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United States Research Report for 1997

by

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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 9% from 14,214 mt in 1996 to 12,958 mt in 1997, and 1997 landings are among the lowest since 1960.

USA cod landings from the Gulf of Maine (Div. 5Y) in 1997 were 5,421 mt, a 25% decrease from 7,194 mt landed in 1996. Fishing mortality on this stock has remained high over the past decade, averaging about 1.1 since 1991. Spawning biomass has declined from over 26,000 mt in 1989 to about 8,000 mt in 1997. Stratified mean biomass indices have increased slightly since the 1991 record low, but continue to remain among the lowest in the series (Figure 1).

Landings from the Georges Bank stock (Div. 5Z and SA 6) in 1997 were 7,537 mt, a 7% increase from 7,020 mt landed in 1996. Fishing mortality in 1997 remained at a low value of 0.26, following a record high of 1.07 in 1994. Spawning stock biomass in 1997 (35,900 mt) was 5% higher than in 1996 (34,200 mt) and 43% higher than the record low in 1994 (25,100 mt). Stratified mean biomass indices from research surveys indicate that total stock biomass declined slightly in 1997 and remains near historic low levels (Figure 2).

2. Haddock

USA landings of haddock (*Melanogrammus aeglefinus*) increased 164% from 570 mt in 1996 to 1,504 mt in 1997. Georges Bank (Div. 5Z) landings increased 184% from 313 mt in 1996 to 888 mt in 1997, while Gulf of Maine (Div. 5Y) landings increased 140% from 257 mt in 1996 to 616 mt in 1997. Landings from both stocks remained at less than 10% of historical levels and were constrained by restrictive management measures.

Research vessel survey indices for 1997 indicated increases in stock levels, but indices for both the Gulf of Maine and Georges Bank stocks remained well below historical levels (Figures 3 and 4). Spawning biomass of the Georges Bank stock increased in 1997 due to broadening of size and age distribution in response to conservation measures. However, spawning biomass is expected to stabilize in the near future if recruitment does not improve.

3. Redfish

USA landings of redfish (*Sebastes* spp.) declined 22% from 322 mt in 1996 to 251 mt in 1997. Research vessel survey indices indicate that stock biomass increased in 1996 and remained relatively high in 1997 compared to the 1980s (Figure 5) due to somatic growth of a relatively strong year class produced in the early 1990s. Redfish from this year class should recruit to the fishery in the next 2-3 years.

4. Pollock (4VWX + 5 stock)

USA landings of pollock (*Pollachius virens*) increased 44% from 2,963 mt in 1996 to 4,252 mt in 1997. 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 continues to remain near a record low (Figure 6).

5. White Hake

USA landings of white hake (*Urophycis tenuis*) decreased 32% from 3,287 mt in 1996 to 2,219 mt in 1997, the lowest annual catch since 1970. Research vessel survey indices indicate that the stock has declined from the stable level of the 1980s to one of the lowest points in the survey series (Figure 7).

6. Yellowtail Flounder

USA landings of yellowtail flounder (*Pleuronectes ferrugineus*) increased 20% from 2,343 mt in 1996 to 2,814 mt in 1997. Research vessel survey indices suggest that the Georges Bank stock (Div. 5Z, E of 69E) biomass has begun to increase, but remains low relative to levels observed in the 1960s, while biomass of 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 1997 totalled 15,636 mt, 13% lower than in 1996. American plaice (*Hippoglossoides platessoides*) (25%), summer flounder (*Paralichthys dentatus*) (26%), winter flounder (*Pleuronectes americanus*) (34%), witch flounder (*Glyptocephalus cynoglossus*) (11%), and windowpane flounder (*Scophthalmus aquosus*) (3%) accounted for virtually all of the 'other flounder' landings in 1997. Compared to 1996, commercial landings in 1997 were lower for American plaice (-10%), summer flounder (-29%), witch flounder (-15%), and windowpane flounder (-45%), but higher for winter flounder (+12%). Research vessel survey indices in 1997 decreased for American plaice, witch flounder and windowpane flounder, while indices for winter flounder and summer flounder remained stable (Figures 10 - 14).

8. Silver Hake

USA landings of silver hake (*Merluccius bilinearis*) decreased slightly (4%) from 16,200 mt in 1996 to 15,570 mt in 1997. Research vessel survey indices for the Gulf of Maine - Northern Georges Bank stock, which increased throughout the 1980s, have been quite variable since 1990. Indices for the Southern Georges Bank - Mid-Atlantic stock have declined in recent years and are now at or near historically low levels (Figures 15 and 16). In both stocks, discards of juvenile fish have been relatively high.

9. Red Hake

USA landings of red hake (*Urophycis chuss*) increased 20% from 1,097 mt in 1996 to 1,318 mt in 1997. 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

USA landings of Atlantic herring (*Clupea harengus*) increased 8% from 89,070 mt in 1996 to 96,120 mt in 1997. The total USA catch including internal waters processing (IWP) transfers and at-sea transfers to Canadian vessels decreased 5% from 103,663 mt in 1996 to 98, 243 mt in 1997. Spawning stock biomass

of the coastal stock complex of herring 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, particularly on juvenile herring. Although there has been no directed fishery for herring on Georges Bank (Div. 5Ze) since the stock collapsed in 1977, there is strong evidence of stock recovery based on research vessel trawl catches (Figure 19), larval survey indices and incidental commercial catches.

11. Atlantic Mackerel

USA commercial landings of Atlantic mackerel (*Scomber scombrus*) declined from 15,702 mt in 1996 to 14,677 mt in 1997. The stock (Subareas 2-6) is currently underexploited, and total biomass remains at record high levels in excess of 2 million mt. Stock rebuilding since 1981, documented by research survey indices (Figure 20), 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 28% from 3,600 mt in 1996 to 2,603 mt in 1997. Research survey biomass indices increased during the late 1970s, fluctuated during the 1980s, and are presently above the long-term average. Recent recruitment has been good and both the 1992 and 1993 year classes appear strong.

