Northwest Atlantic Fisheries Organization

Serial No. N4237 **NAFO SCS Doc. 00/14**

SCIENTIFIC COUNCIL MEETING - JUNE 2000

United States Research Report for 1999

by

S. Clark and K. Sosebee

NOAA/NMFS, Northeast Fisheries Science Center
Woods Hole, MA 02543, USA

A. Status of the Fisheries (Subareas 3-6 Inclusive)

Brief summaries are provided on the status of fisheries for major species of finfish and shellfish.

Revised sampling and reporting protocols were implemented in the Northeast Region in 1994. New auditing and allocation procedures have been developed to prorate total reported landings by species among areas.

1. Atlantic Cod

USA commercial landings of Atlantic cod (*Gadus morhua*) decreased by 13% from 11,111 mt in 1998 to 9,691 mt in 1999. The 1999 landings are the lowest since 1960.

USA cod landings from the Gulf of Maine (Div.5Y) in 1999 were 1,630 mt, a 61% decrease from 4,152 mt landed in 1998. Fishing mortality on this stock has remained high over the past decade, averaging about 1.0 between 1983 and 1997. Fishing mortality declined to about 0.6 in 1998 and likely declined further in 1999. Spawning biomass has declined from over 26,000 mt in 1989 to about 8,200 mt in 1998. Northeast Fisheries Science Center (NEFSC) research vessel survey biomass indices have increased slightly since the 1993 record low, but continue to remain among the lowest in the series (Figure 1).

USA cod landings from Georges Bank (Div.5Z and SA 6) in 1999 were 8,061 mt, a 16% increase from 6,959 mt landed in 1998. Fishing mortality in 1999 was 0.22, continuing a declining trend following a record high of 1.4 in 1994. Spawning stock biomass in 1999 (34,800 mt) was about 9% higher than in 1998 (31,800 mt) and was 74% higher than the record low in 1994 (20,000 mt). Research vessel survey biomass indices have increased since the 1991 record low, but continue to remain well below the time series average (Figure 2).

2. Haddock

USA landings of haddock (*Melanogrammus aeglefinus*) increased 20% from 2,859 mt in 1998 to 3,443 mt in 1999. Georges Bank (Div. 5Z) landings increased 51% from 1,841 mt in 1998 to 2,775 mt in 1999, while Gulf of Maine (Div. 5Y) landings declined 34% from 1,018 mt in 1998 to 668 mt in 1999. Landings from both stocks remain below historical levels and continue to be constrained by management measures.

Research vessel survey biomass indices have increased in recent years for both the Gulf of Maine and Georges Bank stocks but remain below historical levels (Figures 3 and 4). Spawning stock biomass of Georges Bank haddock continued to increase in 1999 and is expected to increase further due to recruitment of the relatively strong 1998 and 1999 year-classes.

3. Redfish

USA landings of redfish (*Sebastes* spp.) increased by 10% from 320 mt in 1998 to 353 mt in 1999. Research vessel survey biomass indices increased in 1996 and remained relatively high from 1997 through 1999 compared to the 1980s (Figure 5) due to growth in biomass of one or more relatively strong year-classes produced in the early 1990s. Redfish from these year-classes should recruit to the fishery over the next several years.

4. Pollock (4VWX + 5 stock)

USA landings of pollock (*Pollachius virens*) decreased by 18% from 5,582 mt in 1998 to 4,594 mt in 1999. Spawning stock biomass increased from 89,000 mt to 204,000 mt between 1974 and 1985, but declined to 125,000 mt in 1992. Spawning biomass is estimated to have increased in 1993/1994 to about 146,000 mt as a result of modest recruitment from the 1987 and 1988 year-classes. Research vessel survey indices suggest that pollock biomass in Subarea 5 has increased over the past 5-6 years but continues to remain low relative to earlier periods (Figure 6).

5. White Hake

USA landings of white hake (*Urophycis tenuis*) increased 11% from 2,360 mt in 1998 to 2,625 mt in 1999. The stock has declined considerably from the relatively stable levels seen in the 1980s. Research vessel survey indices for 1997-1999 are among the lowest in the time series (Figure 7).

6. Yellowtail Flounder

USA landings of yellowtail flounder (*Limanda ferruginea*) increased 23% from 3,560 mt in 1998 to 4,380 mt in 1999. Research vessel survey indices suggest that the Georges Bank stock (Div. 5Z, E of 69E) continues to increase, while the Southern New England stock (Div. 5Z, W of 69E) remains at an historic low (Figures 8 and 9).

7. Other Flounders

USA commercial landings of flounders (other than yellowtail flounder) from Subareas 3-6 in 1999 totaled 14,900 mt, 8% lower than in 1998. Summer flounder (*Paralichthys dentatus*) (33%), winter flounder (*Pseudopleuronectes americanus*) (31%), American plaice (*Hippoglossoides platessoides*) (21%) witch flounder (*Glyptocephalus cynoglossus*) (14%), and windowpane flounder (*Scophthalmus aquosus*) (1%) accounted for virtually all of the 'other flounder' landings in 1999. Compared to 1998, commercial landings in 1999 were lower for winter flounder (-9%), summer flounder (-6%), American plaice (-14%), and windowpane flounder (-68%), but higher for witch flounder (+14%). Research vessel survey indices in 1999 increased for American plaice, summer flounder, and witch flounder, remained constant for winter flounder, and decreased for windowpane flounder (Figures 10 - 14).

8. Silver hake

USA landings of silver hake (*Merluccius bilinearis*) decreased 20% from 14,959 mt in 1998 to 11,974 mt in 1999. Research vessel survey biomass indices for the Gulf of Maine - Northern Georges Bank stock increased throughout the 1980s and varied without trend during 1990-1999; the 1999 index value was above average (Figure 15). Indices for the Southern Georges Bank - Mid-Atlantic stock decreased in the mid-1980s and have remained at low levels throughout the 1990s (Figure 16).

