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United States Research Report for 1998

by

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

Brief sumaries 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 15% from 12,958 mt in 1997 to 11,059 mt in 1998, and 1998 landings are the lowest since 1960.

USA cod landings from the Gulf of Maine (Div.5Y) in 1998 were 4,152 mt, a 23% decrease from 5,421 mt landed in 1997. Fishing mortality on this stock has remained high over the past decade, averaging about 1.1 since 1991. Spawning biomass declined from over 26,000 mt in 1989 to about 8,100 mt in 1998. Research vessel survey biomass indices have increased slightly since the 1993 record low, but remain among the lowest in the series (Figure 1).

USA cod landings from Georges Bank (Div.5Z and SA 6) in 1998 were 6,907 mt, an 8% decrease from 7,537 mt landed in 1997. Fishing mortality in 1998 remained low at 0.22, following a record high of 1.1 in 1994. Spawning stock biomass in 1998 (38,300 mt) was about 7% higher than in 1997 (35,900 mt) and 53% higher than the record low in 1994 (25,100 mt). Research vessel survey biomass indices have increased slightly since the 1991 record low (Figure 2).

2. Haddock

USA landings of haddock (*Melanogrammus aeglefinus*) increased 90% from 1,504 mt in 1997 to 2,859 mt in 1998. Georges Bank (Div. 5Z) landings increased 107% from 888 mt in 1997 to 1,841 mt in 1998, while Gulf of Maine (Div. 5Y) landings increased 65% from 616 mt in 1997 to 1,018 mt in 1998. Landings from both stocks remained at less than 20% of historical levels and were 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 are well below historical levels (Figures 3 and 4). Spawning stock biomass of Georges Bank haddock continued to increase in 1998 and is expected to increase further due to recruitment of the 1996 year class.

3. Redfish

USA landings of redfish (*Sebastes* spp.) Increased 27% from 251 mt in 1997 to 320 mt in 1998. Research vessel survey indices indicate that stock biomass increased in 1996 and remained relatively high in 1997 and 1998 compared to the 1980s (Figure 5) due to growth in biomass of a relatively strong year class produced in the early 1990s. Redfish from this year class should recruit to the fishery over the next several years.

4. Pollock (4VWX + 5 stock)

USA landings of pollock (*Pollachius virens*) increased 31% from 4,267 mt in 1997 to 5,582 mt in 1998. 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 slightly over the past 4 years but continues to remain low relative to earlier periods (Figure 6).

5. White Hake

USA landings of white hake (*Urophycis tenuis*) increased 6% from 2,225 mt in 1997 to 2,360 mt in 1998. The stock has declined considerably from the relatively stable levels seen in the 1980s. Research vessel survey indices for 1997-1998 are among the lowest in the time series (Figure 7).

6. Yellowtail Flounder

USA landings of yellowtail flounder (*Pleuronectes ferrugineus*) increased 27% from 2,814 mt in 1997 to 3,560 mt in 1998. 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 1998 totalled 16,020 mt, 2% higher than in 1997. Summer flounder (*Paralichthys dentatus*) (32%), winter flounder (*Pleuronectes americanus*) (30%), American plaice (*Hippoglossoides platessoides*) (23%) witch flounder (*Glyptocephalus cynoglossus*) (12%), and windowpane flounder (*Scophthalmus aquosus*) (3%) accounted for virtually all of the 'other flounder' landings in 1998. Compared to 1997, commercial landings in 1998 were lower for American plaice (-7%), winter flounder (-9%), and windowpane flounder (-3%), but higher for summer flounder (+26%) and witch flounder (+4%). Research vessel survey indices in 1998 decreased for witch flounder, while indices for American plaice, summer flounder, winter flounder and windowpane increased (Figures 10 - 14).

8. Silver hake

USA landings of silver hake (*Merluccius bilinearis*) decreased 16% from 15,585 mt in 1997 to 13,148 mt in 1998. Research vessel survey indices for the Gulf of Maine- Northern Georges Bank stock increased throughout the 1980s and varied without trend during 1990-1997 (Figure 15). Survey indices markedly increased in 1998 suggesting improved recruitment in the Northern stock. Indices for the Southern Georges Bank - Mid-Atlantic stock have declined since the late 1980s and remain at record low levels (Figure 16).

9. Red Hake

USA landings of red hake (*Urophycis chuss*) decreased 8% from 1,322 mt in 1997 to 1,222 mt in 1998. Landings continue to remain near record low levels. Research vessel survey indices for the Gulf of Maine - Northern Georges Bank stock have increased steadily since the early 1970s, and stock biomass is currently well 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 16% from 97,422 mt in 1997 to 81,601 mt in 1998. 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 increased from 5,393 mt in 1997 to 17,959 mt in 1998.

11. Atlantic Mackerel

USA commercial landings of Atlantic mackerel (*Scomber scombrus*) declined from 15,400 mt in 1997 to 12,506 mt in 1998. 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*) declined 34% from 2,784 mt in 1997 to 1,848 mt in 1998. Research 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*) increased 13% from 16,308 mt in 1997 to 18,385 mt in 1998. Survey swept area biomass estimates suggest that the stock is at a low level.

USA landings of northern shortfin squid (*Illex illecebrosus)* increased 67%, from 13,631mt in 1997 to 22, 705 mt in 1998. The fishery was closed for the first time, in August 1998, when the annual quota was reached. No stock biomass estimates are available.