13. Squids

USA landings of longfin squid (*Loligo pealeii*) increased 19% from 12,459 mt in 1996 to 14,852 mt in 1997. Minimum biomass estimates suggest that the stock is at a low level.

USA landings of shortfin squid (*Illex illecebrosus*) decreased 20% from 16,969 mt in 1996 to 13,631 mt in 1997. No stock biomass estimates are available.

14. Sea Scallops

USA commercial landings of sea scallops (*Placopecten magellanicus*) in 1997 were 6,002 mt (meats), 24% l remained stable on Georges Bank. Closure areas on Georges Bank since 1994 have protected a sizable fraction of the resource such that biomass continues to increase in the closed areas whereas biomass in fished regions continues to decline. Two additional closure areas were implemented in the Mid-Atlantic region in early 1998 to improve yield per recruit by delaying harvest.

B. Special Research Studies

1. Environmental Studies

a) Hydrographic Studies

A report describing surface and bottom temperatures and surface salinities in the Mid-Atlantic Bight and Gulf of Maine in 1997 was submitted as a NAFO SCS Doc. A comparison of recent hydrographic data to the 1978-1992 historical time series is scheduled for publication in the Journal of Northwest Atlantic Fishery Science.

b) Plankton Studies

GLOBEC Georges Bank Study: The USA GLOBEC Georges Bank study continued its third year of field work in 1997. The processes that determine the movement of water and organisms onto, around and off of the Bank (source, retention and loss) provided the focus of work in 1997. In addition, 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 observed beginning in 1995 continued in 1997, not only on the Bank, but throughout the Gulf of Maine region.

c) Aquaculture

The NEFSC Milford Laboratory has established an experimental recirculating culture rotating biological contact, aquacube and bio-cord. Initially, the system will be used to explore the growth of bay scallops, *Argopecten irradians*. A PC, with the addition of a few data acquisition cards, will be used to monitor and assist in managing the system. Process control technology will be applied to minimize human intervention throughout the grow-out period. Algal consumption will be monitored to track food conversion efficiency ratios. Waste production will be monitored and modeled to maximize stocking densities of the system while minimizing filtration needs.

Selection studies are underway to investigate genetic responses for improving growth and survival of bay scallops. Previous findings from early responses to selection for growth indicated variation among several lines, with some modest gains. Subsequent measures on the growth and survival of scallops from the same lines at a later time in development demonstrated less variability in the responses among lines. Preliminary results from breeding the F1 generation suggest that interaction with survival may be a more important factor in selecting scallop populations than selecting for growth alone.

Culture studies with the tautog, *Tautoga onitis*, in recirculating systems continue. Very successful culture of larvae and early-stage juveniles was achieved in such systems. Depending on stage, tautog were fed rotifers and brine shrimp. The rotifers and brine shrimp were fed the algae *Nannochloropsis* (UTEX 2341) and *Isochrysis* sp. (T-ISO and CISO) 24 hours before they were fed to the tautog. These algae enriched the live foods with the N-3 and N-6 series of highly unsaturated fatty acids (HUFAs), which are known to promote good growth and survival of larval marine fish. Survival of tautog through the yolk-sac stage to metamorphosis exceeded results obtained previously in static-bucket culture and static greenwater culture systems.

d) Other Environmental Studies

A Howard Laboratory project assessing the salt marsh restoration efforts in the Arthur Kill, Staten island, NY, continues. The study was funded by the NMFS Restoration Center and is being done in cooperation with the New York Department of Parks and Recreation, the New Jersey Department of Environmental Protection and Rutgers University. The marshes were heavily impacted by the 1990 Exxon Bayway Oil Spill. The primary goal of the study is to characterize and assess the structure and function of two oiled/restored, two oiled/unrestored and two reference marshes, with an emphasis on the trophic linkages within each biological system. The field work was completed in spring 1997. Studies include sediment chemistry; contaminant analyses of sediment and ribbed mussels; growth and condition of ribbed mussels; stable isotope analyses of selected marsh consumers and potential sources of organic matter; macrobenthic surveys and stomach content analyses of mummichogs (*Fundulus heteroclitus*), an important prey for larger fish and birds. Samples are currently being analyzed. Preliminary biogeochemistry results indicate that E_h and sulfide values were station-specific and not uniquely characteristic to the restoration status of the sites. Any restoration related patterns in these parameters were probably overwhelmed by localized anthropogenic impacts (erosion, runoff, vessel wakes) in this heavily urbanized estuary. Other preliminary results show that concentrations of silver, cadmium, chromium, and mercury in ribbed mussels were significantly different between two groups of sites: all the oiled sites vs. the two unoiled ones. The restored sites and one reference site appear to have fewer numbers of benthic infauna than the two unrestored sites. These preliminary survey results suggest that local environmental variabilty in salt marshes and especially in the highly impacted marshes of the Arthur Kill make evaluation of restoration projects based on single variables (such as infauna) difficult over the short-term.

As a result of a three-year collaborative effort with Rutgers University, manuscripts are currently being prepared on the distribution, abundance and habitat specific growth of winter flounder (*Pleuronectes americanus*) and tautog (*Tautoga onitis*) in three estuaries: Great Bay-Little Egg Harbor and the Hudson-Raritan systems in New Jersey and the Connecticut side of

Long island Sound. In addition, other papers on trophic linkages using stable isotopes and the use of RNA/protein ratios to track growth are being written.

A monthly bottom trawl survey of the Hudson-Raritan Estuary (New York/New Jersey) has continued into its seventh year. Manuscripts, reports, and oral presentations are being prepared on overall results of the survey; distribution, relative abundance, and hydrographic preferences to managed species; diets of crabs; and differences in catches between channel and non-channel areas. In addition, data are currently being used in the planning process for dredge material disposal (e.g., contaminant islands and borrow pits) as well as for the expansion of navigation channels.

