect of this proposed rule is to allow the United States to carry out its obligations under the treaty by allowing fishing by both U.S. and Canadian vessels as provided for in the treaty.

The revised treaty includes an initial three-year reciprocal fisheries limitation regime that would reduce the fishing effort each year until a level is reached in the third year that is slightly above the pre-1998 average level of fishing. The fishing limitation can be adjusted by agreement to accommodate changing conservation and fishery management needs. The mutually agreed upon fisheries limitation regime is expected to be in place by June 2004.

VI. EASTERN TROPICAL PACIFIC OCEAN TUNA FISHERIES

International Dolphin Conservation Program Act Research (IDCPA) – During the past year, research activities at the SWFSC related to the IDCPA included (1) completion of a research survey to investigate trends in population size of dolphin stocks most affected by the tuna purse seine fishery in the eastern tropical Pacific Ocean (ETP) and (2) presentation of continued analyses of past data at two ETP-dedicated sessions of the biennial conference of the Society for Marine Mammalogy.

2003 Dolphin Research Survey – The research survey made in 2003, *Stenella* Abundance Research (STAR03), was a continuation of and complimentary to past surveys by the SWFSC from which abundances were estimated for depleted stocks of ETP dolphins. The primary goal of STAR03 was to estimate abundance for these depleted stocks and to compare these with estimates from past cruises to determine if stocks are recovering from their depleted status. The line transect survey was conducted simultaneously on two NOAA research vessels from July to December. A total of 1,732 marine mammal sightings were made between the two vessels in 216 days at sea.

In addition to the line transect portion of the survey, supplemental projects were carried out to aid in estimating abundance of the dolphin stocks and assess their overall status. Photographs of dolphin schools were taken from a helicopter to help obtain accurate school size estimates to calibrate the line transect estimates. The photographs also indicate proportion of calves and school structure. Photographs also were taken from the research vessels and from small boats for stock identity and documenting geographic variation in dolphins. Skin biopsy samples were collected from cetaceans to provide a database for investigations of stock

structure and phylogenetic relationships. Additionally, researchers used sonobuoys and a towed hydrophone array to collect cetacean acoustic data to supplement sighting effort.

Although the primary aim of the research survey was to evaluate trends in abundance of depleted dolphin stocks, a variety of ancillary research projects were included to aid in interpreting the results of the abundance estimation. To better understand variations between previous and current estimates of abundance, this ancillary research was designed to help determine if there has been an environmental regime shift that could affect dolphin abundances. In addition to marine mammals, scientists recorded sightings of seabirds and sea turtles. Daily sampling of flying fish and other surface organisms was also conducted, and active acoustics were used to sample micronekton biomass between 0 and 500 m depth. Concurrent with these activities, oceanographic data were collected several times a day.

Presentations Made at Marine Mammal Conference – The Society for Marine Mammalogy is a nonprofit entity that promotes the educational, scientific, and managerial advancement of marine mammal science. Its fifteenth Biennial Conference on the Biology of Marine Mammals was held in Greensboro, North Carolina, in December 2003. More than 1,350 marine mammalogists were in attendance. The conference had two sessions dedicated to ETP studies, with 11 presentations given by SWFSC scientists or contractors. Their talks all related to depleted ETP dolphin stocks and fell under a variety of topics, including abundance, ecosystem studies, stress, behavior, and reproduction and synthesis.

VII. PELAGIC SHARK RESEARCH

The SWFSC's shark research focuses on highly migratory pelagic sharks that occur along the U.S. Pacific Coast, including shortfin mako, blue, and three species of thresher sharks. Researchers are studying the sharks' biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. This information is provided to international, national, and regional fisheries conservation and management bodies charged with ensuring that shark populations remain at sustainable levels. Some of the recently completed or ongoing shark research activities being carried out by the SWFSC are discussed below.

Shark Surveys and Tagging – Surveys are carried out in the Southern California Bight to track trends in abundance of juvenile and sub-adult blue and shortfin mako sharks and neonate common thresher sharks. The commercial and sport catch of these species within the U.S. Pacific Coast Exclusive Economic Zone (EEZ) is largely juvenile sharks, although catches of adult blue and thresher sharks and a few adult shortfin mako sharks also occur. Efforts to determine abundance trends from commercial fishery data have so far been complicated by changes in fishing methods and areas and regulatory restriction over time, which have resulted in wide swings in both catch and distribution that are difficult to interpret. Therefore, consistent, fishery-independent sampling was needed, with slightly different survey strategies required for the more oceanic shortfin mako and blue sharks compared to the more coastal common thresher shark. The thresher shark and mako shark are important commercial sharks in California and popular sport species, especially in highly populous Southern California. Although the blue shark has little market importance, it is a leading bycatch species in the U.S. West Coast drift gillnet and high-seas longline fisheries.

Offshore longline surveys from relatively large research vessels have proved most appropriate for sampling and estimating abundance trends of the more oceanic species (shortfin

mako and blue shark). The surveys have enabled the SWFSC to obtain a valuable abundance index for the shortfin mako, which can be linked to a historical time series of logbook and landings data from a former commercial mako longline fishery in the Southern California Bight during 1988-1991. Abundance trend information is also obtained for the blue shark, which is compared to that obtained from observers in the drift gillnet and high-seas longline fisheries. The surveys are carried out cooperatively with the California Department of Fish and Game and Mexican researchers with CICESE in Ensenada, Baja California, Mexico. Tagging is also carried out to determine movements and obtain information on shark age and growth.

Juvenile Mako and Blue Shark Abundance Survey – This survey, conducted since 1994, now provides a 10-year time series of fishery-independent CPUE and length-frequency data for shortfin mako and blue shark in the Southern California Bight. In 2003, the juvenile shark survey deployed a total of 5,635 hooks at 28 sampling stations off Southern California. Catch included 66 mako sharks, 104 blue sharks, 1 common thresher shark, and 30 pelagic rays. The catch-effort data indicate the overall catch rate was 0.33 sharks per 100 hook-hours for shortfin mako sharks and 0.54 sharks per 100 hook-hours for blue sharks.