14. Sea Scallops

USA commercial landings of sea scallops (*Placopecten magellanicus*) in 1998 totalled 5,974 mt, slightly above the 1997 value of 5,936 mt. Results from the 1998 survey indicate substantial increases in recruitment and biomass over 1997 levels in both the Georges Bank and Mid-Atlantic regions. Exploitable stock biomass increased in closed areas but remained relatively constant in open areas. Biomass estimates for closure areas on Georges Bank were the highest since 1975. Closed areas in the Mid-Atlantic region were implemented in early 1998 to improve yield per recruit by delaying harvest.

B. Special Research Studies

1. Environmental Studies

a) Hydrographic Studies

Ecosystems monitoring work during 1998 included (1) the 6 standard seasonal cruises to measure temperature, salinity, chlorophyll-a and zooplankton on the continental shelf, and (2) monthly sampling along transects between Boston and Nova Scotia and between New York and Bermuda on ships of opportunity to measure temperature, salinity, phytoplankton and zooplankton. Studies of historical variation in temperature and salinity in the Gulf of Maine and the Middle Atlantic Bight were published (J. Northw. Atl. Fish. Sci. 24) or

submitted. Several manuscripts on historical variation in zooplankton abundance and species composition were also completed and submitted to the NOAA Technical Report Series or other outlets. A NAFO SCR document summarizing results of 1997 sampling aboard ships of opportunity was also completed. Considerable progress was also made in preparing manuals describing standard ecosystem survey and ship of opportunity (SOOP) sampling designs, equipment and sampling procedures (NOAA Technical Memorandum Series).

b) Plankton Studies

GLOBEC Georges Bank Study: The USA GLOBEC Georges Bank study continued its fourth year of field work in 1998. Six monthly surveys of the Bank were conducted which measured the hydrography (temperature, salinity and fluorescence) and currents (by ADCP) and collected samples to determine the distribution and abundance of zooplankton and ichthyoplankton (cod and haddock larvae). These activities were part of a planned 5-year study (1995-1999). The hydrographic observations indicated that the reduction in salinity initially observed in 1995 continued in 1998, not only on the Bank, but throughout the Gulf of Maine region.

c) Aquaculture

Bay Scallop Restoration: A bay scallop spawner transplant was conducted in the Niantic River by the Waterford East-Lyme Shellfish Commission (CT) and staff at the Milford Laboratory, Milford, CT to explore resource enhancement techniques. In June 1998, a very high over-winter survival rate was determined for about 8,000 scallops, 35 - 50 mm shell height, originally transplanted in November of 1997. The study area currently has a substantial eelgrass population, and a very low bay scallop population, based on historical data. Other research conducted in the Niantic River includes an assessment of natural spatfall and recruitment and investigation of over-winter survival of hatchery seed. A mail survey has also been initiated to evaluate future trends in harvest levels. Results to date are cause for cautious optimism about restoration prospects for this estuary.

Bay Scallop Aquaculture: Bay scallop culture studies continued in recirculating systems with evaluation of biofilters and seaweed culture in scallop culture effluent to remove nitrogenous wastes from the waste stream. A cooperative study with the Bridgeport Aquaculture (High) School was completed. Juvenile scallops were deployed in lantern nets on the school=s long-line culture system off Bridgeport, CT, monitored throughout the growing season, and harvested in November. Scallop growth and survival were measured and evaluated throughout the study. Standard Chinese-style nets appear to be less cost-effective than Japanese-style nets because of increased labor requirements.

Tautog and Black Seabass Aquaculture: A second full season of tautog (*Tautoga onitis*) culture in recirculating systems was completed. A number of larval fish were reared successfully to the juvenile stage. Live foods were identified as a limiting factor in production. This issue has been addressed by refurbishing one laboratory for the exclusive task of raising rotifers and brine shrimp as food for larval tautog. A new recirculating system was installed for the culture of juvenile fish to live-market size (9-10 in). Culture of black sea bass (*Centropristis striata*) was initiated using gravid field-collected spawning stock.

Shellfish Feeding: For the first time, practical feeding standards have been identified for molluscan shellfish, specifically post-set bay scallops, *Argopecten irradians*, and eastern oysters, *Crassostrea virginica*. Experiments employing a computer-automated feeding system demonstrated that a daily ration between two and five percent of shellfish live weight in dry matter of feed, introduced to the shellfish on a nearly-continuous basis, will maximize either conversion efficiency (2%) or growth rate (5%). High-lipid *Tetraselmis* strains shown previously to contain a superior biochemical nutritional profile were used in these experiments. This work also demonstrated the importance of adjusting shellfish stocking density in rearing tanks so that algal-feed suspensions do not exceed the pseudofeces threshold. Practical applications of these findings include design criteria for new land-based shellfish-seed nursery facilities, management of existing facilities, and guidelines for economic analyses.

Harmful Algal Bloom Impacts on Coastal Food Webs: Cooperative studies were initiated to evaluate effects of harmful algal bloom (HAB) organisms upon coastal food webs. A suite of microalgal-consuming invertebrates is being exposed, under controlled laboratory conditions, to cultured HAB species, and responses, in terms of survival, growth, fecundity, and histopathology, are being documented. Results to date show that one HAB alga, the dinoflagellate *Prorocentrum minimum*, is acutely toxic to some stages of the bay scallop, *Argopecten irradians*, but not harmful to water-column algavores, including several copepod and microzooplankton species. These studies are continuing with other HAB species. Findings will provide important information for understanding the role of top-down controls upon HAB dynamics.

d) Other Environmental Studies

At the James J. Howard Marine Sciences Laboratory, Highlands, NJ, a two year survey was completed in the Navesink River/Sandy Hook Bay estuarine system to characterize young-of-the-year habitat requirements for a variety of species including winter flounder, *Pseudopleuronectes americanus*, fluke, *Paralichthys dentatus*, black seabass, *Centropristis striata*, and blue crabs, *Callinectes sapidus*. Major habitat shifts occur with small changes in fish size. Nominal habitat types such as seagrass beds, beaches, mud flats, and marsh creeks, were not found to be good predictors of habitat association. Settlement habitat in winter flounder is associated with regions of low temperature, high salinity, and high sediment organic content. Larger winter flounder are associated with different ranges of the same parameters, and shallower depths. Habitats for this species appear to change rapidly with size, particularly within the first 6 months of life. Surveys to evaluate the quality of habitat models developed for winter flounder are continuing. Field data are being integrated into predictive models (analysis of habitat quality) and habitat models are being used along with GIS to quantify habitat.