2. Biological Studies

a) Fish Species

Flatfish: Studies of the rates of growth, development and survival during early life history were conducted at the James J. Howard Marine Sciences Laboratory, Highlands, NJ. These vital rates are often poorly known even for our best studied species, and usually require laboratory experimentation to achieve baseline estimates. Studies were initiated on winter flounder, *Pleuronectes americanus*, and summer flounder, *Paralichthys dentatus*. The effects of temperature on duration of life periods, growth rates, survival and sizes at transitions between life periods were estimated based on replicated populations reared at multiple temperatures (10 temperatures for embryonic period, 5 temperatures for larval period). Survival of winter flounder (from hatching to metamorphosis) in the second year of this study (1998) have been surprisingly high, exceeding 75%. The young juveniles settling in these reared populations will be used for two purposes beyond providing estimates of growth, developmental and survival rates. First, the values of meristic traits of recently metamorphosed individuals that experienced different larval period temperature regimes will be determined via clearing-and-staining techniques. If a temperature dependency can be validated, this relationship will be used to infer the temperature regimes experienced by wild-caught fish. Second, young juveniles will be the prey in predation trials that use various common local predators. These predation studies will quantify the size-specific risks of mortality due to these predators.

b) Age and Growth

Approximately 51,515 age determinations were completed for 15 species of finfish and shellfish in support of resource assessment analyses and other research in 1997.

Cod, *Gadus morhua*, haddock, *Melanogrammus aeglefinus*, and winter flounder, *Pleuronectes americanus*, age structures were exchanged with Canadian age readers and Atlantic herring, *Clupea harengus*, and summer flounder, *Paralichthys dentatus*, structures were exchanged with readers from USA state laboratories in a continuing effort to maintain comparability of age determinations between laboratories ageing these species.

Ages from 6,053 bluefish, *Pomatomus saltatrix*, from 1985-96 commercial and survey samples were aged and growth parameters estimated. Growth and maturation analyses were performed for fourspot flounder, *Paralichthys oblongus*. Research to validate ageing of cusk, *Brosme brosme*, and summer flounder using elemental analyses was initiated. Smolt scales collected in support of the NMFS-MASA (Maine Atlantic Salmon Authority) Atlantic Salmon Project were also analyzed.

Research to develop indices of maturity and egg quality in Atlantic cod and summer flounder continued. These studies are designed to develop biochemical and histological methods for accurately determining maturation schedules for these important species and to validate the macroscopic methods for determining maturation during standard trawl surveys.

c) Food Chain Dynamics

Studies of trophic dynamics based on an integrated program of long-term (since 1963) monitoring and process-oriented predation studies continued in 1997. In addition to standard research vessel survey sample collection, a series of process-oriented studies focusing on predation of early life stages of cod and haddock on Georges Bank were conducted during 1992-96 with funding from the NOAA Coastal Ocean Program (NCOP).

Food habits samples were collected during NEFSC survey activities during the winter, spring and fall on the Northeastern and Mid-Atlantic continental shelf. Estimates of prey volume and composition were made at sea for selected species. During winter, 7,750 stomachs from 24 species were examined, while 13,988 stomachs from 31 species, and 12,294 stomachs from 32 species were examined during the spring and fall, respectively. Diet sampling emphasized elasmobranchs (spiny dogfish, smooth dogfish, and various skates), gadids, and flatfishes.

Revisions to the 33 year time series of food habits data collected during NEFSC bottom trawl surveys continued. An 18 year subset of this time series is now available for analysis including data from over 120,000 stomach samples collected from 1973-90. Data from the 13 process-oriented NCOP cruises including data from over 35,000 stomachs are also available. The processing of the 1991-97 bottom trawl survey food habits data is scheduled for completion in 1998.

d) Apex Predators

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. To delineate shark migratory patterns and stock structure, a multi-decadal cooperative tagging program involving over 6,500 volunteer recreational and commercial fishermen, scientists and fisheries observers has been conducted since 1962 and extends along the North American and European coasts. Data utilized to monitor changes in abundance and biological samples required for studying age and growth, feeding ecology, and reproductive biology are obtained regularly at sportfishing tournaments, from commercial longline vessels and from domestic and foreign research vessels. Resource surveys are also conducted to assess and monitor species composition and abundance of coastal shark species, to tag and release individuals, to collect essential biological information, and to link distribution patterns with environmental parameters using oceanographic and remotely sensed data.

In 1997, members of the Cooperative Shark Tagging Program tagged and released 8,816 fish, including 31 species of sharks and 11 species of teleosts. The principal shark species tagged were blue (68%), sandbar (9%), tiger (4%), mako (3%), Atlantic sharpnose, blacktip, and porbeagle (2% each). Information was also received on 685 recaptured fish representing 21 species of sharks and 4 species of teleosts. *Blue* (482), *sandbar* (61), *tiger* (34), *porbeagle* (23), *and shortfin mako* (22) sharks represented the predominant species recaptured. The addition of the 1997 data brings the total number of sharks tagged to over 147,000 and recaptures to nearly 7,500.

A cooperative USA/Canada research program to examine the biology of the porbeagle shark, *Lamna nasus*, continued in 1997. During 1997, four cruises were conducted targeting porbeagles in the Gulf of Maine with the primary purpose of tagging and injecting individual sharks with oxytetracycline to validate the periodicity of vertebral column banding. Distribution information and biological samples were also taken for ongoing migration, feeding ecology, and reproductive biology studies.

Reproductive dynamics studies of nurse, *Ginglymostoma cirratum*, and sandbar, *Carcharhinus plumbeus*, sharks also continued. This research is focusing on the identification of mating areas of nurse sharks in the waters off Florida utilizing ultrasonic telemetry; and fidelity of sandbar sharks to summer nursery areas off the east coast of the USA using gillnet sampling and tag/recapture data from young-of-the-year and juvenile sandbars.

e) Marine Mammals

Small Cetaceans

In July 1997, a shipboard cruise was conducted in the southern Gulf of Maine and Georges Bank region to collect marine mammal biopsy samples. Seventy-nine biopsy samples were obtained from common dolphins, bottlenose dolphins, Risso=s dolphins, spotted dolphins, white-sided dolphins, pilot whales, fin whales and humpback whales.
In August 1997, wild harbor porpoises were passively tracked by listening to the animal=s echolocation signals (clicks) using two bottom-mounted arrays of hydrophones. Utilizing time-

difference-of-arrival direction finding and line-of-position fixing it was possible to document harbor porpoise underwater movements and natural behavior in three dimensions.