During the 2003 survey, 138 sharks were tagged with conventional tags to collect movement data, 34 sharks were marked with oxytetracycline for age and growth studies, 38 DNA samples were collected, and 25 blood samples were obtained for condition and post-release survival studies. Eleven satellite pop-up tags and seven smart position and temperature transmitting tags were deployed on 11 individual mako sharks in a continuing series of habitat, migration, and condition studies. Early results indicate mako sharks surface briefly, allowing data transmissions of temperature and location on a near daily basis. Mako sharks use a large coastal habitat stretching from Southern California to Magdalena Bay in Baja California Sur, Mexico (Fig. 3). Four adult blue sharks were tagged with a total of seven satellite-linked archival tags in a cooperative Tagging of Pacific Pelagics project to define the physical habitat of Pacific blue shark. These sharks tended to move offshore and to the south and southwest (Fig. 4).

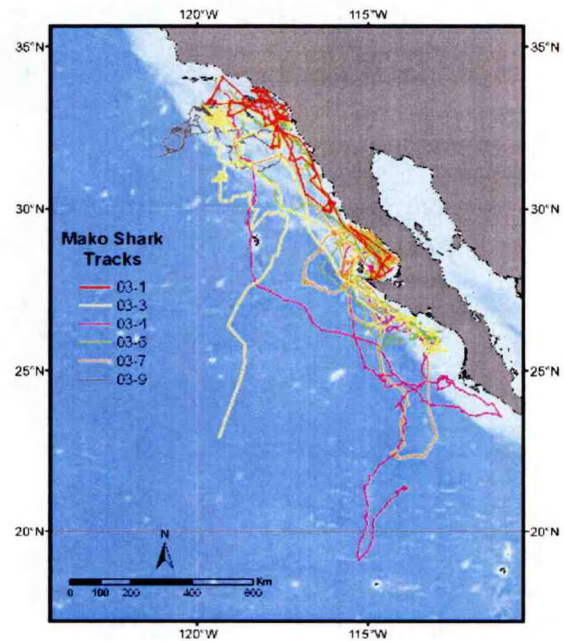


Figure 3. Movements of shortfin mako sharks as reported by satellite-linked tags deployed during the 2003 NMFS juvenile shark survey.

For developing an index of relative abundance for juvenile sharks, the CPUE is defined as catch per 100 hook-hours and summarized by set. Catches of shortfin mako shark varied from 43 individuals sampled in 2000 to 189 individuals sampled in 2001. For blue shark, catches varied from 73 individuals sampled in 2002 to 903 individuals sampled in 2000. Higher CPUE rates for mako sharks occurred in the first four years of the 10-year time series, ranging between 0.58 and 1.03, but turned negative for the last four years ($\alpha = 0.05$; Fig. 5). The blue shark CPUE for the fixed strata, alternate, and random blocks indicates a significant negative slope ($\alpha = 0.05$; Fig. 5).

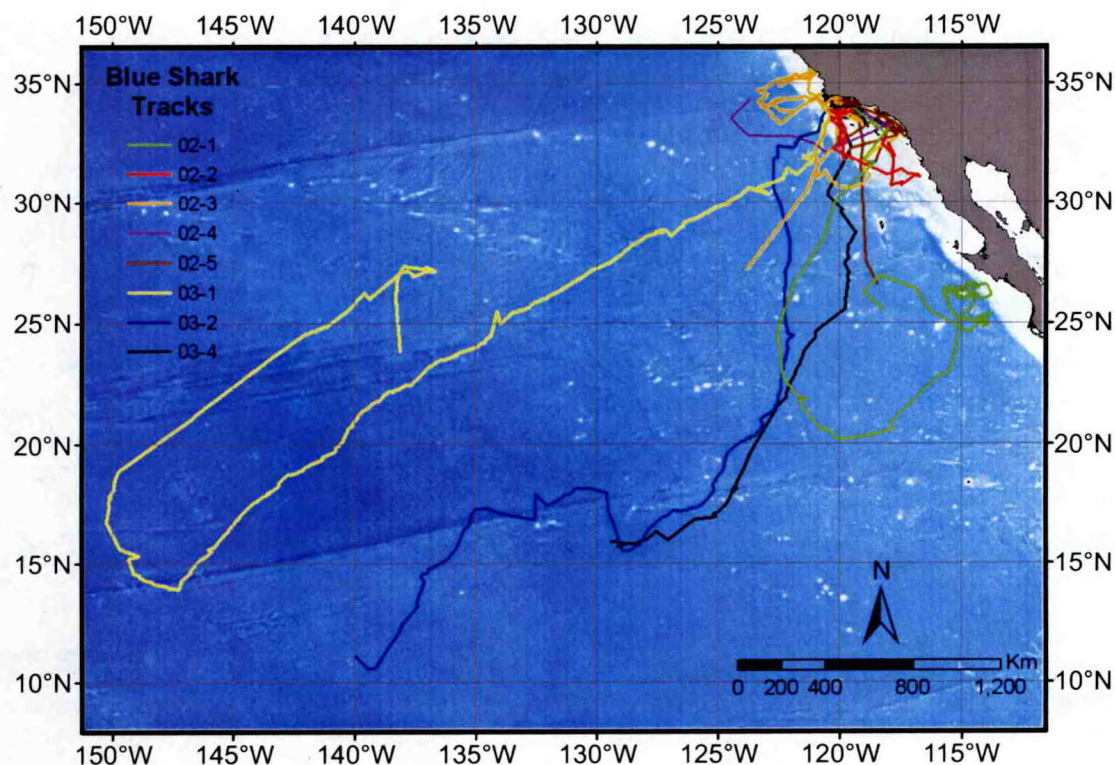


Figure 4. Movements of blue sharks as reported by satellite-linked tags deployed during the 2002 and 2003 NMFS juvenile shark surveys.