A cooperative project assessing salt marsh restoration efforts in the Arthur Kill, Staten Island NY, continued. These marshes, heavily impacted by the 1990 Exxon Bayway oil spill, were subsequently replanted with salt marsh cordgrass, *Spartina alterniflora*. The primary goal of the study is to characterize and assess the structure and function of two oiled/replanted, two oiled/unplanted and two reference marshes. The field work was completed in spring 1997. Studies include sediment chemistry, contaminant analyses of sediments and ribbed mussels, growth and condition of ribbed mussels, stable isotope analyses of selected marsh consumers and sources of organic matter, macrobenthic surveys, and stomach content analyses of mummichogs, *Fundulus heteroclitus*. Preliminary results are as follows. Mummichog food habits: High percentages of detritus, algae, and other plant material may be indicators of poor diet in a stressed environment. Macrobenthic surveys: Oligochaetes, nematodes, and the polychaete *Manayunkia*, all stress tolerant species, were the most abundant fauna. Seasonal differences occur, with greater faunal abundances in spring, due to brooding of resident invertebrates. Minor differences were detected between sites in number and kinds of taxa present. Restoration efforts do not appear to have affected the levels of trace metals in the mussels; and mussels from oiled sites had higher levels of certain trace metal contaminants than those from unoiled reference sites. Sediment biogeochemistry: Sediment biogeochemistry was station-specific, mediated by the effects of highly localized anthropogenic influences and interactions with sediment grain size, organic matter content, marsh flora, and burrowing fauna. This suggests that small-scale habitat heterogeneity of perhaps a few meters, due either to anthropogenic or natural disturbances or variability, can render comparisons of restored marshes to "pristine" marshes difficult particularly in such heavily urbanized habitats as the Arthur Kill. Growth of ribbed mussels: Mussels in the southernmost, unoiled reference site within the Kill had the highest growth. This may be an indication that this site is a better habitat for ribbed mussels, perhaps suffering less anthropogenic impacts or stress. This could also reflect the fact that the mussels at this site were found to contain less trace metal contamination than mussels in either replanted or unplanted sites.

Four manuscripts are in review related to habitat comparisons across three northeastern U.S. estuarine systems. Five selected nominal habitat-types (eelgrass, macroalgae, adjacent areas without vegetation and tidal marsh creeks) were assessed for relative quality temporally and spatially. Abundance of winter flounder (15-80 mm TL), was usually higher in eelgrass and its adjacent unvegetated areas than in other habitats. Habitat use by winter flounder was not consistent across macroalgae and its adjacent unvegetated areas or marsh creek habitats among the estuaries or between years. Growth rates of caged young-of-the-year winter flounder and tautog varied with fish size, habitat, estuary and year. In contrast with some earlier studies,

comparisons across nominal habitat types within and among estuaries did not show that growth was consistently higher in any particular habitat type. Growth rates were relatively independent of whether a habitat was vegetated or adjacent to vegetation. Episodic habitat-specific environmental changes (i.e. dissolved oxygen) also influenced growth rates. The growth rates of the two species varied temporally and were dependent on the interaction of both the specific estuary and habitat in which the species lived. Trophic linkages using stable isotopes indicated an important link between sedimentary organic matter and winter flounder and tautog via benthic invertebrates. Variability among habitats across estuaries between years indicates the importance of a multi-year, interdisciplinary approach to habitat evaluation.

2. Biological Studies

a) Fish Species

Dietary studies are being conducted by the Howard Laboratory in the Navesink River/Sandy Hook Bay system on winter flounder, fluke, and other fishes. Interannual, seasonal, and spatial sources of variation are being examined in the context of available prey fields. Laboratory experiments are also being conducted to examine prey choice, functional responses, and effects of habitat characteristics on predation rates. Searobins, *Prionotus evolans*, may be one of the most important predators on age-0 winter flounder, and experimental studies will be expanded in 1999 using both searobins and fluke.

Until 1998, there were no studies that compared the feeding behavior of striped bass, *Morone saxatilis*, and bluefish, *Pomatomus saltatrix*, together. Anecdotal reports of striped bass feeding near or under schools of feeding bluefish suggest that striped bass may benefit from this interaction. Other anecdotal evidence suggests that striped bass Adrive@ bluefish away from prey schools. These questions are currently being addressed by examining the foraging of adult striped bass and bluefish in the Howard Laboratory research aquarium. Predation trials have been completed, and the potential for competition between juvenile bluefish and striped bass in growth experiments is being examined. Although bluefish grow much faster than striped bass, the species did not inhibit one another in terms of growth when abundant food was provided in the laboratory setting.

Bimonthly gillnet collections are also being made in the Navesink River-Sandy Hook Bay estuarine system to survey and assess habitat associations of pelagic species including bluefish, weakfish, *Cynoscion regalis*, and striped bass. Beach seine collections of juvenile striped bass and bluefish were also made in Long Island marine embayments to examine overlap in habitat and food resource use. Studies on reproduction and on rates of growth, development, and survival during early life history stages are continuing for several marine and estuarine species.