9. Red Hake

USA landings of red hake (*Urophycis chuss*) increased 13% from 1,343 mt in 1998 to 1,512 mt in 1999. Landings have remained at low levels since 1980. Research vessel survey biomass indices for the Gulf of Maine -

Northern Georges Bank stock have increased steadily since the early 1970s, and stock biomass is currently above the long-term average. Indices for the Southern Georges Bank - Mid-Atlantic stock, however, continue to remain depressed despite low fishing mortality (Figures 17 and 18).

10. Atlantic herring

Total USA landings of Atlantic herring (*Clupea harengus*) decreased 3% from 81,601 mt in 1998 to 79,374 mt in 1999. Spawning biomass of the coastal stock complex has increased continuously since 1982 and is currently well above the high levels observed in the late 1960s. Stock size has increased due to both strong recruitment and reduced fishing mortality on both adult and juvenile herring. There is strong evidence of stock recovery on Georges Bank (Div. 5Ze) based on research vessel trawl catches and larval survey indices. Commercial landings from Georges Bank decreased from 17,959 mt in 1998 to 4,477 mt in 1999, however, hydroacoustic estimates of the Georges Bank component in Autumn 1999 indicate a very high stock size.

11. Atlantic Mackerel

USA commercial landings of Atlantic mackerel (*Scomber scombrus*) declined slightly from 12,506 mt in 1998 to 12,015 mt in 1999. The stock (Subareas 2-6) is currently underexploited, and total biomass remains at record high levels. Stock rebuilding since 1981 has resulted from very low fishing mortality rates and the recruitment of several very good year-classes (1982, 1987, 1988, 1991, and 1993).

12. Butterfish

USA landings of butterfish (*Peprilus triacanthus*) increased 14% from 1,848 mt in 1998 to 2,101 mt in 1999. Research vessel survey biomass indices increased during the late 1970s, fluctuated during the 1980s, and are presently at the long-term average.

13. Squids

USA landings of longfin inshore squid (*Loligo pealeii*) decreased 3% from 19,205 mt in 1998 to 18,560 mt in 1999. Survey swept area biomass estimates suggest that the stock is at a low level.

USA landings of northern shortfin squid (*Illex illecebrosus)* decreased 69% from 23,597 mt in 1998 to 7,388 mt in 1999. The autumn 1999 survey biomass index value was among the lowest observed since 1967 (Figure 19).

14. Sea Scallops

USA landings of sea scallops (*Placopecten magellanicus*) in 1999 totaled 10,053 mt (meat weight), well above the 1998 value of 5,974 mt. Much of the increase in landings (2,680 mt) was due to a limited re-opening of a previously closed portion of Georges Bank.

Research vessel surveys in 1999 indicated continued increases in recruitment and biomass over 1998 levels in both the Georges Bank and Mid-Atlantic regions. The greatest increases in exploitable stock biomass occurred in closed areas but due to improved recruitment, biomass in open areas increased as well.

Three closed areas on Georges Bank and two closed areas in the Mid-Atlantic region now comprise the majority of exploitable scallop biomass in USA waters. Portions of the Georges Bank closure areas will be opened to restricted fishing in 2000; closed areas in the Mid-Atlantic region, implemented in early 1998, are projected to re-open in 2001. Rotational area harvest policies are now under development.

B. Special Research Studies

1. Environmental Studies

a) Hydrographic Studies

Ecosystems monitoring work by the NEFSC Narragansett Laboratory during 1999 included (1) the 6 standard seasonal cruises to measure temperature, salinity, chlorophyll-a and zooplankton on the continental shelf covering Cape Hatteras through the Gulf of Maine, and (2) monthly sampling along transects between Boston Massachusetts and Cape Sable, Nova Scotia and between New York and Bermuda on ships of opportunity to measure temperature, salinity, acoustic doppler current profiling, phytoplankton and zooplankton. A study of historical variation in temperature and salinity in the Gulf of Maine and the Middle Atlantic Bight from 1991 through 1999 is scheduled for publication in late 2000. An additional study on slow variations in mean path of the Gulf Stream east of Cape Hatteras was published in Geophysical Research Letters. Several manuscripts on historical variation in zooplankton abundance and species composition are in preparation or review. Considerable progress was also made in preparing manuals describing standard ecosystem survey and ship of opportunity (SOOP) sampling designs, equipment and sampling procedures. These are currently scheduled for publication in 2000.

b) Plankton Studies

GLOBEC Georges Bank Study: The USA GLOBEC Georges Bank study completed its fifth and final year of field work in 1999. Six monthly surveys of the Bank were conducted which measured hydrography (temperature, salinity, and fluorescence) and currents (by ADCP) and collected samples to determine the distribution and abundance of zooplankton and ichthyoplankton. In addition another 20 cruises were conducted to study the exchange processes in the frontal regions around the Bank. Hydrographic observations during the year indicated that the reduction in salinity observed from 1995-1998 had begun to reverse with higher salinity values being observed on the Bank and throughout the Gulf of Maine region. This change in water properties is not believed to have originated locally, but instead is believed to be associated with changes in inflows to the region from the oceanic slope water region offshore and from the Scotian Shelf.

c) Benthic Studies

Georges Bank: Field studies were initiated by staff at the NEFSC James J. Howard Laboratory to determine effects of mobile gear on habitats. Emphasis to date has been on effects of scallop dredges on gadid, flatfish and scallop habitat on Georges Bank. A June 1999 cruise to Closed Area II occupied 47 stations, including station pairs just in and outside area borders. Bottom grab and trawl samples were taken. The US Geological Survey and University of Connecticut also participated, using a Seabed Observation and Sampling System (SEABOSS) to take video and still photographs along transects through the stations. A shorter cruise was made to Closed Area I in July, similarly emphasizing pairs of stations straddling the closed area borders. Eighteen stations were sampled. Some results of these cruises (e. g., fish abundance and size) are available. Other analyses, such as fish food habits and benthic invertebrate assemblages, will not be completed until 2001. Two more cruises are scheduled for June and October 2000.