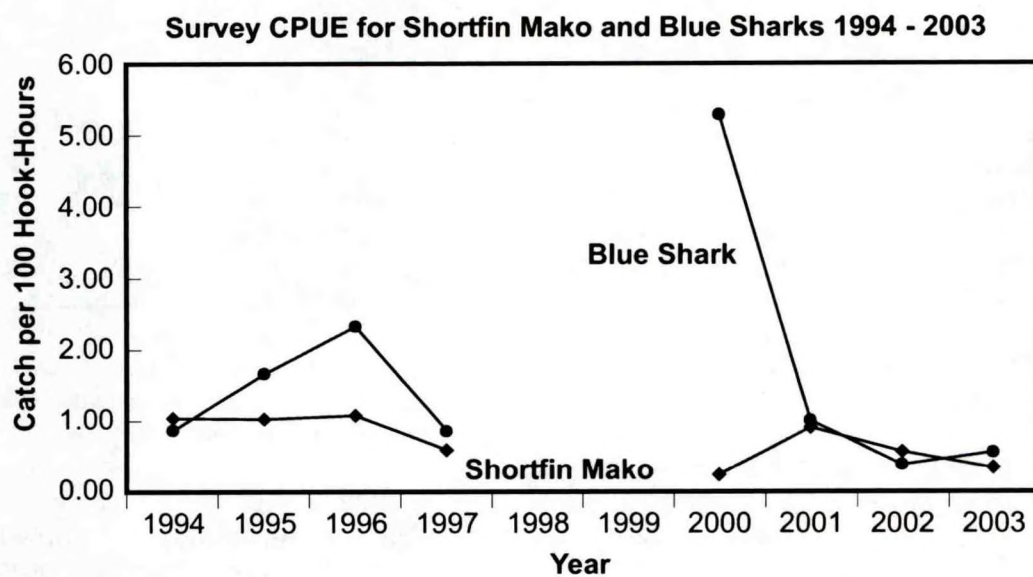


Figure 5. CPUE of shortfin mako and blue sharks during the NMFS juvenile shark survey of the Southern California Bight, 1994-2003.

Total lengths of all sharks were measured throughout the survey period. Mean lengths of shortfin mako shark ranged between 109.7 and 137.2 cm long for males and between 98.1 and 137.0 cm long for females (Fig. 6). Shortfin mako sharks reach maturity at about 200 cm total length for males and 280 cm total length for females. Few mature males and no mature females were sampled during the survey. There was little size difference between males and females. The trend in length frequency for blue sharks indicates seasonal variability and increasing size (Fig. 6). Mean total lengths of blue shark ranged between 87.5 and 142.9 cm long for females and between 115.3 and 177.3 cm long for males.

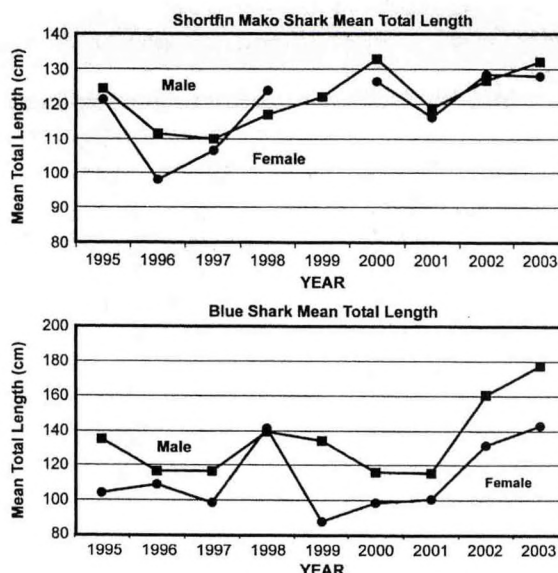


Figure 6. Mean total lengths for shortfin mako and blue shark, 1995–2003.

This survey provides data on relative shark abundance, size of catch, and life history parameters needed to address issues of stock condition. The survey indicates a negative CPUE trend of relative abundance for shortfin mako and blue shark composition in the Southern California Bight. The 342 stations that sampled shortfin mako shark indicated a continued decline in mean CPUE, from a high of 1.03 in 1994 to 0.33 in 2003. The CPUE trend for blue shark likewise decreased over the period but with greater variability. These trends do not necessarily indicate a serious decline in abundance. The size of catch for shortfin mako shark and blue shark is apparently increasing. It is not known if this is because there are fewer young animals entering the local population or the proportion of larger animals has increased from offshore immigration of mature individuals. The data do indicate the need for continued monitoring.

Common Thresher Shark Survey – A common thresher shark pre-recruit index and nursery ground survey was begun during the year. Its primary purpose is to produce a relative abundance index for the West Coast population of the common thresher shark by periodically sampling 0-year pups in their core nursery grounds off Southern California. Once the nursery area is defined, and a representative core area (or areas) is identified, the sampling design would be constructed. Sampled annually, this should result in a neonate index of abundance that mirrors adult abundance, since stock and recruitment are tightly linked in K-selected sharks such as the common thresher shark.

The common thresher shark stock off the U.S. West Coast is thought to be a regional and more coastal stock, migrating annually between Mexico and the three contiguous West Coast states. It utilizes Southern California (and possibly northern Mexico) as a pupping and nursery area. This stock was overfished in the 1980s and is now in a slow recovery phase after various area and season closures were imposed by the states of Oregon, Washington, and California. The common thresher shark stock has a relatively low potential rate of population growth and apparent dependence on inshore, high-use coastal areas as nursery grounds, especially during the first year of life. Population growth is estimated to be just above replacement, therefore close recruitment monitoring is needed to ensure its continued recovery from its former overfished condition.