Flatfish: Studies continued on winter flounder and were initiated on summer flounder and windowpane (*Scophthalmus aquosus*) to evaluate effects of temperature on growth, developmental, and mortality rates of eggs, larvae, and juveniles. Experimental designs generally include multiple temperatures (10 temperatures for embryonic period, 4 temperatures for larval period) and several replicate populations within a temperature. Data from the experimental rearings are being used to evaluate variability in developmental, morphometric, and meristic traits, and how these relate to environmental factors. Survival of winter flounder from hatching to metamorphosis in 1998 was surprisingly high, exceeding 95% at the warmer temperatures. The winter flounder study provided exemplary data for demonstrating the limitations in previous evaluations of the time course of mortality in larval fishes in general and detecting critical periods in particular. Summer flounder were brought into spawning condition by daylength, temperature, and hormonal manipulations. Larvae are currently being reared under four different regimes of increasing temperature. Windowpane were cultured successfully from hatching through metamorphosis in large numbers during 1998.

Recently settled juvenile flatfish have been used in evaluations of mortality by invertebrate predators. Specifically, the role of relative body sizes of flatfish juveniles (both winter and summer flounder) in influencing predation by the bay shrimp, *Crangon septemspinosa*, has been assessed and predictive equations describing these interactions developed.

Gadid studies: Feasibility studies were conducted on growth and survival of larval Atlantic cod, *Gadus morhua*, and haddock, *Melanogrammus aeglefinus*, obtained from broodstock held at the NMFS facility in Narragansett, RI. Efforts are underway to acquire cod broodstock from local NJ waters- the southernmost extreme of the species= range.

Atlantic tomcod, *Microgadus tomcod*, is of interest as an indicator of habitat and fish community health and as a forage fish in NY-NJ estuarine systems. It serves well as a model gadid because of its compressed life history (reaching reproductive maturity within 1 year). Although much field data exist on tomcod few studies have reported even baseline information on growth, developmental, and survival rates. Our studies on these rates through the egg, larval, and early juvenile periods have been successful and preliminary reports are being prepared.

b) Age and Growth

Approximately 50,361 age determinations were completed by Woods Hole Laboratory staff for 12 species of finfish and shellfish in support of resource assessment analyses and other research in 1998. This included 15,692 white hake, *Urophycis tenuis*, from 1982-98 and 4,440 winter flounder from 1980-98. Cod and haddock age structures were exchanged with Canadian age readers; and Atlantic herring,*Clupea harengus*, summer flounder and yellowtail flounder, *Pleuronectes ferrugineus*, structures were exchanged with readers from US state laboratories in a continuing effort to maintain comparability of age determinations between laboratories ageing these species.

Several research projects were initiated in 1998 to address the following topics: 1) determination of age and growth parameters for northern shortfin squid, *Illex illecebrosus*, 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; 3) patterns of seasonal movement of Atlantic cod utilizing otolith microconstituent analysis; and 4) establishment of baseline microconstituents for winter flounder, redfish, *Sebastes fasciatus*, silver hake, *Merluccius bilinearis*, and haddock. Research to validate ageing of cusk, *Brosme brosme*, continued.

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 1998. Modelling and analytical efforts focused on species interactions between elasmobranchs, major groundfish, and principal pelagics. Food habits samples were collected during NEFSC winter, spring and fall 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, 5,798 stomachs from 27 species were examined, while 8,103 stomachs from 32 species, and 8,467 stomachs from 31 species were examined during the spring and fall surveys, respectively. Diet sampling emphasized elasmobranchs (spiny dogfish and various skates), gadids, and flatfishes.

Revisions to the 35 year time series (1973-97) 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 200,000 stomach samples. Data from the 13 process-oriented NOAA Coastal Ocean Program (NCOP) cruises including data from over 35,000 stomachs are also available. The processing of the 1998 bottom trawl survey food habits data is scheduled for completion in 1999.

d) Apex Predators Program

Apex predators research is focused on determining migration patterns, age and growth, food chain dynamics, 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 needed to define essential fish habitat for shark species in US waters.

A cooperative USA/Canada research program on the biology of the porbeagle shark, *Lamna nasus*, continued in 1998. Preliminary analysis of porbeagle vertebrae was accomplished towards the development of a growth curve for this species. In addition, a research cruise was conducted to target porbeagles in the Gulf of Maine and Canadian waters using oxytetracycline to validate the periodicity of vertebral column banding and to attach archival tags on selected fish. Distribution information and biological samples were also taken for ongoing migration, feeding ecology, and reproductive biology studies.

A longline survey was completed between Key West, FL and Delaware Bay in the spring of 1998. Objectives of this cruise included: investigate the distribution, abundance and species composition of sharks; collect baseline C/E data; tag sharks for migration studies; and collect samples for biological studies. A total of 945 fish (917 sharks) representing 22 species were caught on 91 longline sets. Sharks represented 97% of the catch of which sandbar sharks (*Carcharhinus plumbeus*) were the most common (69% overall) followed by tiger sharks (*Galeocerdo cuvier*) (15%) and dusky sharks (*C. obscurus*) (4%).

Reproductive dynamics and nursery ground studies also continued. This research focuses 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 1998 involved the use of ultrasonic telemetry to investigate fine scale movement patterns of neonate and juvenile sandbar sharks in their Delaware Bay pupping grounds, 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

The U.S. Marine Mammal Commission met in Portland, Maine during November 1998. Major issues included: northern right whale status, harbor porpoise and bottle nose dolphin take reduction efforts, and seal interactions with fisheries.