Middle Atlantic Bight: A study was also begun to determine environmental and habitat variables most critical in defining nursery habitat quality for yellowtail flounder and silver hake in the Middle Atlantic Bight, and to experimentally test effects of dredging on habitat quality, abundance and growth of these species. This is a cooperative study with the University of Miami, Rutgers University, and the Mid-Atlantic Bight National Undersea Research Center. The study uses submersible technology and shipboard sampling at two sites within the Sea Scallop Hudson Canyon South Closure Area, and one site outside the area. Each site includes two control and two treatment areas, the latter having been dredged with a commercial scallop dredge. The areas were sampled three times in 1999: just before dredging, and 2 days and 6 weeks after dredging. The sites will be revisited in June 1999, one year after dredging.

d) Aquaculture Studies

Bay Scallop Restoration: Attempts continue to increase severely depleted populations of bay scallops (*Argopecten irradians*) in the Niantic River in Connecticut. During the summer of 1999, the Waterford East-Lyme Shellfish Commission (CT) and staff at the NEFSC Milford Laboratory successfully raised over 30,000 hatchery-reared scallops, overwintered them in suspended cages, and deployed them into spawner sanctuaries throughout the river. The progression of gametogenesis and spawning of these scallops was documented. In 1998 the study area had a substantial eelgrass population, which serves as a critical habitat for settling scallop larvae. Unfortunately, spatial coverage of eelgrass beds declined precipitously during 1999. Harvest survey returns from recreational fishermen will help to evaluate if these efforts were productive.

Tautog Stock Enhancement: Studies of a natural tautog (*Tautoga onitis*) population in New Haven Harbor have identified a significant young-of-the-year (YOY) nursery area. Physical habitat characteristics and abundance and spatial distribution of YOY tautog have been quantified and marking studies with wire-coded tags are in progress to estimate movement, growth, and changes in population size. Trapping studies will be conducted in 2000 to identify juvenile tautog (age 1- 3) habitat. If available, tagged hatchery-reared tautog will be released at this site in September 2000.

e) Other Environmental Studies:

Investigation of Lobster Mortalities in Long Island Sound: Staff of the NEFSC Milford Laboratory examined moribund lobsters (*Homarus americanus*) from western Long Island Sound during the peak of a 1999 mortality event which killed more than one million lobsters. In cooperative studies with the New York Department of Environmental Conservation, the Connecticut Department of Environmental Protection, and the University of Connecticut, laboratory staff evaluated the possibility of bacterial infection as a cause of the mortalities. No evidence of bacterial infection was found. However, scientists at the University of Connecticut found parasitic amoebae in tissues of affected lobsters. Future studies will attempt to determine whether the amoeba is the primary cause of mortalities or is secondary after environmental stress.

Analytical Tools for the Study of Habitat Utilization by Estuarine-Dependent Resource Species:
James J. Howard Laboratory staff have integrated multivariate statistical analysis and geographic information systems (GIS) techniques to provide spatially-explicit analyses of habitat for fishery resource species. The Navesink River/Sandy Hook Bay Estuarine System (NSHES) in New Jersey is an important nursery ground for winter flounder, summer flounder, blue crabs (*Callinectes sapidus*) and other species and has been used as a test site for the analytical approach. In fall 1998 a two-year seasonal survey of 84 fixed stations was completed to provide spatially comprehensive data for trawlable fishes and macroinvertebrates, bathymetry, sediment characteristics, submerged vegetation, water quality parameters, and shoreline vegetation and development. Generalized additive models (GAMs) were developed from these data to describe relationships between environmental parameters, including macrobenthos, and juvenile winter flounder. Relationships were distinctly non-linear and multivariate, and changed dramatically with fish size during the first year of life.

Maps for the probability of capturing fish of particular sizes were produced by integrating GAMs with GIS using cell-based data for the environmental parameters. These revealed two important centers of settlement in the system, and that nursery locations shift rapidly with fish size. Nursery habitats expand, contract, and shift in position with seasonal and annual changes in key environmental variables. Simple habitat classification schemes therefore appear inadequate for description of winter flounder EFH.

Independent collections for winter flounder and environmental parameters were made at 12 stations in NSHES in the spring and summer of 1999 to test the habitat models. The test sets revealed that these habitat models are robust and have good predictive capability. A manuscript has been submitted to Marine Ecology Progress Series. In 2000, new analyses will be conducted on habitat associations of blue crabs in NSHES. Studies on spatial variation in winter flounder growth and mortality are continuing.

Essential Habitat for Estuarine-Phase Bluefish : During 1998 and 1999, staff at the James J. Howard Laboratory conducted twice-monthly gill net collections for bluefish *(Pomatomus saltatrix)* and other pelagic predators and prey species in the Navesink River/Sandy Hook Bay Estuarine System (NSHES) in New Jersey. The population data are currently under analysis for distribution and habitat association, and the diets of age-0 and age-1 bluefish are being examined. Habitat features being examined include temperature, salinity, turbidity, bathymetry, distance from shore, and the presence of prey organisms, using generalized additive models and geographic information systems. Additional studies will be conducted in collaboration with Rutgers University during 2000 to examine relationships between bluefish distribution, circulation patterns, and physical features of the water column such as tidal fronts and turbidity maxima, as well as the abundance of prey species.

2. Biological Studies

a) Fish Species

Studies on life history and ecology of marine and estuarine fishes continue at the James J. Howard Laboratory, with a primary focus on variations in reproduction and the growth, development, and survival of offspring during their early life history.

Flatfish studies: Studies are continuing on winter flounder and summer flounder to evaluate effects of temperature on growth, development, and mortality rates of eggs, larvae, and juveniles. Experimental designs generally include multiple temperatures (10 temperatures for embryonic period, 4 to 6 temperatures for larval period) and several replicate populations within temperatures. Data are providing insights on variability in developmental, morphometric, and meristic traits, and how these patterns relate to environmental factors. Survival of winter flounder from hatching to metamorphosis in 1998 was surprisingly high, exceeding 95% at the warmer temperatures. Summer flounder experiments are designed to evaluate the role of time and location of spawning, and therefore the thermal environments experienced by eggs and larvae. In addition, late larvae and early juvenile summer flounder are being subjected to water temperatures typical of inshore and bay habitats during mid-winter, which is the season of ingress of summer flounder.