Initial pilot sampling was successfully conducted in September–October 2003 in the coastal area south of Point Conception to Santa Monica Bay but was hampered by the presence of an intense red tide bloom. Catch rates from this sampling are being analyzed and compared with catch rates from former observed net fisheries operating in these areas in the past.

Shark Demographic Analyses – SWFSC researchers use information on the vital rates of sharks and apply it to mathematical models to estimate and compare the rebound potentials of various shark species (i.e., their relative productivity and ability to rebound from fishing pressure or other sources of mortality). The researchers have developed a method which does not require large data sets and incorporates a density-dependent population response, which can be used to examine the relative productivity of a range of shark species, including most U.S. West Coast sharks. Two shark demographic papers have been published since the inception of the project, and two papers, “Shark productivity and reproductive protection, and a comparison with teleosts” and “Intrinsic rates of increase of pelagic elasmobranchs,” are currently in press.

Estimating Sustainable Catch Levels for U.S. Pacific Coast Common Thresher and Shortfin Mako Shark – In addition to research vessel survey trends, commercial catch trends of pelagic sharks are also examined. Relative abundance trends for common thresher, shortfin mako, and blue shark in the California-based drift net fishery have been investigated using data from fisher bridge logs, onboard observer records, and an NMFS fishery-independent relative abundance survey. Preliminary results indicate that local thresher shark stocks may be rebuilding after being overfished during the 1980s. Trends in relative abundance of shortfin mako and blue sharks show a slightly decreasing trend in abundance along with decreased fish size in the catch over the same period, but the extent to which this has been influenced by shifts in environmental conditions and fish distributions is not known. A sustainable yield function was developed by SWFSC staff for the common thresher shark population that is accessible to the West Coast mainly drift gillnet fishery. The production function was based on the species’ rebound potential and amount of population decrease before recovery began, because the catch and effort data from the fishery primarily reflected fishery contraction rather than sustainable production. Rebound potential was estimated from life history parameters. Population decrease was estimated from CPUE changes in the Southern California Bight during the period 1981–1999. These estimates produced parameters for the logistic production model that produced a midpoint proxy estimate of local maximum sustainable yield available to the West Coast fishery at 450 t. From this a conservative regional harvest guideline for an optimum yield of 340 t was recommended. Present catch levels are approximately 300 t.

Relative abundance trends of shortfin mako shark in the Southern California Bight were examined for deriving a West Coast harvest guideline for this species. The mako sharks, mostly juveniles from a population whose adults are largely inaccessible and probably widely distributed offshore, are caught primarily in the drift gillnet fishery. The drift gillnet CPUEs did not indicate a consistent effect from exploitation, and therefore 75% of the average catch level of 200 t per year was recommended for a harvest guideline and optimum yield estimate of 150 t. Present catches are just under 100 t.

This status of stocks information was incorporated into the Pacific Fishery Management Council’s highly migratory species fishery management plan, adopted and published by the Council in 2003, and submitted to the NMFS and U.S. Department of Commerce for approval.

Pelagic Shark Feeding Ecology – Since 1999, work has continued investigating the feeding ecology of the common thresher shark during various oceanic regime changes, with recent work focusing on a comparison of blue, shortfin mako, and common thresher shark diets when these species co-occur in California Current waters off California and Oregon. The first paper resulting from these studies, "Feeding habits of the common thresher shark sampled from the California-based drift gill net fishery, 1998-99", was published in 2001, and a second paper, "Diet differences in the common thresher shark during transition from a warm to cool-water regime off California-Oregon, 1998-2000", was recently submitted for publication.

Mako and Thresher Shark Age, Growth, and Maturity – Ageing studies are underway to determine age and growth of shortfin mako shark sampled by Japanese longline from widely distributed localities in the Pacific and common thresher shark from the California-Oregon driftnet fishery. Sharks are aged by counting the concentric calcified bands in X-rays of cross sections of the shark's vertebra. The purpose of the mako ageing project is to help clarify movements of and effects of high-seas exploitation on different mako age groups. The researchers also hope to resolve existing problems in interpreting the timing of the formation of these calcified rings. This is a joint study between scientists from the National Research Institute of Far Seas Fisheries at Shimizu, Japan, and SWFSC scientists at La Jolla, California, to independently age a sample of about 250 subadult and adult mako sharks from the western and central North Pacific.

Thresher shark vertebrae are also being aged at the SWFSC using X-radiography techniques. The purpose is to expand and refine previous thresher ageing studies using a larger sample size from the driftnet fishery with accompanying information on sex and maturity stage. Tetracycline marking and release of tagged juvenile makos and juvenile and subadult threshers off California has begun to verify the timing of "annual" ring formation.

Blue Shark Dynamics in the U.S. Pacific Coast EEZ – In an upcoming collaborative project with San Diego State University, SWFSC researchers will study the dynamics of the various life stages of male and female blue sharks in the U.S. West Coast EEZ, using U.S. drift gillnet observer data collected since 1990. The results will be used to fill in the gaps in knowledge of blue shark dynamics in the extreme northeastern part of its range in the Pacific Ocean, for comparison with the Nakano migration model for blue shark in the North Pacific. According to the Nakano model, birth occurs in early summer in nursery areas located at 34 to 45°N, then 1- to 5-year-old females move north of these latitudes while 2- to 4-year-old males move south. On reaching maturity, blue sharks apparently migrate to the subtropics and tropics to join the reproductively active population. Better information on the dynamics of blue sharks in the EEZ may also help fishermen avoid undesirable bycatch of this non-marketable shark.