Small Cetaceans

Aerial or shipboard surveys to document spatial and temporal distribution of harbor porpoises from North Carolina to Maine were conducted throughout the winter and spring of 1998.

In July 1998, a shipboard cruise was conducted from North Carolina northward to Cape Cod to collect cetacean biopsy samples. Biopsy sampling was attempted on 615 occasions, targeting 7 species, with 321 biopsy samples being collected.

The triennial cetacean survey was conducted to fulfill part of NEFSC assessment mandates under the Marine Mammal Protection Act (MMPA). This was a combined aerial and shipboard sighting survey conducted during July-September 1998 in the area from Virginia to the Scotian Shelf. These data will be used to estimate the abundance and distribution of small, medium, and some large cetaceans.

Methodology of abundance estimation from line transect surveys continue to be developed in two projects. Methods to estimate the probability of detecting harbor porpoises on the track line (g(0)) during aerial line transect surveys were developed and field tested. The robustness and efficiency of several line transect analytical methods were investigated using simulated data sets.

Updated abundance and 1997 by-catch estimates were reported in the *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments Report-1999* for all strategic and a few nonstrategic stocks (n = 28) in these waters. These results were reported to the Atlantic Scientific Review Group in November 1998.

The Gulf of Maine-Bay of Fundy Harbor Porpoise Take Reduction Plan was implemented in December 1998. The immediate goal of the Plan is to reduce the incidental take of harbor porpoise in USA fisheries from the ca.1993-97 annual average of 1,895 porpoise to below the PBR level (483 animals per year).

Large Cetaceans

A large whale survey was conducted in offshore waters of the Gulf of Maine during winter 1998. Purposes of the survey were to assess the distribution of large whales in the study area, and to conduct oceanographic sampling of present and historic large whale habitat.

During August, 1998, a large whale survey was conducted in the offshore waters from Georges Bank to Sable Island Bank, focusing on the western Scotian Shelf. Purposes 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. In addition, the Center is funding the 4th year of detailed genetic study of the North Atlantic northern right whale population.

The Northeast Large Whale Implementation Team met on a quarterly basis. Focus of recent discussions have dealt largely with approaches to reducing ship strike mortalities of large whales.

Pinnipeds

Monthly aerial surveys of seal distribution and abundance in the Cape Cod area began in autumn 1998. The focus of this work is on the recently established year-round population of grey seals (several hundred) in the Monomoy-Nantucket Sound region off Cape Cod. Work began on the collection of fecal materials for prey assessment at major seal haul-outs in these areas.

A coordination meeting was held during spring 1998 between all seal researchers in the NE. Issues discussed included a comprehensive research plan, expanded survey efforts, manuscript preparation, and funding.

Marine Turtles

The NEFSC began development of a marine turtle research program during 1998. Initial focus will include bycatch estimation and development of indices of abundance in NW Atlantic waters.

3. Studies of Fishing Operations

The NEFSC placed observers aboard fishing vessels in 5 different categories of fisheries in 1998. All of the fisheries operated in NAFO Subareas 5 and/or 6.

a) New England and Mid-Atlantic Gillnet Fisheries

The NEFSC deployed observers on 1,235 trips for 1,321 days in these fisheries during 1998. The primary objective was to estimate incidental catch rates of harbor porpoise and other marine mammals. A total of 96 marine mammals were caught, including (in order of highest occurrence) harbor porpoise, harbor seal, harp seal, gray seal, saddleback dolphin, and bottlenose dolphin. A total of 202 biological samples were collected from these animals including measurements, entire carcass collection, 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 forwarded for age and growth studies. A total of 227 sea birds were caught, including (in order of highest occurrence) double crested cormorants, common loon, red-throated loon, greater shearwater, sooty shearwater, northern gannet, mergansers, brown pelican, kittiwake,

scoter, manx shearwater, and storm petrel. Thirteen sea turtles were caught and released alive including 6 loggerhead, 4 Kemp=s ridley, 2 green, and 1 unidentified turtle.

b) Swordfish Drift Gillnet

Observers were placed aboard 12 trips in 1998, totaling 157 days on 11 different domestic drift gillnet vessels targeting swordfish and tuna. The fishery operates with a small swordfish quota and limited seasons. Yellowfin tuna, swordfish, albacore tuna, mako sharks, Mahi mahi, and skipjack tuna were caught. Bycatch from this fishery included white marlin, blue shark, hammerhead shark, dusky shark, and pelagic stingray. A total of 294 marine mammals were taken incidentally, 254 of which were saddleback dolphin. Marine mammal takes also included pilot whales, Risso=s dolphin, beaked whales, bottlenose dolphin, and striped dolphins. A total of 907 biological samples were collected from these animals including measurements, entire carcass collection, and tissue samples. A total of 34 sea turtles were taken including loggerheads (26), leatherbacks (6) and green (2). Twenty one of these (16 loggerhead, 4 leatherbacks, and 1 green) were released alive. No sea birds were taken during these trips.

c) Otter Trawl Fisheries

Otter trawl fishery coverage in 1998 included 68 trips and 238 days aboard vessels in the northern shrimp, New England multispecies groundfish, summer flounder, *Illex* squid, *Loligo* squid, and Atlantic mackerel 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.