Evaluations of mortality risks of recently settled juvenile flatfish are continuing, using winter and summer flounder as prey and bay shrimp, *Crangon septemspinosa*, blue crab, and summer flounder as predators. Studies include size-specific risk of predation, using various sizes of prey and predators, and consider the role of water temperature in determining the duration of the period juvenile flounder are vulnerable to these size-limited predators.

Gadid studies: Research efforts that began in 1998-1999 on Atlantic tomcod, *Microgadus tomcod*, are continuing. This species is of local interest as a sentry of habitat and fish community health and as an important forage fish in the estuarine systems in New Jersey and New York waters. It is of particular interest as a model gadid because of its compressed life history, reaching reproductive maturity within 1 year in nature on the New Jersey coast. Healthy tomcod can be grown in large numbers in the laboratory, and fish hatched in 1999 have already achieved gender differentiation. Results of studies on growth and developmental rates through the egg, larval, and early juvenile periods are being prepared for publication.

Goosefish studies: Research on goosefish, *Lophius americanus*, includes growth and maturation, and development and survival of early life stages. Egg veil fragments are being collected in cooperation with commercial fishermen and maintained in the laboratory. These egg masses will be the source of larvae and juveniles for descriptive and experimental studies in the summer of 2000.

b) Age and Growth

Approximately 40,749 age determinations were completed for 14 species of finfish and shellfish in support of resource assessment analyses and other research in 1999. In addition to Atlantic cod, haddock, and yellowtail flounder, 8,604 summer flounder, 5,471 witch flounder, and 5,158 pollock were aged.

Cod and haddock age structures were exchanged with Canadian age readers; and Atlantic herring and yellowtail flounder structures were exchanged with readers from USA state laboratories in a continuing effort to maintain comparability of age determinations.

Several research projects initiated in 1998 continued in 1999, these being 1) determination of age and growth parameters for northern shortfin squid through enumeration of daily growth rings in statoliths; 2) stock identification of Atlantic herring using elemental and shape analysis of otoliths and gross morphometrics of the entire fish; and 3) patterns of seasonal movement of Atlantic cod utilizing otolith microconstituent analysis. Studies initiated in 1999 included 1) collaborative studies with the University of Rhode Island on juvenile cod and haddock otoliths, and 2) age validation studies for goosefish.

c) Food Web Dynamics

Studies of trophic dynamics based on an integrated program of long-term (since 1963) monitoring and process-oriented predation studies continued in 1999. Modeling and analytical efforts focused on species interactions between elasmobranchs, major groundfish, and principal pelagics. Food habits samples were collected during NEFSC winter, spring and autumn surveys on the Northeastern and Mid-Atlantic continental shelf. Estimates of prey volume and composition were made at sea for selected species. During the winter survey, 6,054 stomachs from 24 species were examined, while 6,236 stomachs from 46 species, and 5,625 stomachs from 45 species were examined during the spring and autumn surveys, respectively. Diet sampling emphasized lesser known species, elasmobranchs (spiny dogfish, *Squalus acanthias*, and various skates), gadids, and flatfishes.

Revisions to the 26 year time series (1973-98) of food habits data collected during NEFSC bottom trawl surveys continued. The majority of the time series is now available for analysis, including data from over 250,000 stomach samples. Data from 13 process-oriented NOAA Coastal Ocean Program (NCOP) cruises including data from over 35,000 stomachs are also available. The processing of the autumn 1998 and all 1999 bottom trawl survey food habits data is scheduled for completion in 2000.

d) Apex Predators Program

Apex predators research focused on determining migration patterns, age and growth, feeding ecology, and reproductive biology of highly migratory species, particularly large Atlantic sharks. The Cooperative Shark Tagging Program (CSTP) involving over 6,500 volunteer recreational and commercial fishermen, scientists and fisheries observers (conducted since 1962) continued to tag large coastal sharks and provided information to define essential fish habitat for shark species in US waters in 1999.

A cooperative USA/Canada research program on the biology of the porbeagle shark, *Lamna nasus*, continued in 1999. Final analysis of porbeagle shark vertebrae was accomplished leading to the development of a growth curve for the species. Verification of this curve was provided by independent generation of growth curves using tag/recapture and length-frequency modal analyses. Validation of the periodicity of the vertebral bands was confirmed up to age 11 using both tetracycline marked vertebrae and known age recaptures. Reproductive sampling continued in 1999 and preliminary maturity estimates were generated. Histological processing was begun on reproductive tissues. Tagging was continued for migration studies.

Reproductive dynamics and nursery ground studies also continued, focusing on the identification and characterization of mating, pupping and nursery areas of small and large coastal sharks along the Atlantic coast of the US. Studies in 1999 involved the use of ultrasonic telemetry to investigate fine scale movement patterns of neonate and juvenile sandbar sharks in their pupping grounds in Delaware Bay, a post-release survivorship study, and in conjunction with biologists from five U.S. coastal states, mapping and collecting baseline catch and relative abundance data for shark species utilizing the coastal zone.

e) Marine Mammals

Small Cetaceans

The NEFSC conducted aerial and shipboard surveys in the Gulf of Maine during March-June 1999 to document spatial and temporal distribution of harbor porpoise (*Phocoena phocoena*) and other cetacean species (notably northern right whales, *Eubalaena glacialis*). The triennial harbor porpoise abundance survey was conducted as a combined aerial and shipboard sighting survey during July-August from Cape Cod, Massachusetts to Nova Scotia.

Methods to estimate the probability of detecting harbor porpoises on the track line (g(0)) during passive acoustic transect surveys were developed and field tested. The robustness and efficiency of several line transect analytical methods were also investigated using simulated data sets.

Final 1997 by-catch estimates were reported to the Atlantic Scientific Review Group (ASRG) in April 1999, and published in the *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments Report-1999* (December 1999). Updated abundance and 1998 by-catch estimates were reported in the draft *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments Report-2000* for all strategic and several nonstrategic stocks (n = 34) in these waters.