A shipboard sighting survey was conducted during August-September 1997 in the New England sea mount region to estimate the relative abundance and distribution of marine mammals, preliminary to evaluating whether this region should be included in a large scale abundance survey planned for summer of 1998.

To document the spatial and temporal distribution of harbor porpoises in the waters from North Carolina to Maine, aerial or shipboard surveys were conducted nearly every month during 1997.

Methodology of abundance estimation from line transect surveys was 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 that estimate g(0) and incorporate covariates that account for heterogeneities in the probability of detection was investigated using simulated data sets.

Updated abundance and 1996 by-catch estimates were reported in the U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments Report for the following cetaceans: harbor porpoises, white-sided dolphins, common dolphins, pilot whales, beaked whales, sperm whales, offshore bottlenose dolphins, Risso=s dolphins, striped dolphins, and spotted dolphins.

A 6-day necropsy session was held at the National Museum of Natural History in Washington, DC during June 1997. During this session, 37 stranded carcasses of harbor porpoises were necropsied and samples were collected to support research in life history, genetics, ecology, contaminants, morphology and physiology.

A take reduction team met during January to August 1997 to design a method to reduce the by-catch of harbor porpoises in the Mid-Atlantic coastal gill net fisheries. The Take Reduction Team for harbor porpoises in the Gulf of Maine reconvened for one meeting during December 1997.

Analyses were initiated to investigate potential by-catch reduction methods. Initial focus is on possible relationships between take rates of common dolphins and gear characteristics in the Northwestern Atlantic drift gillnet fishery and between take rates of harbor porpoises and gear characteristics in the Mid-Atlantic coastal sink gillnet fishery.

The dynamics of pods of pilot whales harvested in the Faroe Islands were examined based on both historical catch data and scientific data collected in the late 1980s, in cooperation with Faroe Island scientists.

A study was initiated in the fall of 1997 to model the marine mammal predator-prey interactions in the Gulf of Maine. The marine mammals included are harbor porpoises, harbor seals, white-sided dolphins, humpback whales, fin whales and minke whales. Canonical correspondence analysis will be used to suggest possible guilds and so determine the ecological implications and possible interactions with fishers.

Large Whale Studies

The NEFSC continues to direct research on large whale species in waters off the northeast coast of the United States by both agency scientists and non- governmental institutions. Priority species are those which are currently considered endangered, especially right and humpback whales.

Particular emphasis is placed upon the critically endangered northern right whale, the North Atlantic population of which is estimated to number approximately 300 individuals. NEFSC supported research during 1997 focused on population assessment, studies of distribution, abundance, vital rates, habitat use, population dynamics, population biology, genetics, and rates and causes of mortality/ threats to recovery. Field work conducted by NEFSC includes both aerial and shipboard surveys in offshore waters.

NEFSC scientists estimate the minimum population size for humpback whales in the North Atlantic as 10,600 animals (CV = 0.067) as of 1997. For 1991-96, human caused mortality in U.S. waters

was estimated to be 5.8 animals per year. Although still listed as endangered, North Atlantic humpback appear to be recovering strongly in most areas. NEFSC played a key role in a large-scale two-year study entitled Years of the North Atlantic Humpback (YONAH). YONAH combined photo-identification techniques with molecular genetic studies to conduct a comprehensive assessment of humpback whales throughout much of their North Atlantic range. Several thousand humpbacks were individually identified by either photo-ID or genotyping (YONAH was the first project to use genetics as the primary means of individual identification in a free-ranging population of mammals). The project has resulted in new (and much more precise) estimates of abundance, as well as a comprehensive understanding of the genetic structure of this oceanic population.

Additional assessment work on large whales, notably fin and sei whales, continues.

Seals

A harbor seal coast-wide aerial abundance survey along the Maine coast was conducted in May/June during the 1997 pupping season. The minimum abundance estimate, uncorrected for animals in water or outside survey area, was 30,990 seals (25,631 adults; 5,539 pups). Since 1981, the average annual increase in total seal and pup abundance, respectively, have been 4.2% and 12.9%. Both pup production and the number of pupping sites along the eastern Maine coast have also increased in recent years.

A year-round population of grey seals (several hundred) has been established in the Monomoy-Nantucket Sound region off Cape Cod. This continues a trend first observed in the early 1980's when Sable Island branded seals were recorded on Monomoy National Wildlife Refuge. Historically, a population of grey seals resided in the Nantucket Sound region, but bounty killing extirpated the population by the mid-1900's. Systematic surveys of grey seals (and harbor seals) will be conducted in Massachusetts during 1998.

3. Studies of Fishing Operations

The NEFSC placed observers aboard fishing vessels in 6 general categories of fisheries in 1997.

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 1,142 trips for 1,257 days in these fisheries which occur year round. The primary emphasis of the studies was to estimate incidental catch rates of harbor porpoise and other marine mammals. A total of 191 marine mammal takes were observed, including (in order of highest occurrence) harbor porpoise, harbor seal, harp seal, gray seal, white sided dolphin, and saddleback dolphin. A total of 126 biological samples were collected from these animals including body measurements, entire carcasses, and tissue samples. Retained and discarded finfish catches were weighed or estimated for a portion of the observed tows. Finfish length frequencies and age structures were also obtained for age and growth studies. A total of 92 sea birds were caught, including (in order of highest occurrence) greater shearwater, common loon, northern gannet, sooty shearwater, cormorant, brown pelican, red-throated loon, and thin-billed murre. One loggerhead and three unidentified turtles were caught and released alive.

b) Swordfish Drift Gillnet

Observers were placed aboard two trips, totalling 13 days on 2 different domestic drift gillnet vessels which targeted tuna and sharks. 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 and marketed. Bycatch from this fishery included white marlin, blue shark, hammerhead shark, dusky shark, and pelagic stingray. Five incidental marine mammal takes were observed, including 1 beaked whale and 4 saddleback dolphins. No sea turtle or sea bird takes were observed on these trips.