Incidental catches of marine mammals and sea turtles were recorded. One marine mammal (pilot whale) was caught. A total of 3 loggerhead turtles were caught and released alive. No sea bird takes were observed.

d) Sea Scallop Dredge Fisheries

Observers were deployed on 26 trips in 1998, consisting of 225 days aboard 15 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. Bycatch included monkfish, 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 1998, the offshore lobster pot fishery was observed during 6 trips, totaling 38 days. Bycatch consisted of Jonah crabs (predominantly). Estimated or actual weights of catches were collected from all hauls. Individual carapace measurements were collected from lobsters and some crabs. No incidental catches of marine mammals, sea turtles, or sea birds were observed.

f) Pelagic Longline Fisheries

There were no Pelagic Longline Fisheries trips observed in 1998.

ACKNOWLEDGEMENTS

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.

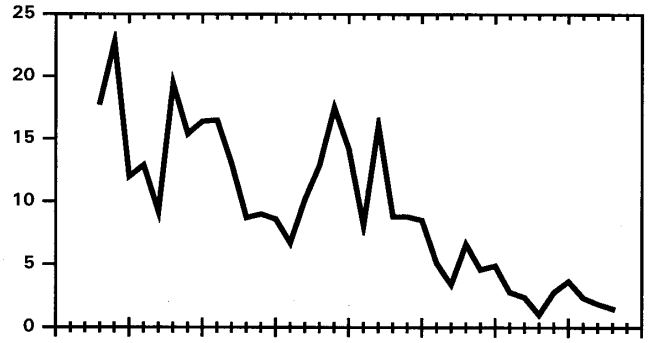

Figure 1. NEFSC autumn bottom trawl survey biomass indices for Gulf of Maine cod.

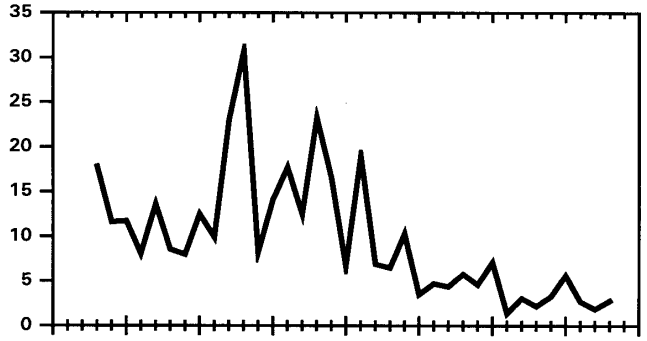

Figure 2. NEFSC autumn bottom trawl survey biomass indices for Georges Bank cod.

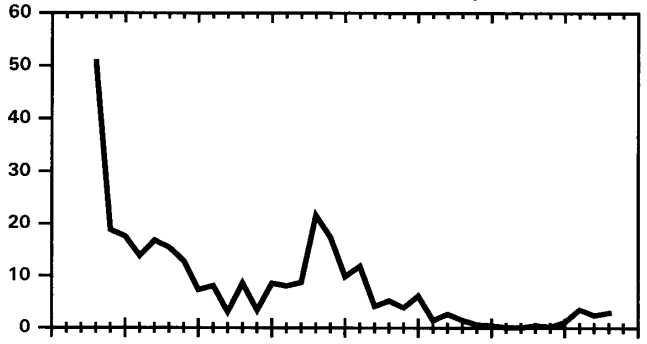

Figure 3. NEFSC autumn bottom trawl survey biomass indices for Gulf of Maine haddock.

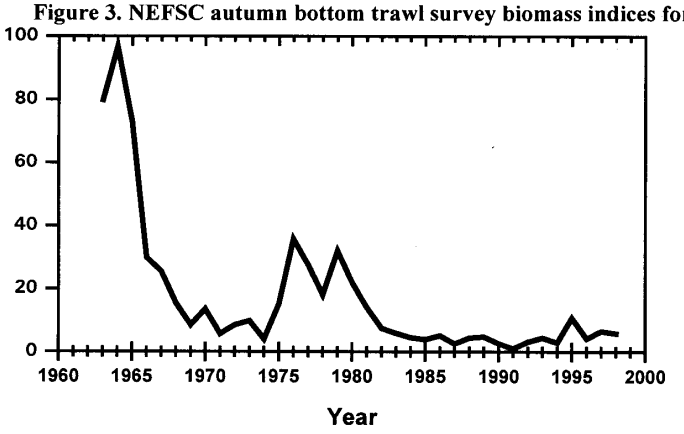

Figure 4. NEFSC autumn bottom trawl survey biomass indices for Georges Bank haddock.

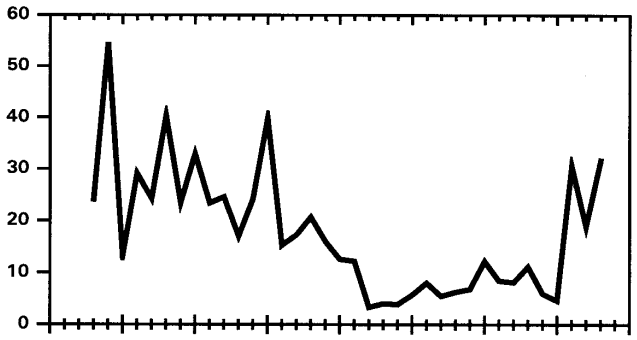

Figure 5. NEFSC autumn bottom trawl survey biomass indices for redfish.