The Gulf of Maine Harbor Porpoise Take Reduction Team met in December 1999 to discuss results of the first year of implementation of the Gulf of Maine-Bay of Fundy Harbor Porpoise Take Reduction Plan implemented in December 1998. The immediate goal of the Plan is to reduce the incidental take of harbor porpoise in USA fisheries from the 1993-1997 annual average of 1,895 porpoise to below the Potential Biological Removal (PBR) level (483 animals per year). By-catch during the first eight months of the Plan's implementation (an estimated 237 animals taken) suggest that the goal of reducing the take to 483 animals per year may have been achieved in 1999.

Large Cetaceans

During July to September 1999, a large whale survey was conducted in the offshore waters from Georges Bank to the Bay of Fundy, and east along the Scotian Shelf to the Gully and French Bank. The objectives of the survey were to assess the distribution of large whales in the study area; photograph large whales for individual identification; obtain skin biopsy samples of large whales for genetic, toxicological and stable isotope analysis; and conduct oceanographic sampling of present and historic large whale habitats.

The NEFSC continues to support the right whale photo catalogue maintained at the New England Aquarium, and the sightings database housed at the University of Rhode Island. The NEFSC is also funding the fifth year of detailed genetic study of the North Atlantic northern right whale population.

The Northeast Large Whale Implementation Team continued to meet on a quarterly basis todiscuss approaches to reducing ship strike mortalities of large whales.

The Atlantic Large Whale Take Reduction Team met in February 1999 to discuss the Final Atlantic Large Whale Take Reduction Plan. The immediate goal of the plan is to reduce the incidental take of large whales (right, humpback, *Megaptera novaeangliae*, fin, *Balaenoptera physalus*, and minke, *Balaenoptera acutorostrata*) to below each species' PBR.

A workshop was held in Woods Hole, MA hosted by the NMFS and the International Whaling Commission during October, 1999 to discuss development of analytic tools to predict the distribution of right whales in offshore waters.

Pinnipeds

Monthly aerial surveys of seal distribution and abundance in the Cape Cod area continued. Work has also begun on the regular collection of seal food habits materials from haul-outs. The focus of this work is on harbor seals (*Phoca vitulina*) and the recently established year-round population of grey seals (*Halichoerus grypus*) (several hundred) in the Monomoy-Nantucket Sound region off Cape Cod.

A pilot project was conducted during spring 1999 to capture and instrument harbor seals in New England waters.

f) Marine Turtles

The NEFSC continued development of a marine turtle research program. During 1999, work included by-catch estimation for Northwest Atlantic fisheries during 1994-1998, tracking studies in Cape Cod Bay, and response to a record number of turtle strandings in late autumn.

3. Studies of Fishing Operations

The NEFSC placed observers aboard fishing vessels in 5 different fishery categories in 1999. All of these fisheries operated in NAFO Subareas 5 and/or 6.

a) New England and Mid-Atlantic Gillnet Fisheries

The NEFSC deployed observers on 1,034 trips covering 1,180 sea days in New England and Mid-Atlantic fisheries during 1999. The primary objective was to estimate incidental catch rates of harbor porpoise and other marine mammals. A total of 86 marine mammals were caught, including (in order of highest occurrence) harbor seal, harbor porpoise, bottlenose dolphin, gray seal, harp seal, white-sided dolphin and saddleback dolphin. A total of 112 biological samples were collected from these animals including body measurements, entire carcasses, and tissue samples. Kept and discarded finfish catches were weighed or estimated for a portion of the observed tows. Length frequencies and age structures were also obtained for finfish and used for age and growth studies. A total of 350 sea birds were caught, including (in order of highest occurrence) unidentified cormorants, greater shearwater, common loon, red-throated loon, manx shearwater, northern gannet, unidentified shearwater, black scoter, thick billed murre and double crested cormorant. Sixteen sea turtles including 13 loggerhead, 1 Kemp=s ridley, 1 green, and 1 unidentified turtle were caught of which 6 were released alive.

b) Swordfish Drift Gillnet

The swordfish drift gillnet fishery was closed in 1998 and remained closed in 1999.

c) Otter Trawl Fisheries

Otter trawl fishery coverage in 1999 included 121 trips and 371 days aboard vessels in the New England multispecies groundfish, summer flounder, northern shortfin squid, longfin inshore squid, Atlantic mackerel and Atlantic herring fisheries. Weights were collected for retained and discarded finfish, crustacean, and squid catches. Biological samples, including length frequencies and ageing structures, were also collected for age and growth studies.

Two pilot whales and one saddleback dolphin were observed taken as well as total of 15 loggerhead, 2 Kemps ridley and 2 unidentified turtles of which 14 were released alive. No sea bird takes were observed.

d) Sea Scallop Dredge Fisheries

Observers were deployed on 30 trips in 1999, consisting of 258 days aboard 22 different scallop vessels. Individual measurements were collected from kept and discarded sea scallops. Biological samples, including length frequencies and ageing structures, were also collected from kept and discarded finfish. Weights of catches were collected for each gear set. No incidental catches of marine mammals, sea turtles, or sea birds were

recorded from the observed hauls. By-catch included goosefish, cod, winter flounder, summer flounder, yellowtail flounder, witch flounder, American plaice, haddock, red hake, white hake, spotted hake, silver hake, scup, herring, mackerel, skates, dogfish, lobster, crabs, clams and squid.

e) Lobster Pot Fisheries

In 1999, the offshore lobster pot fishery was observed during 7 trips, totaling 53 days. By-catch consisted of Jonah crabs (predominantly). Estimated or actual weights of catches were collected from all hauls. Individual carapace measurements were collected from lobsters and crabs. No incidental catches of marine mammals, sea turtles, or sea birds were observed.

f) Pelagic Longline Fisheries

There were 3 pelagic longline fishery trips observed in 1999 for a total of 16 days. The vessels targeted swordfish and tunas. One Risso's dolphin was hooked, but released alive. No other marine mammals, sea turtles or sea birds were taken.