c) Otter Trawl Fisheries

Observer coverage included 125 trips and 476 days aboard otter trawl vessels in the northern shrimp, New England multispecies groundfish, summer flounder, *Illex* squid, *Loligo* squid, and Atlantic mackerel fisheries. Actual and estimated weights were collected for retained and discarded finfish, crustacean, and squid catches. Biological samples, including length frequencies and ageing structures, were collected for age and growth studies. Incidental catches of marine mammals, sea turtles, and sea birds were recorded. Four marine mammal takes were observed (2 saddleback dolphins, 1 white sided dolphin, and 1 pilot whale). One loggerhead turtle was caught and released alive. A total of 15 sea bird takes (all greater shearwaters) was observed.

d) Sea Scallop Dredge Fisheries

Observers were deployed on 28 trips, consisting of 363 days aboard 21 different scallop vessels. Individual measurements were recorded from kept and discarded sea scallops. Biological samples, including length frequencies and ageing structures, were collected from kept and discarded finfish. Actual or estimated weights of catches were collected for each gear set. No incidental catches of marine mammals or sea birds were observed. One green sea turtle was captured and released alive. 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

The offshore lobster pot fishery was observed during 1 trip, totalling 7 days. Bycatch consisted of Jonah crabs (predominantly). Estimated or actual weights of catches were collected from all hauls. Individual carapace measurements were collected from both lobsters and some crabs. No incidental catches of marine mammals, sea turtles, or sea birds were observed.

f) Pelagic Longline Fisheries

Observers were deployed for 7 trips, totalling 150 days, on 6 different pelagic longline vessels targeting swordfish and mixed tunas. Landings were primarily yellowfin tuna and swordfish. Bycatch consisted of blue shark, albacore tuna, mahi mahi, shortfin mako, bigeye tuna, pelagic stingray, blue marlin, white marlin, and dolphinfish. Observed incidental takes included 1 pilot whale, 10 sea turtles (2 leatherback and 8 loggerhead), and 22 sea birds (all shearwaters). The pilot whale was released alive, as were all ten sea turtles.

ACKNOWLEDGEMENTS

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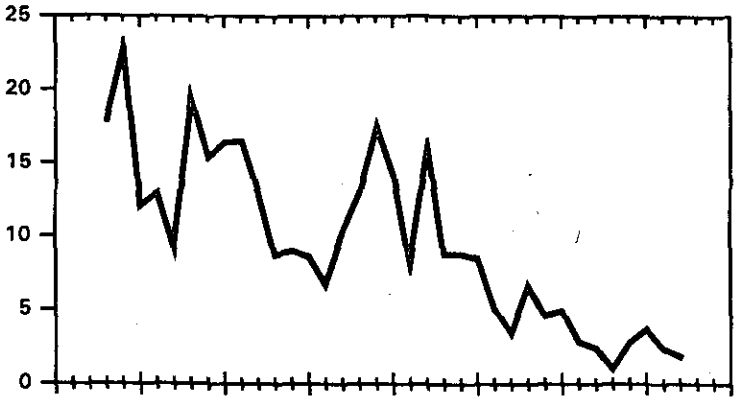

Figure 1. NEFSC autumn bottom trawl survey biomass indices for Gulf of Maine cod.

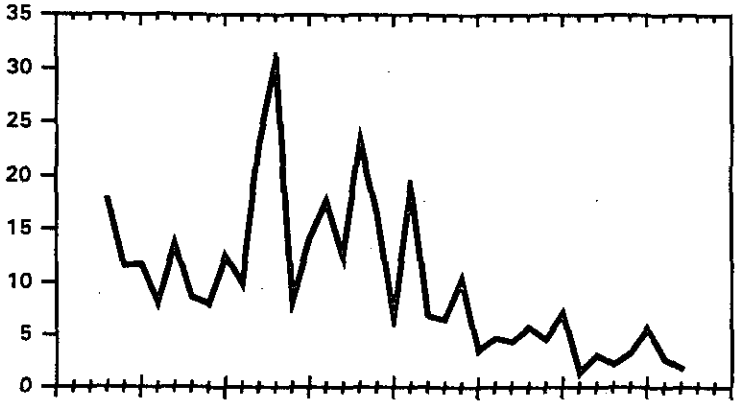

Figure 2. NEFSC autumn bottom trawl survey biomass indices for Georges Bank cod.

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

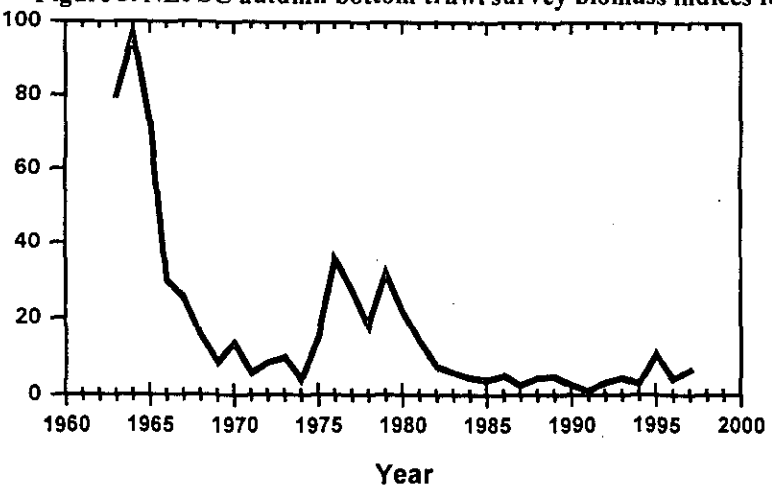

Figure 4. NEFSC autumn bottom trawl survey biomass indices for Georges Bank haddock.