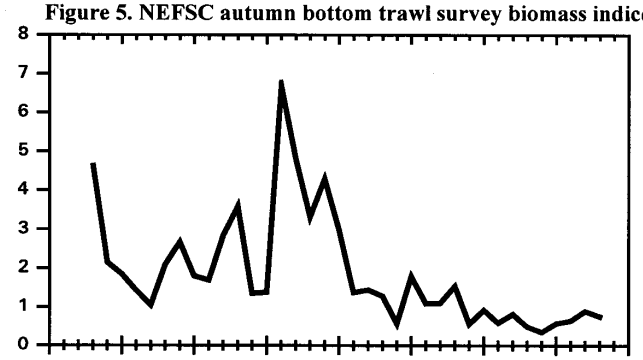

Figure 6. NEFSC autumn bottom trawl survey biomass indices for pollock.

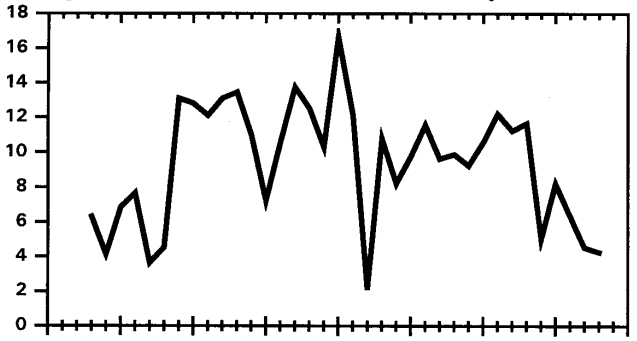

Figure 7. NEFSC autumn bottom trawl survey biomass indices for white hake.

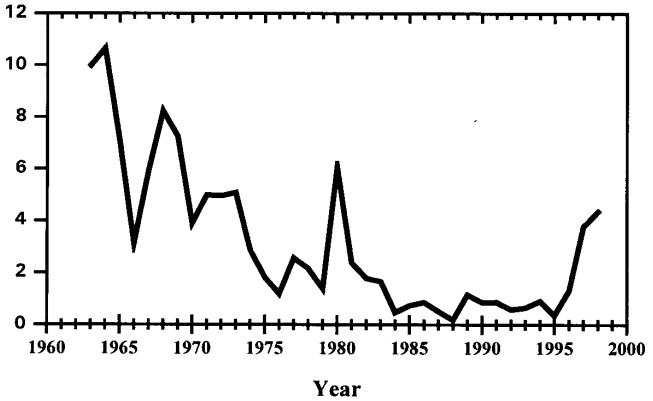

Figure 8. NEFSC autumn bottom trawl survey biomass indices for Georges Bank yellowtail flounde

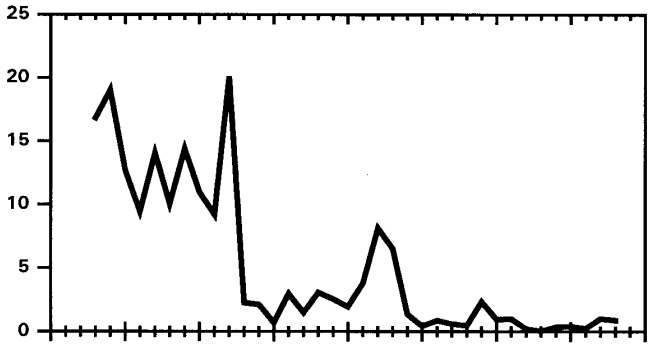

Figure 9. NEFSC autumn bottom trawl survey biomass indices for Southern New England yellowtail flounder.

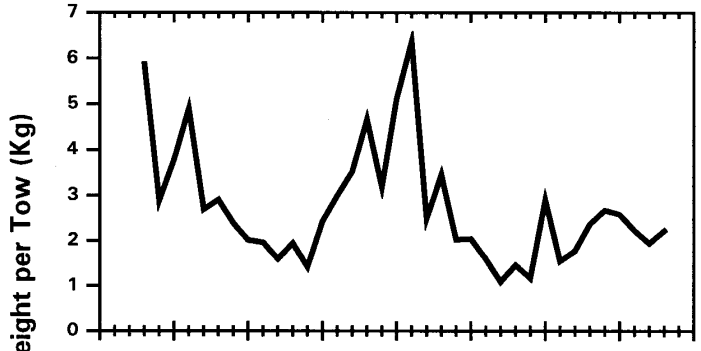

Figure 10. NEFSC autumn bottom trawl survey biomass indices for American plaice.

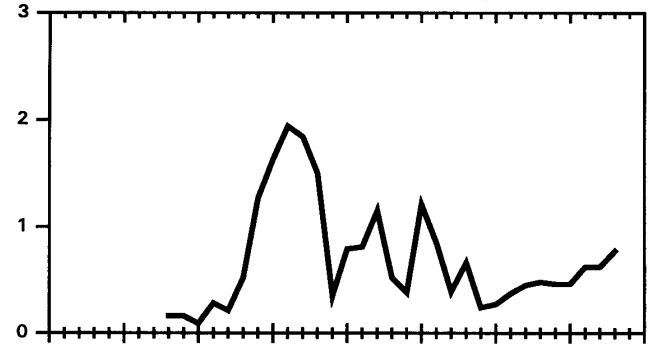

Figure 11. NEFSC spring bottom trawl survey biomass indices for summer flounder.

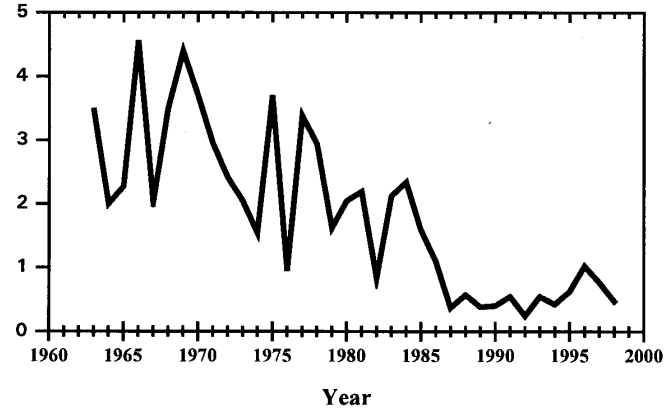

Figure 12. NEFSC autumn bottom trawl survey biomass indices for witch flounder.