ACKNOWLEDGMENTS

The assistance of several members of the Resource Evaluation and Assessment Division, the Fisheries and Ecosystems Monitoring and Analysis Division, the Ecosystems Processes Division and the Aquaculture and Enhancement Division of the NEFSC in the preparation of this report is gratefully acknowledged by the authors.

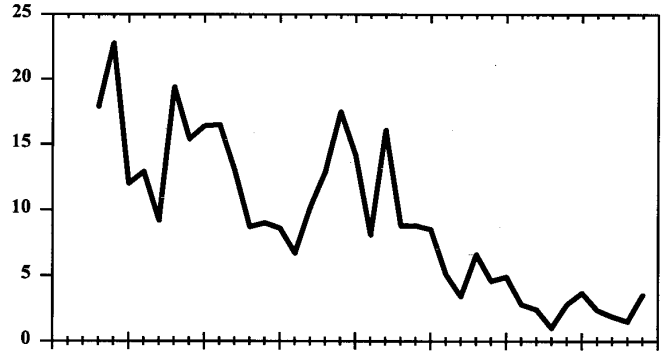

Figure 1. NEFSC autumn bottom trawl survey biomass indices for Gulf of Maine cod.

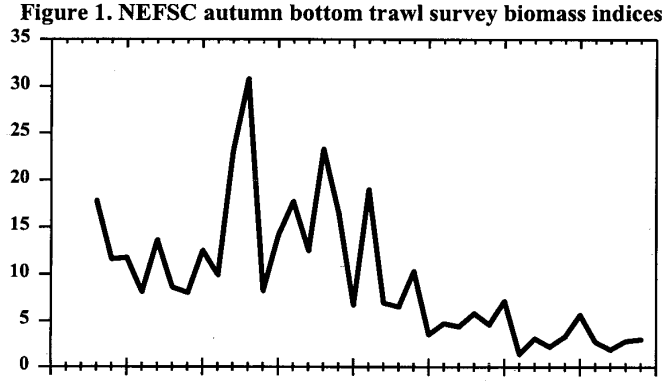

Figure 2. NEFSC autumn bottom trawl survey biomass indices for Georges Bank cod.

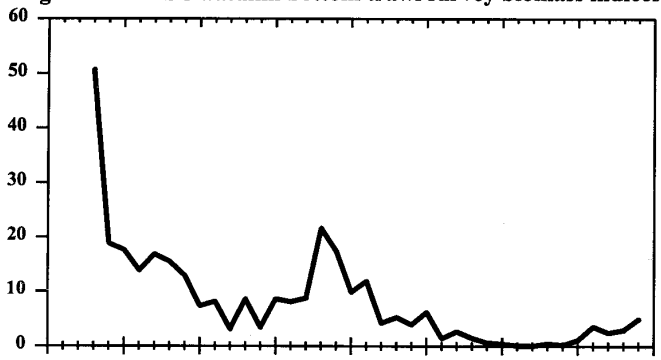

Figure 3. NEFSC autumn bottom trawl survey biomass indices for Gulf of Maine haddock.

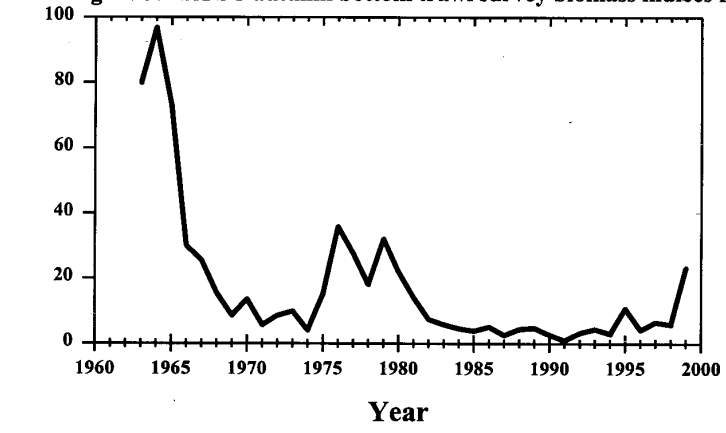

Figure 4. NEFSC autumn bottom trawl survey biomass indices for Georges Bank haddock.

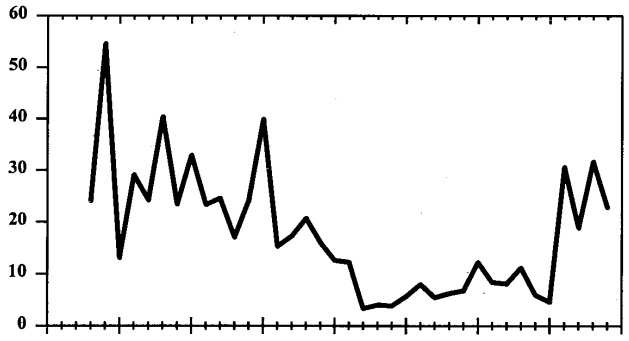

Figure 5. NEFSC autumn bottom trawl survey biomass indices for redfish.

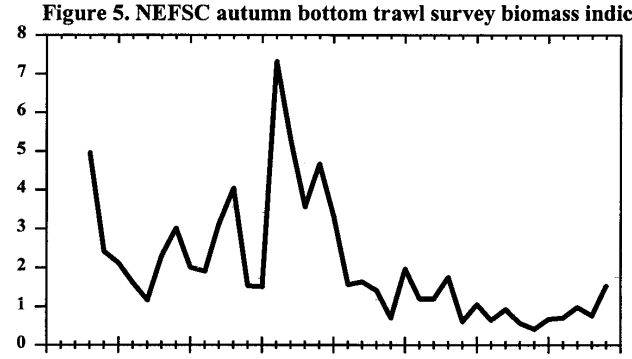

Figure 6. NEFSC autumn bottom trawl survey biomass indices for pollock.