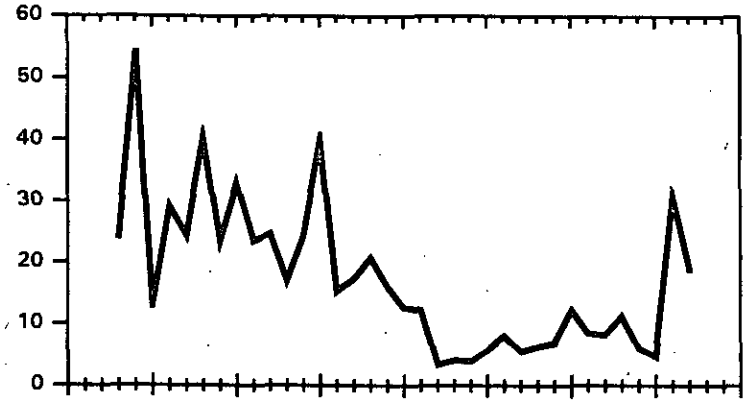

Figure 5. NEFSC autumn bottom trawl survey biomass indices for redfish.

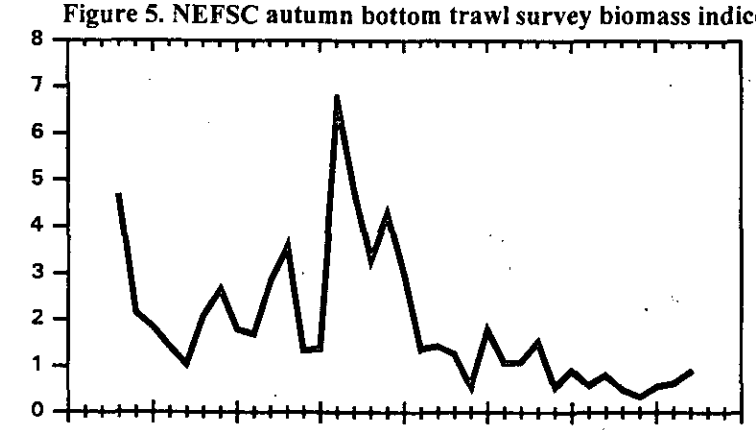

Figure 6. NEFSC autumn bottom trawl survey biomass indices for pollock.

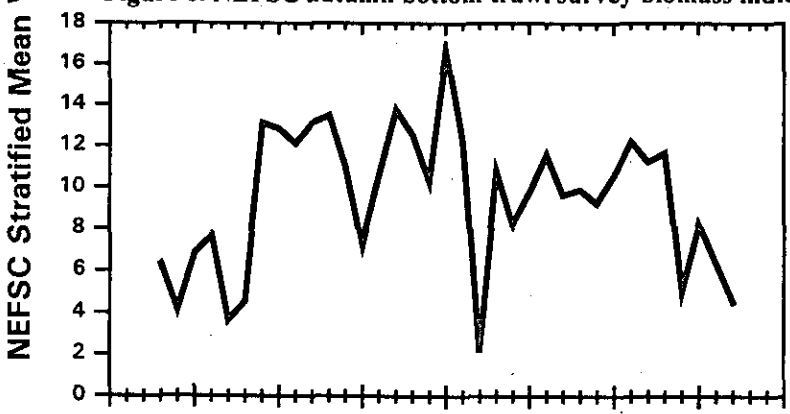

Figure 7. NEFSC autumn bottom trawl survey biomass indices for white hake.

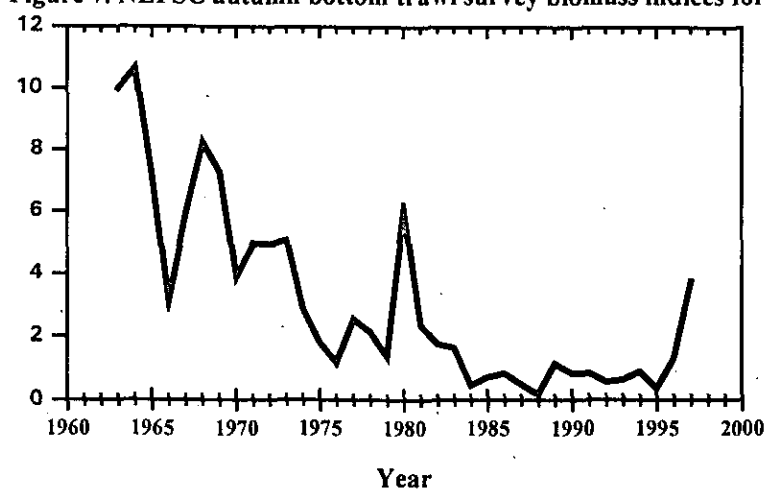

Figure 8. NEFSC autumn bottom trawl survey biomass indices for Georges Bank yellowtail flounder.

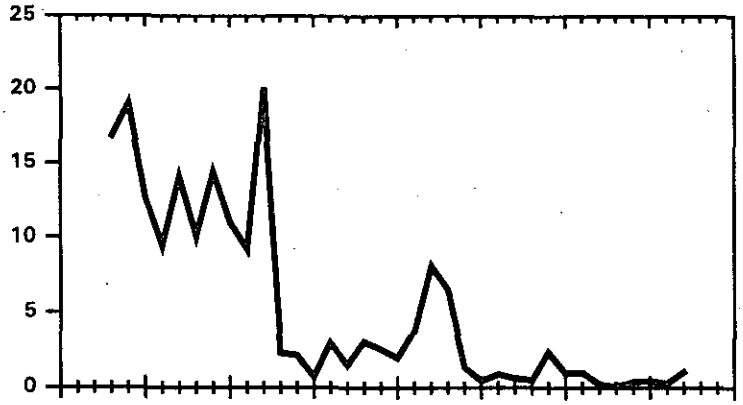

Figure 9. NEFSC autumn bottom trawl survey biomass indices for Southern New England yellowtail flounder.

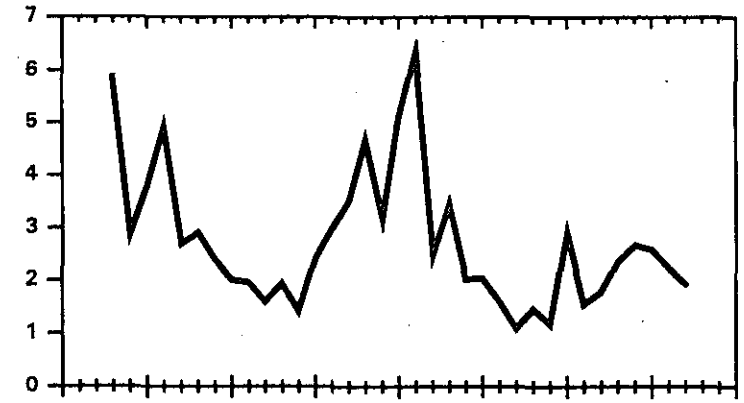

Figure 10. NEFSC autumn bottom trawl survey biomass indices for American plaice.