VIII. BILLFISH ANGLER CATCH RATES AND MOVEMENTS

The Center's billfish research program provides information for the conservation and management of billfish resources in the Pacific Ocean. This research includes recreational and commercial fishery monitoring, stock assessments, biological research into the life history and ecology of specific billfish species, and determining the economic importance of billfish resources. Two major components of that research are the International Billfish Angling Survey and the Billfish Tagging Program. These produce essential information pertaining to the recreational billfish angling community for exploring conservation and management concerns.

Billfish Angler Survey – The International Billfish Angler Survey provides recreational catch and fishing effort information at major fishing centers throughout the Pacific. Begun in 1969, the survey now provides a long time series of recreational catch and fishing effort for billfish in many key Pacific locations. CPUE (measured in catch of billfish per angler fishing day) is measure of angler success that when tracked over time can indicate changes in stock size caused by overfishing, changing environmental conditions, and even local economic or political events. CPUE is an important component of stock assessment models used by fishery managers in developing management options.

In 2002, 477 billfish anglers reported catching 3,038 billfish during 4,824 fishing days. The annual mean CPUE for all billfish was 0.63 billfish per day in 2002, up from 0.44 billfish per day in 2001. The current overall mean catch rate of 0.63 billfish per day is above the prior four-year average of 0.53 (1999–2002). The years 2000 and 2002 had the highest overall billfish CPUE recorded since the survey began. The prior all-time mean high catch rate of 0.57 billfish per day occurred during the first years of this survey (1969 to 1971). The lowest catch rates averaged 0.33 billfish per day during the mid-1970s.

Billfish Tagging Program – The angler-based Billfish Tagging Program has provided tagging supplies to billfish anglers for 40 years, providing data on the biology, distribution, and migration patterns of billfish. Recapture data indicate that blue marlin, striped marlin, sailfish, and swordfish move extensively throughout the Pacific but without an apparent specific pattern of migration. These transpacific movements, whether seasonal migrations, nomadic wanderings, or generally dispersive, expose billfish to high-seas commercial and coastal recreational fisheries. Billfish tagged and released by anglers and commercial fishers in the North Pacific are recaptured throughout the North and South Pacific by vessels operating in coastal and international waters.

Striped marlin are widely distributed in the Pacific and generally move in a directed yet dispersive manner away from core areas of high abundance, including the Hawaiian archipelago and the central coast of Mexico. Striped marlin tag and releases total 21,730 since 1963, with 334 recaptures, yielding a 1.54% recapture rate (Table 1). The majority of tagged striped marlin were tagged and released from Hawaii, Southern California, and Baja California Sur, Mexico. Recaptures indicate movement from Southern California to Baja California Sur but show little movement in the reverse direction. Striped marlin tagged off Southern California and Baja California Sur generally move south and offshore to the east. Several have been recaptured after moving great distances, including Hawaii, Peru, and the South Pacific. There is little indication of direct movement from Hawaii to the U.S. West Coast, although fish arriving off Baja and Southern California are thought to be from the central North Pacific.

Species Name	Release 2003	Release Total	Return Total	Rate %
Striped Marlin	301	21,730	334	1.54
Sailfish	204	8,518	47	0.55
Pacific Blue Marlin	481	6,786	71	1.05
Billfish, unid.	-	4,308	5	0.12
Black Marlin	6	3,355	69	2.06
Short-Billed Spearfish	140	1,507	2	0.13
Broadbill Swordfish	2	521	18	3.45
Yellowfin Tuna	-	347	24	6.92
Skipjack Tuna	-	99	2	2.02
Albacore Tuna	-	87	0	0
Bigeye Tuna	-	79	2	2.53
Bluefin Tuna	-	56	6	10.71
TOTALS	1,134	47,393	580	1.22

Table 1. Summary of billfish and tuna tagged in 2003 with releases and recoveries for 1963–2003.

A total of 6,786 blue marlin have been reported tagged with 71 recaptures, resulting in a 1.05% recapture rate (Table 1). Of those, 11 (15%) had missing release information and could not be analyzed. Nearly half of these marlin were released and recaptured within 200 nmi of Hawaii, indicating considerable interisland movement and residence times. Other billfish released off Hawaii moved west and offshore from 200 to 600 nmi. One blue marlin was recaptured after traveling to the Marquesas Islands (2,357 nmi), another to the South China Sea (4,450 nmi), and a third to New Caledonia (3,508 nmi). Blue marlin tagged off Baja California Sur also traveled west to Hawaii and to the Marquesas Islands in the South Pacific. Blue marlin are infrequent visitors to Southern California with few releases, and no recaptures exist.

Cooperating billfish anglers and U.S. commercial fishers have tagged a total of 521 broadbill swordfish. Recaptures total 18 for a return rate of 3.45% (Table 1). The SWFSC, along with cooperating Southern California billfish anglers and commercial fishers, conventionally tagged 17 swordfish in 1978 in an effort to identify movement patterns in the Southern California Bight. Six of those swordfish were recaptured within 35 days, and none had moved more than 30 nmi. Swordfish tagged north of Hawaii on U. S. longline vessels moved northeast toward the west coast of North America and were recaptured by other commercial fishing vessels. One swordfish tagged northeast of Hawaii by a commercial longline vessel was recovered near San Clemente Island, California, by a drift gillnet vessel fishing for swordfish.

Adopt-A-Billfish Program – The Adopt-A-Billfish tagging program in the Pacific is coordinated by a team of scientists from the NMFS Southeast and Southwest Fisheries Science Centers, the University of Miami's Center for Sustainable Fisheries, and The Billfish Foundation. In the Pacific, SWFSC biologists are collaborating with the Presidential Challenge tournament series off the coast of Central America. In 2003 and 2004, Adopt-A-Billfish collaborators traveled to Panama, Costa Rica, Guatemala, and Mexico, where they tagged 30 sailfish, 2 blue marlin, and 1 black marlin with satellite data archiving tags. This study seeks to determine the survival rate of large billfish caught and released during international tournament conditions and to evaluate site fidelity within the countries of Mexico and Central America.