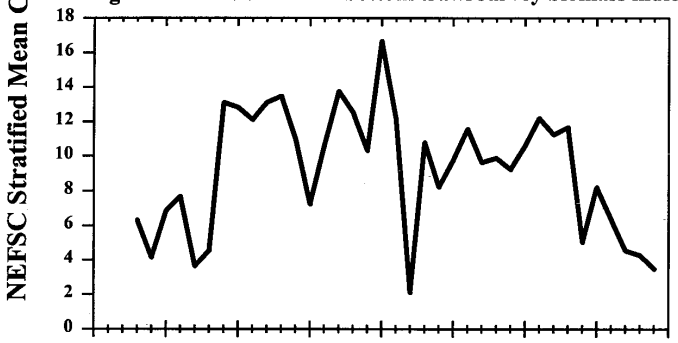

Figure 7. NEFSC autumn bottom trawl survey biomass indices for white hake.

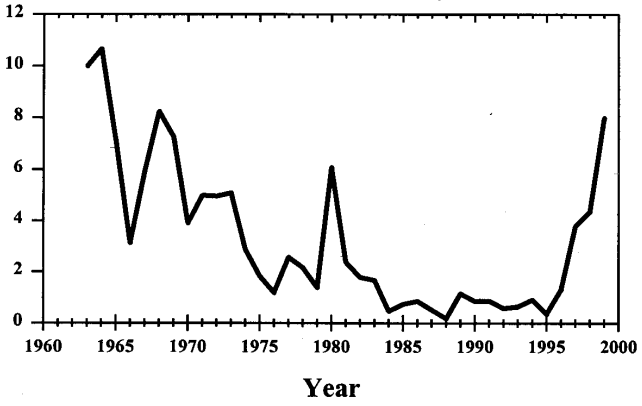

Figure 8. NEFSC autumn bottom trawl survey biomass indices for Georges Bank yellowtail flounder.

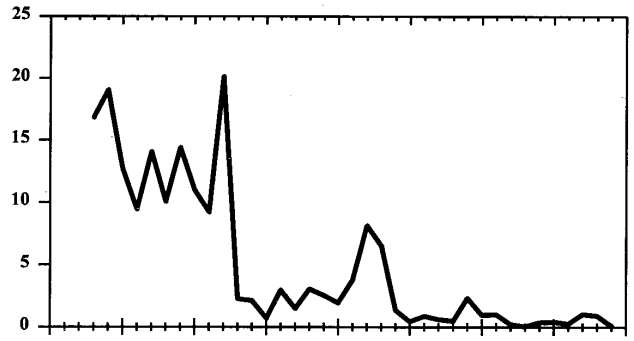

Figure 9. NEFSC autumn bottom trawl survey biomass indices for Southern New England yellowtail flounder.

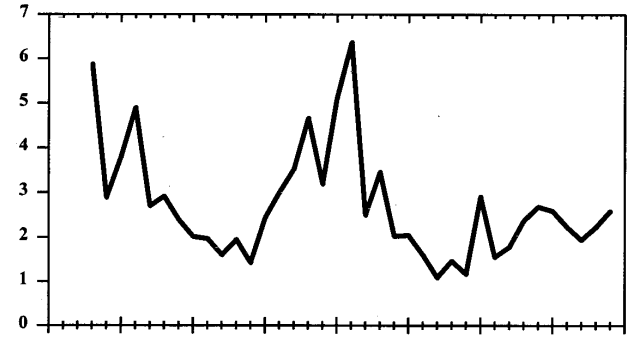

Figure 10. NEFSC autumn bottom trawl survey biomass indices for American plaice.

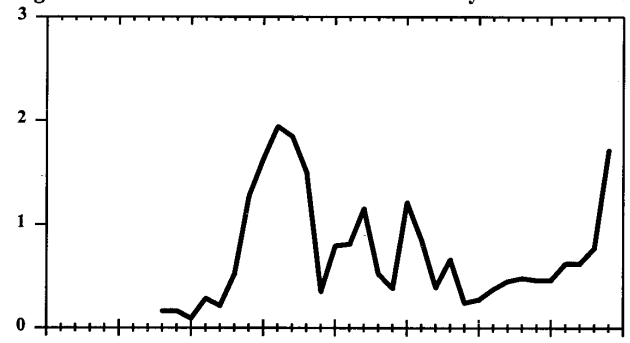

Figure 11. NEFSC spring bottom trawl survey biomass indices for summer flounder.

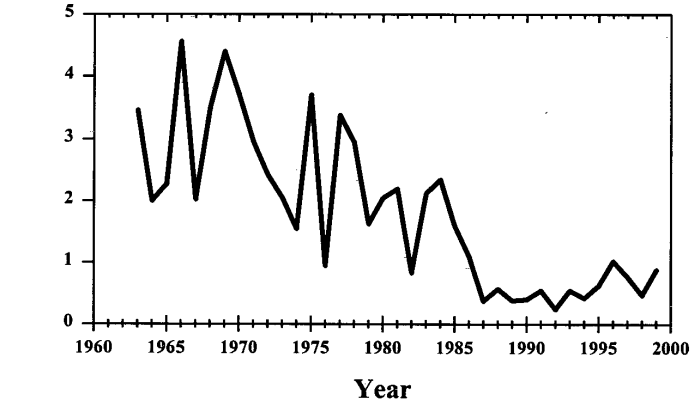

Figure 12. NEFSC autumn bottom trawl survey biomass indices for witch flounder.

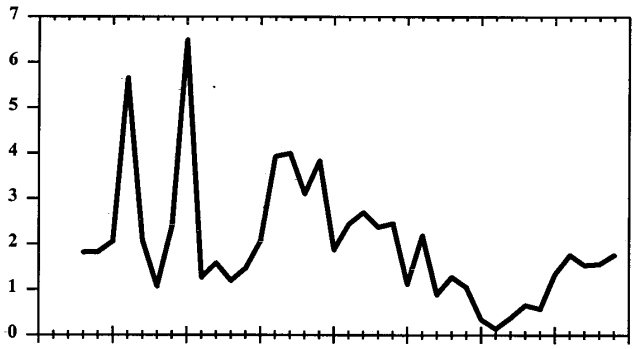

Figure 13. NEFSC autumn bottom trawl survey biomass indices for Georges Bank winter flounder.