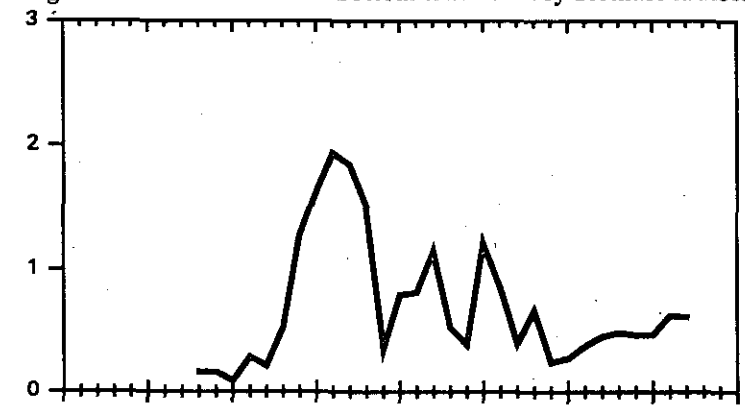

Figure 11. NEFSC spring bottom trawl survey biomass indices for summer flounder.

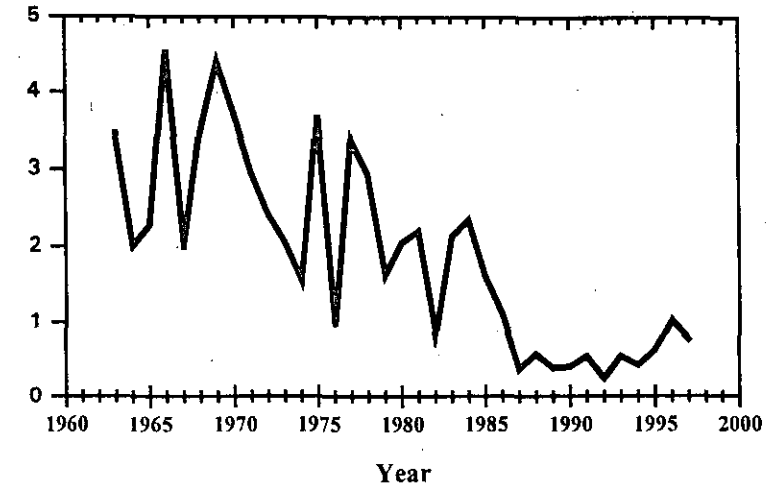

Figure 12. NEFSC autumn bottom trawl survey biomass indices for witch flounder.

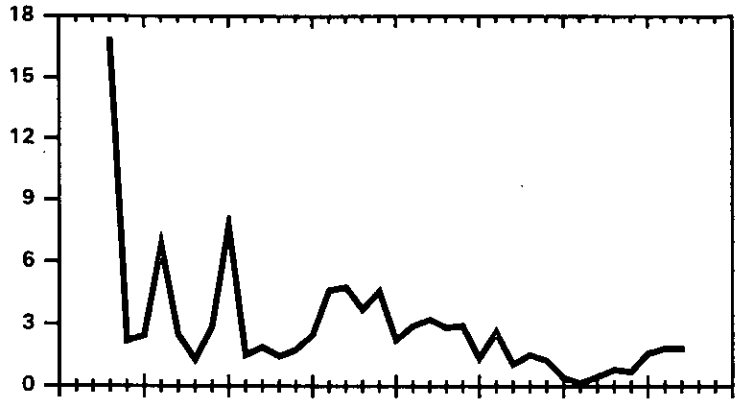

Figure 13. NEFSC autumn bottom trawl survey biomass indices for Georges Bank winter flounder.

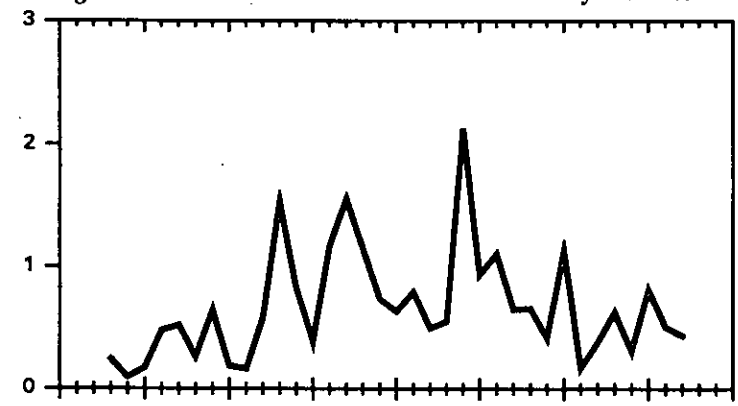

Figure 14. NEFSC autumn bottom trawl survey biomass indices for windowpane flounder.

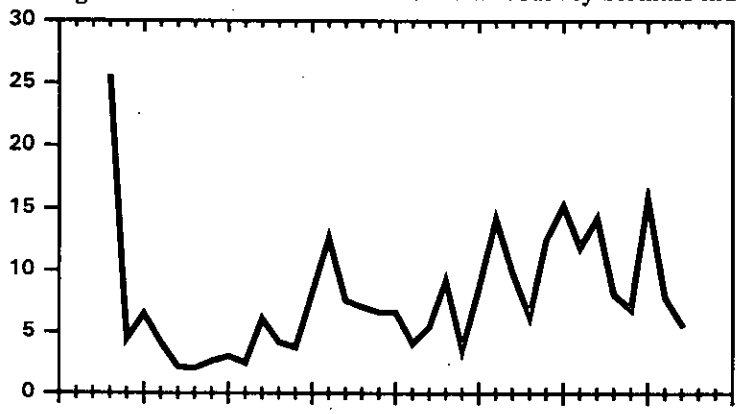

Figure 15. NEFSC autumn bottom trawl survey biomass indices for northern silver hake.