Results to date indicate that, during tournament conditions, sailfish survive being caught and released only when proper tagging protocols are followed. The longest tag deployment to date is 90 days. Results of tag data also indicate significant movement across international boundaries from Mexico to Panama.

IX. PACIFIC COUNCIL HIGHLY MIGRATORY SPECIES ACTIVITIES

In August 2003, a fishery management plan (FMP) and environmental impact statement for U.S. West Coast fisheries for highly migratory species (HMS) were published by the Pacific Fishery Management Council and submitted to the NMFS and Secretary of Commerce. At its November 2003 meeting, the Council formally initiated development of an amendment to limit entry in the California-based high-seas pelagic longline fishery. In developing the initial recommendations (e.g., qualifying criteria), the Council directed the HMS Management Team to use Magnuson-Stevens Act requirements for limited access programs and four recommendations made by the HMS Advisory Subpanel. SWFSC biologists and economists have contributed substantially to the plan, including preparation of the stock assessment, fisheries description, essential fish habitat, regulatory analyses, and socio-economic impact sections. SWFSC economists are now working on options for limited entry qualifying criteria for the longline fishery.

In December 2003, the NMFS published a proposed rule for regulations to implement the HMS FMP. In the proposed rule and request for comments, the NMFS expressed concern about potential impacts on protected species of one FMP provision allowing the California-based high-seas longline fishery to continue targeting swordfish east of 150°W longitude. Consultation was also initiated under Section 7 of the Endangered Species Act concerning the potential impacts of the fisheries under the FMP on threatened and endangered species. The NMFS approved the FMP in February 2004, except for a provision to allow swordfish targeting by longline vessels east of 150°W, which was disapproved because of prospective impacts on loggerhead sea turtles. An Endangered Species Act rule to prohibit such longline fishing until the Council has amended its management program in a way that ensures adequate protection of sea turtles subsequently went into effect in April 2004. Regulations implementing the approved portions of the fishery management plan for highly migratory species became effective in May 2004.

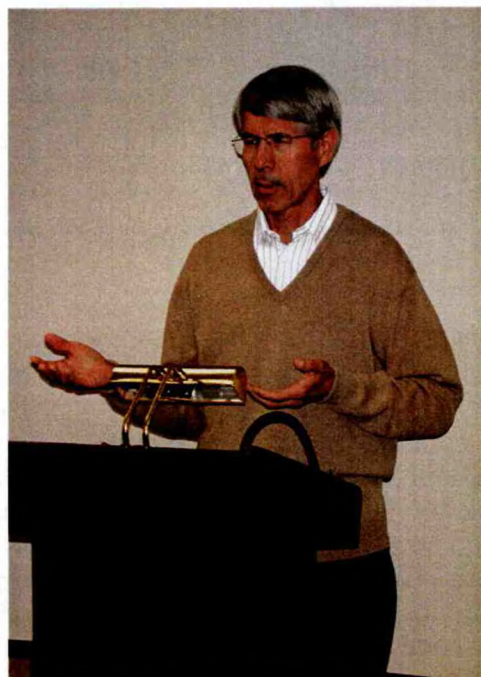
X. OTHER

Mike Tillman Retires – Dr. Michael F. Tillman retired in January 2004, after 11 years as SWFSC Director and more than three decades of federal service with the NMFS. His retirement was celebrated with a reception at Scripps Institution of Oceanography.

Tillman, an Alaskan Native and member of the Tlingit Indian Tribe, was born in Seattle, Washington, and received his primary and secondary education there. He received his B.S., M.S., and Ph.D. degrees from the University of Washington and first joined the NMFS in 1972 to supervise a modeling study of the Bering Sea marine ecosystem, based out of Seattle. In 1974, he was assigned to the assessment of whale stocks to help support U.S. policies at the International Whaling Commission, serving on its Scientific Committee and then chairing the Committee from 1982 to 1985.

In 1979, he was appointed as the first director of the National Marine Mammal Laboratory in Seattle, which was established as a principal source of scientific expertise on marine mammals within the NMFS. From 1983 to 1986, he served as the first professional director of the Conservation Monitoring Center of the International Union for Conservation of Nature (IUCN) in Cambridge England. In 1987, he returned to NMFS headquarters in Washington, D.C., as chief of the Conservation Science Division within the Office of Protected Resources. Tillman was appointed NMFS' Senior Scientist for Fisheries in 1988, and for two years he oversaw the NMFS' field-based research and science programs.

In 1990, he was appointed Deputy Assistant Administrator for Fisheries, responsible for the day-to-day operation of the NMFS, overseeing the activities of 2,000 employees and a budget of more than \$200 million annually. In 1993, he was appointed Science Director of the NMFS Southwest Region, overseeing the research programs on Pacific fisheries, marine mammals, and



Dr. Michael F. Tillman

endangered species undertaken by the SWFSC in California and Hawaii, as well as the NMFS Antarctic research program.

Among his many international activities, Mike Tillman served as chairman of the IUCN Species Survival Commission's Cetacean Specialist Group and as a member of the Commission's Steering Committee. He was a U.S. delegate to the International Council for the Exploration of the Sea and to the Interim Scientific Committee for North Pacific Tunas and Tuna-like Species. Tillman is Deputy U.S. Commissioner to the International Whaling Commission and served as U.S. Commissioner to the Inter-American Tropical Tuna Commission.

Tillman is a research associate of the Scripps Institution of Oceanography at the University of California in San Diego and serves on the External Advisory Board of the California State University, Los Angeles' Center for Excellence in Science and Technology, supporting its efforts to train minority graduate students. He has authored or co-authored more than 40 publications, focusing mainly on whale stock assessment methods and results. Dr. Tillman is a recipient of the Presidential Rank Award of Meritorious Executive, the Albert Schweitzer Medal of the Animal Welfare Institute, Presidential Appointments as U.S. Commissioner to the Inter-American Tropical Tuna Commission and as Deputy U.S. Commissioner to the International Whaling Commission, and three Department of Commerce Bronze Medals.