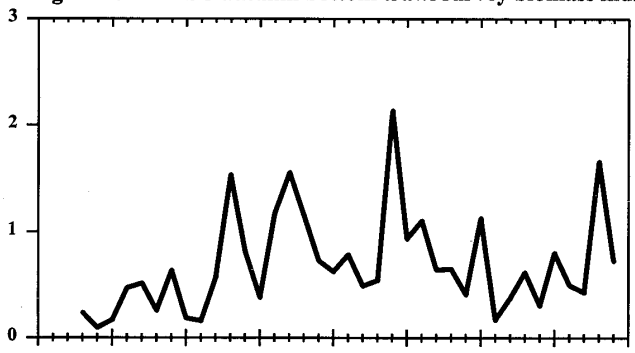

Figure 14. NEFSC autumn bottom trawl survey biomass indices for northern windowpane flounder.

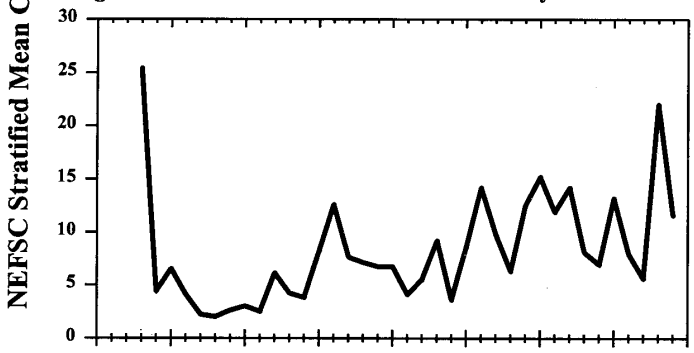

Figure 15. NEFSC autumn bottom trawl survey biomass indices for northern silver hake.

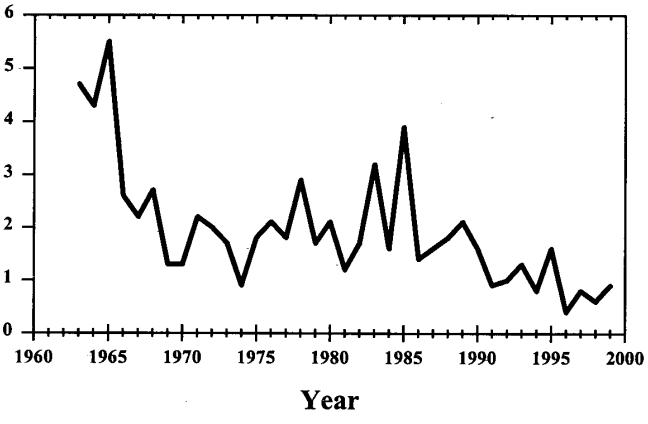

Figure 16. NEFSC autumn bottom trawl survey biomass indices for southern silver hake.

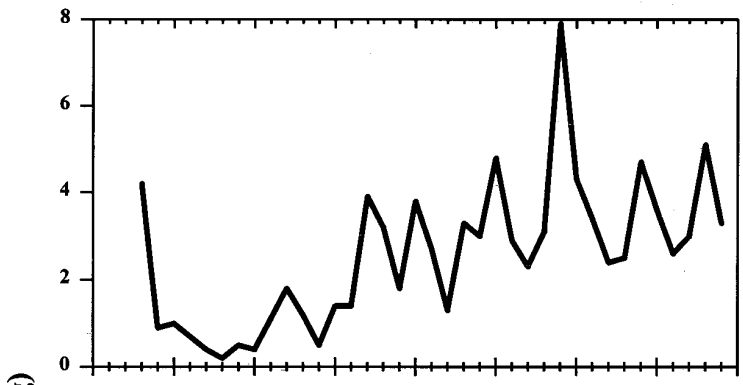

Figure 17. NEFSC autumn bottom trawl survey biomass indices for northern red hake.

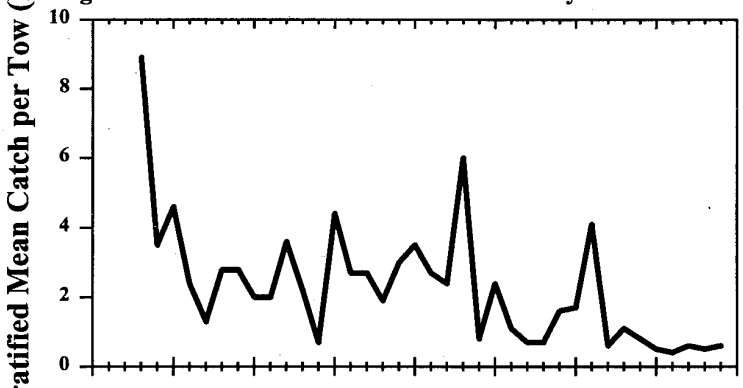

Figure 18. NEFSC autumn bottom trawl survey biomass indices for southern red hake.

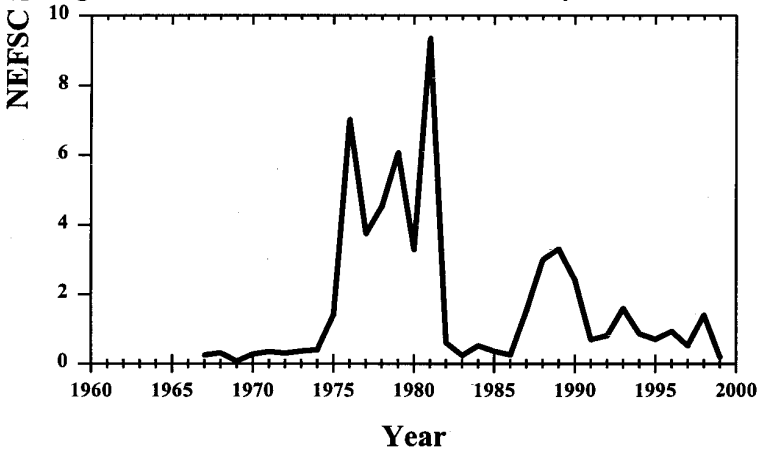

Figure 19. NEFSC autumn bottom trawl survey biomass indices for *Illex*.