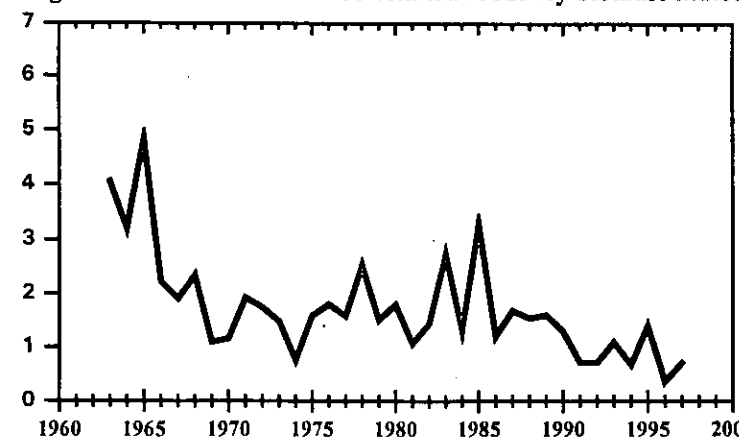

Figure 16. NEFSC autumn bottom trawl survey biomass indices for southern silver hake.

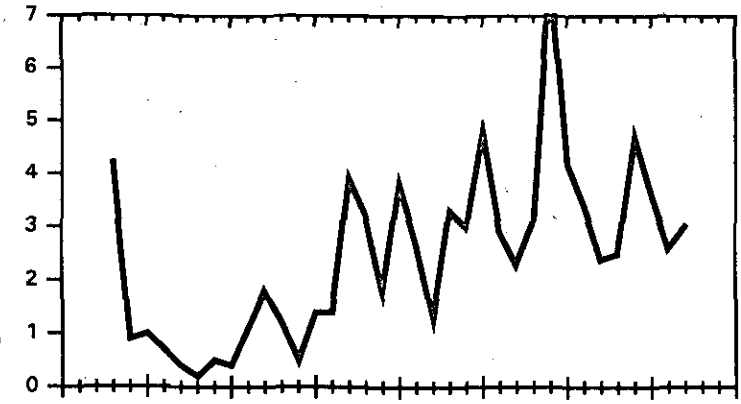

Figure 17. NEFSC autumn bottom trawl survey biomass indices for northern red hake.

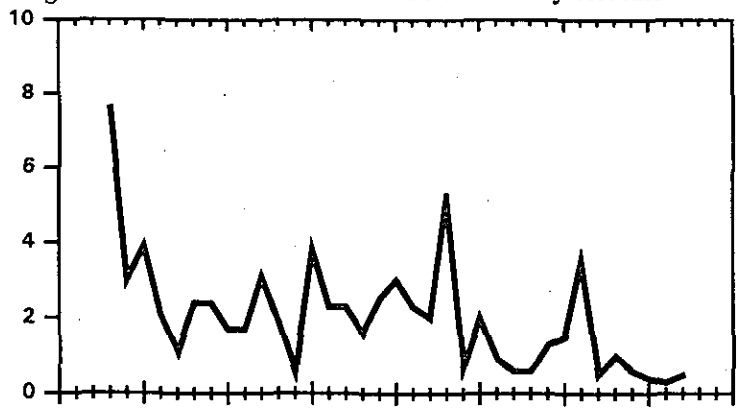

Figure 18. NEFSC autumn bottom trawl survey biomass indices for southern red hake.

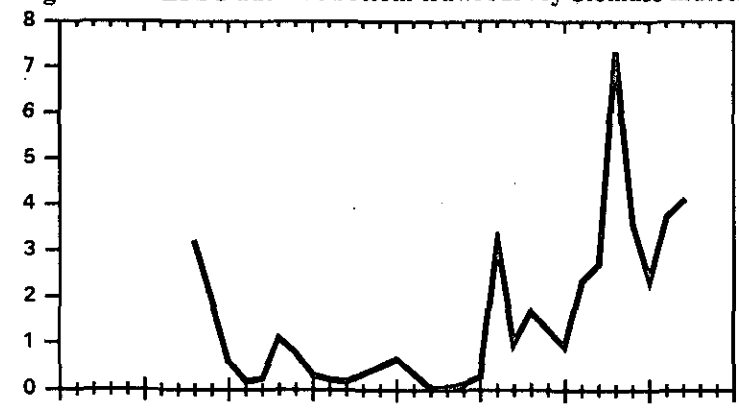

Figure 19. NEFSC spring bottom trawl survey biomass indices for Atlantic herring.

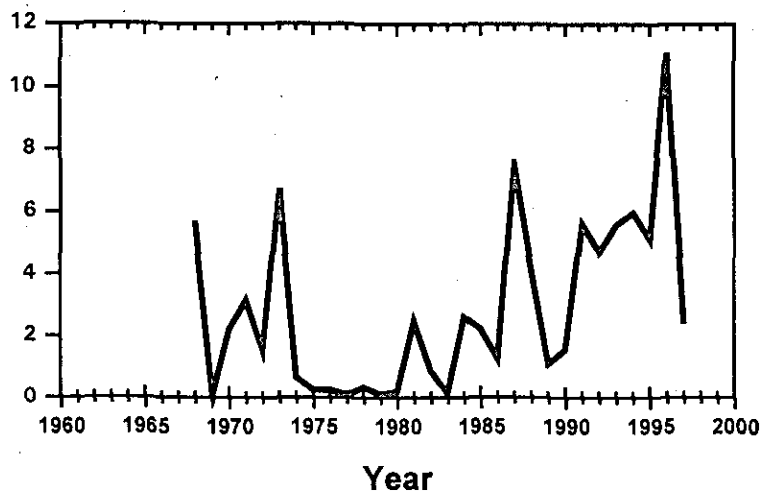

Figure 20. NEFSC spring bottom trawl survey biomass indices for Atlantic mackerel.