Mike's many friends and colleagues at the SWFSC congratulate him for his numerous outstanding contributions to the NMFS and to the conservation of threatened and endangered whales, and wish him a happy and productive retirement.

XI. SWFSC PUBLICATIONS ON TUNA AND TUNA-RELATED SUBJECTS

- Barlow, J., and G. Cameron. 2003. Field experiments show that acoustic pingers reduce marine mammal bycatch in the California drift gillnet fishery. *Mar. Mamm. Sci.* 19(2):265–283.
- Carretta, J. V., K. A. Forney, M. M. Muto, J. Barlow, J. Baker, and M. Lowry. 2004. U.S. Pacific marine mammal stock assessments: 2003. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-358, 291 p.
- Childers, J., 2003. Summary of the 2002 U.S. North and South Pacific albacore troll fisheries. SWFSC Admin. Rep., La Jolla, LJ-03-09, 49 p.
- Dotson, R., and R. Charter. 2003. Trends in the southern California sport fishery. *Calif. Coop. Ocean. Fish. Investig. Rep.* 44:94–106.
- Herrick Jr., S. F., R. Rasmussen, D. Dealy, and D. Squires. 2003. An analysis of producer surplus and private profit for the Pacific coast HMS fishing fleets. SWFSC Admin. Rep., La Jolla, LJ-03-07.
- Hinke, J. T., I. C. Kaplan, K. Aydin, G. M. Watters, R. J. Olson, and J. F. Kitchell. 2004. Visualizing the food-web effects of fishing for tunas in the Pacific Ocean. *Ecol. Soc.* 9(1):10. [online] URL: <http://www.ecologyandsociety.org/vol9/iss1/art10>.
- Hobson, E. S. In press. Evolution of California marine teleost fishes. *In* L. Allen, M. Horn, and D. Pondella (eds.), *Ecology of California marine fishes*. University of California Press.

- Hyrenbach, K. D., and R. C. Dotson. 2003. Assessing the susceptibility of female black-footed albatross (*Phoebastria nigripes*) to longline fisheries during their post-breeding dispersal: an integrated approach. *Biol. Conserv.* 112:391–404.
- Kirkley, J. E., D. Squires, M. F. Alam, and J. O. Ishak. 2003. Excess capacity and asymmetric information in developing country fisheries: the Malaysian purse seine fishery. *Amer. J. Agr. Econ.* 85(3):647–662.
- Lai, N. C., N. Dalton, Y. Y. Lai, C. Kwong, R. Rasmussen, D. Holts, and J. B. Graham. 2004. A comparative echocardiographic assessment of ventricular function in five species of sharks. *Comp. Biochem. Physiol. A* 137(3):506–521.
- Lai, N. C., K. E. Korsmeyer, D. Holts, and D. Ramon. 2003. Metabolic rates of two oceanic elasmobranchs, the shortfin mako (*Isurus oxyrinchus*) and the pelagic ray (*Dasyatis violacea*). *FASEB J.* 17(4):A422.
- Maunder, M. N., G. M., Watters, and S. J. Harley. 2003. A-SCALA: An age-structured statistical catch-at-length analysis for assessing tuna stocks in the eastern Pacific Ocean. *Inter-Am. Trop. Tuna Comm. Bull.* 22(5):435–530.
- Olson, R. J., and G. M. Watters. 2003. A model of the pelagic ecosystem in the eastern tropical Pacific Ocean. *Inter-Am. Trop. Tuna Comm. Bull.* 22(3):133–217.
- Ortiz, M., E. D Prince, J. E. Serafy, D. B. Holts, K. B. Davy, J. G. Peperell, M. B. Lowry, and J. C. Holdsworth. 2003. Global overview of the major constituent-based billfish tagging programs and their results since 1954. *Mar. Freshw. Res.* 54(4):489–507.
- Perrin, W. F. 2004. Chronological bibliography of the tuna-dolphin problem, 1941–2001. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-356, 256 p.
- Polovina, J. J., E. Howell, D. M. Parker, and G. H. Balazs. 2003. Dive-depth distribution of loggerhead (*Carretta carretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific: Might deep longline sets catch fewer turtles? *Fish. Bull., U.S.* 101:189–193.
- Schick, R. S., J. Goldstein, and M. E. Lutcavage. In press. Bluefin tuna (*Thunnus thynnus*) distribution in relation to sea surface temperature fronts in the Gulf of Maine (1993–1996). *Fish. Oceanogr.*
- Squires, D., R. Q. Grafton, M. F. Alam, and I. H. Omar. 2003. Technical efficiency in the Malaysian gill net artisanal fishery. *Envir. Dev. Econ.* 8:481–504.
- Tillman, M. F. 2003. Director's report to the 54th tuna conference on tuna and tuna-related activities of the Southwest Fisheries Science Center. SWFSC Admin. Rep., La Jolla, LJ-03-06, 32 p.
- Watters, G. M., R. J. Olson, R. C. Francis, P. C. Fiedler, J. J. Polovina, S. B. Reilly, K. Y. Aydin, C. H. Boggs, T. E. Essington, C. J. Walters, and J. F. Kitchell. 2003. Physical forcing and the dynamics of the pelagic ecosystem in the eastern tropical Pacific: simulations with

Approved by the Science Director

Archer, F. I., T. Gerrodette, S. Chivers, and A. Jackson. Estimation of spotted dolphin (*Stenella attenuata*) calf deficit in tuna purse-seine sets from 1973 to 1990 and 1996 to 2000. For consideration for publication in Fishery Bulletin.