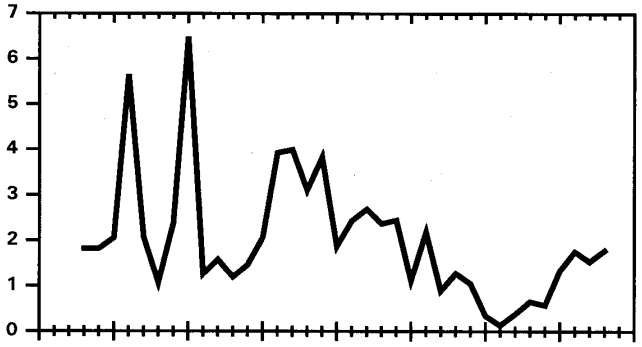

Figure 13. NEFSC autumn bottom trawl survey biomass indices for Georges Bank winter flounder.

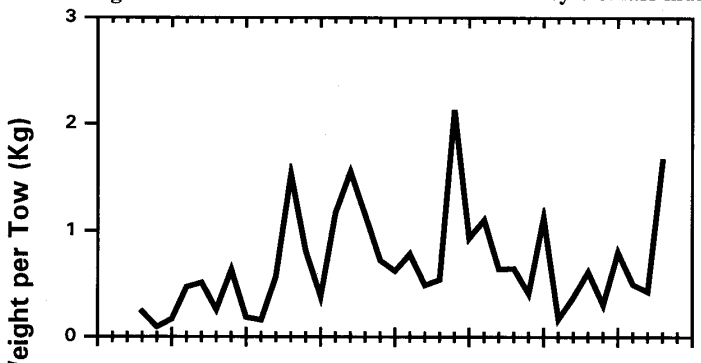

Figure 14. NEFSC autumn bottom trawl survey biomass indices for windowpane flounder.

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

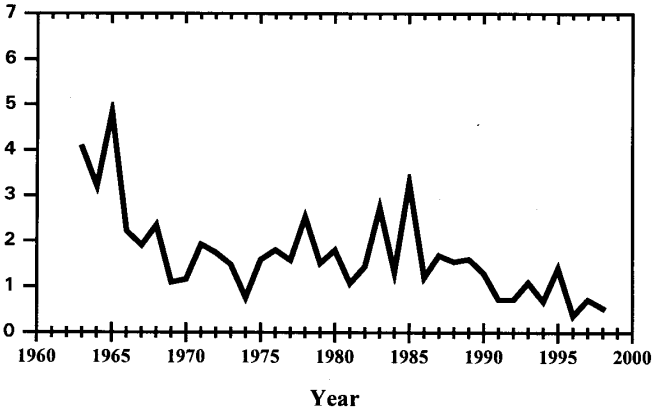

Figure 16. NEFSC autumn bottom trawl survey biomass indices for southern silver hake.

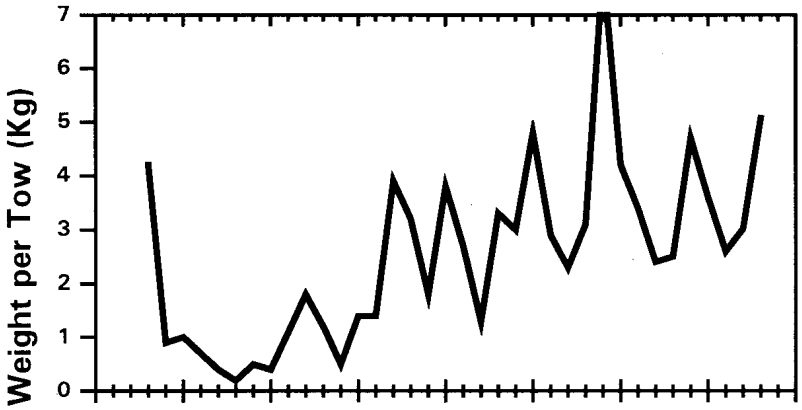

Figure 17. NEFSC autumn bottom trawl survey biomass indices for northern red hake.

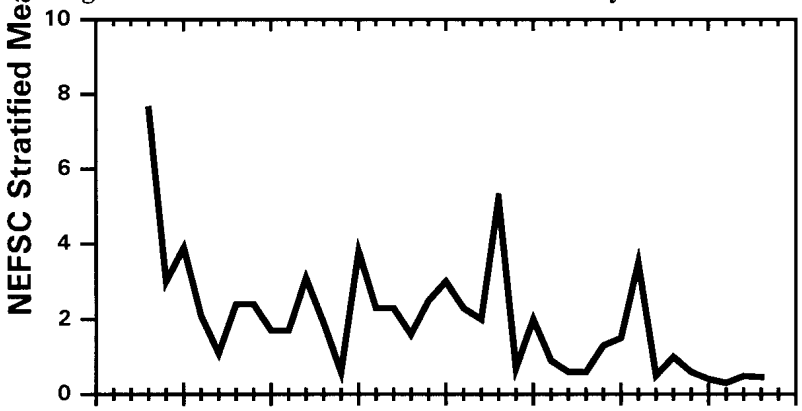

Figure 18. NEFSC autumn bottom trawl survey biomass indices for southern red hake.