Edwards, E. F. Mother-calf behavior and its implications for dolphins chased by tuna purse-seiners – A review. For consideration for publication in Marine Mammal Science.

Fiedler, P. C., and L. D. Talley. Hydrography of the eastern tropical Pacific: A review. For consideration for publication in Progress in Oceanography.

Preti, A., S. E. Smith, and D. A. Ramon. Diet differences in the common thresher shark (*Alopias vulpinus*) during transition from a warm to cool-water regime off California-Oregon 1998–2000. For consideration for publication in California Cooperative Oceanic Fisheries Investigations Report.

Sepulveda, C. A., S. Kohin, C. Chan, R. Vetter, and I. Graham. Movement patterns, depth preferences, and stomach temperatures of free-swimming juvenile mako sharks. For consideration for publication in Marine Biology.

Unpublished Working Papers from the Interim Scientific Committee Meeting

Childers, J. 2004. Summary of the 2002 U.S. North and South Pacific albacore fisheries. North Pacific Albacore Workshop Intersessional Meeting Paper, NPALBint/04/02. SWFSC Admin. Rept. LJ-03-09. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Coan Jr., A. L. 2004. North Pacific Albacore Workshop data base catalog. North Pacific Albacore Workshop Intersessional Meeting Paper, NPALBint/04/01. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Coan, A. L., and J. Wetherall. 2004. Catalog of U.S. North Pacific highly migratory species catch-effort and size composition data. Statistics Working Group Paper. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Crone, P. R., and R. J. Conser. 2004. Critical evaluation of important time series associated with albacore fisheries (United States, Canada, and Mexico) of the eastern North Pacific Ocean. North Pacific Albacore Workshop Intersessional Meeting Paper, NPALBint/04/03. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Hill, K., and A. L. Coan Jr. 2004. Documentation of procedures used to calculate the U.S. catch of northern bluefin tuna in the Pacific Ocean. Bluefin Working Group Paper. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Holts, D. 2004. Billfish angler catch rates and movements. Marlin Working Group Paper. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Ito, R.Y., and A. L. Coan Jr. 2004. U.S. swordfish fisheries in the North Pacific Ocean. Swordfish Working Group Paper. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Kohin, S., P. R. Crone, and J. Childers. 2004. North Pacific albacore archival tagging project (2001-05). North Pacific Albacore Workshop Intersessional Meeting Paper, NPALBint/04/04. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Pacific Islands Fisheries Science Center and Southwest Fisheries Science Center. 2004. U.S. national report to ISC4 on North Pacific pelagic fisheries. Plenary Working Paper. 4th meeting of the Interim Scientific Committee, Honolulu, Hawaii, January-February 2004.

Unpublished Working Papers from the Standing Committee on Tunas and Billfish

Coan Jr., A. L., and D. G. Itano. 2003. An update of factors (2003) that may have affected U.S. purse seine catch rates in the central-western Pacific Ocean: an examination of fishing strategy and effective fishing effort. FTWG Working Paper. 16th meeting of the Standing Committee on Tunas and Billfish, Mooloolaba, Australia, July 2003.

Coan, A. L., and P. R. Crone. 2003. Fishery-related attributes associated with FAD and log fishing practices conducted by the U.S. purse seine fleet in the central-western Pacific Ocean, 1997-2002. FTWG Working Paper. 16th meeting of the Standing Committee on Tunas and Billfish, Mooloolaba, Australia, July 2003.

Itano, D. G., and A. L. Coan Jr. 2003. An assessment of the accuracy of yellowfin and bigeye tuna species identification by American Samoa port samplers. FTWG Working Paper. 16th meeting of the Standing Committee on Tunas and Billfish, Mooloolaba, Australia, July 2003.

Ito, R., D. Hamm, A. L. Coan Jr., and J. Childers. 2003. Summary of U.S. fishery statistics for highly-migratory species caught in the central-western Pacific, 1998-2002. NFR Working Paper. 16th meeting of the Standing Committee on Tunas and Billfish, Mooloolaba, Australia, July 2003.

Presentations from the Biennial Conference of the Society for Marine Mammalogy

Archer, F., and K. Robertson. Weaning and food habits of spotted dolphin (*Stenella attenuata*) calves in the eastern tropical Pacific. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Cowan, D., and B. Curry. Histopathological assessments of dolphins necropsied on board vessels in the eastern tropical Pacific tuna fishery. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Cramer, K., and W. Perryman. Estimation of reproductive and demographic parameters of the eastern spinner (*Stenella longirostris orientalis*) and northeastern offshore spotted (*Stenella attenuata*) dolphin using aerial photogrammetry. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Fiedler, P., et al. Effects of environmental variability on spotted and spinner dolphin abundance in the eastern tropical Pacific Ocean. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Forney, K., et al. Stress studies on dolphins involved in eastern tropical Pacific Ocean purse-seine operations. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Gerrodette, T., and J. Forcada. Abundance and trends of dolphins affected by the tuna purse-seine fishery in the eastern tropical Pacific Ocean. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Mesnick, S., et al. To flee or not to flee: Behavioral responses to research vessels in six populations of eastern tropical Pacific dolphins. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Pabst, D., et al. Measuring temperature and heat flux from dolphins in the eastern tropical Pacific: Is thermal stress associated with chase and capture in the tuna purse-seine fishery? Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Romano, T., et al. Investigation of the effects of repeated chase and encirclement on the immune system of spotted dolphins (*Stenella attenuata*) in the eastern tropical Pacific. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Wade, P. et al. Dynamics of the eastern spinner dolphin and the northeastern offshore spotted dolphin populations: Are they recovering? Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.

Weihs, D. Hydrodynamics of dolphin drafting. Presentation at 15th Biennial Conference of the Society for Marine Mammalogy, Greensboro, North Carolina, December 2003.