

Northwest Atlantic



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United States Research Report for 1994

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. More detailed information on these and other species is included in a report entitled "**Status of the Fishery Resources off the Northeastern United States for 1994**" prepared by the Northeast Fisheries Science Center of the National Marine Fisheries Service (NMFS), and in "**Our Living Oceans: Report on the Status of U.S. Living Marine Resources 1995**", a report prepared by NMFS Headquarters in Silver Spring, Maryland.

In 1994, revised sampling and reporting protocols were implemented in the Northeast Region. As a result, new auditing and allocation procedures are being developed to prorate total reported landings by species among areas. Until these procedures are fully developed, reported landings will not be available by NAFO Division. In this report, therefore, total USA commercial landings are presented by species.

1. Atlantic Cod

USA commercial landings declined 23% from 22,877 t in 1993 to 17,545 t in 1994. Total cod landings in 1994 were the lowest in 21 years (*i.e.*, since 1973). Research vessel survey indices in 1994 indicate that the Gulf of Maine (Div. 5Y) and Georges Bank (Div. 5Z and Subarea 6) cod stocks remain at or near their lowest recorded levels.

2. Haddock

USA landings in 1994 declined 63% from 878 t in 1993 to 328 t in 1994, the lowest level on record. Research vessel survey indices in 1994 indicated that both the Gulf of Maine (Div. 5Y) and Georges Bank (Div. 5Z) haddock stocks were at or near record-low levels. Spawning biomass of Georges Bank haddock increased slightly in 1994, and is expected to increase further in 1995 due to improved recruitment from the 1992 year class. However, stock size levels are still quite low compared to historic levels.

3. Redfish

USA landings of redfish declined 45% from 795 t in 1993 to 440 t in 1994. Research vessel survey indices indicate that stock biomass continues to remain low despite some increases in recruitment from year classes produced in the mid-1980s.

4. Pollock (4VWX + 5 stock)

USA landings from this stock declined 34% from 5,673 t in 1993 to 3,749 t in 1994, the lowest annual catch since 1968. Spawning stock biomass increased from 89,000 to 204,000 t between 1974 and 1985, but declined to 125,000 t in 1992. Spawning biomass is estimated to have increased in 1993/1994 to about 146,000 t as a result of modest recruitment from the 1987 and 1988 year classes.

5. Yellowtail Flounder

USA landings in 1994 declined 14% from 3,621 t in 1993 to 3,098 t in 1994, a record-low. Research vessel survey indices suggest that the current size of the Georges Bank yellowtail stock is only 10% of those observed in the 1960s, while the abundance of the Southern New England stock is only 5% of that during the late 1960s. The Georges Bank stock remains in an overexploited state, with few age groups present in the population. The Southern New England stock is considered to have collapsed.

6. Other Flounders

USA commercial landings of flounders (other than yellowtail flounder) from Subareas 3 - 6 in 1994 totalled 16,893 t, 15% lower than in 1993. American plaice (30%), summer flounder (30%), winter flounder (21%), witch flounder (16%) and windowpane flounder (3%) accounted for virtually all of the 'other flounder' landings in 1994. Compared to 1993, commercial landings in 1994 were lower for American plaice (-13%), winter flounder (-31%) and windowpane flounder (-67%), but higher for witch flounder (+3%) and summer flounder (+12%). Research vessel biomass indices in 1994 remained at or near record-low levels for all stocks, except American plaice (which remained at an average level).

7. Silver Hake

USA landings of silver hake declined 7% from 17,187 t in 1993 to 16,039 t in 1994. Research survey biomass indices for the Gulf of Maine-Northern Georges Bank stock, which increased throughout the 1980s, substantially declined in 1993 and 1994 despite recent good recruitment. Survey indices for the Southern Georges Bank-Mid Atlantic stock have declined in recent years and are now near historically low levels. In both stocks, discards of juvenile fish have been relatively high.

8. Red Hake

USA landings of red hake increased 2% from 1,674 t in 1993 to 1,701 t in 1994. Landings continue to remain at or near record-low levels. Research vessel biomass indices for the Gulf of Maine-Northern Georges Bank stock have increased steadily since the early 1970s; stock biomass is currently well above the long-term average. Biomass indices for the Southern Georges Bank-Mid Atlantic stock, however, continue to remain depressed despite low fishing mortality.

9. Atlantic Herring

USA landings of Atlantic herring declined 9% from 49,487 t in 1993 to 45,246 t in 1994. 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 continuing evidence of stock recovery based on research vessel survey results and incidental commercial catches.

10. Atlantic Mackerel

USA commercial landings in 1994 totalled 8,918 t, a 91% increase over 1993 (4,667 t). Total stock biomass (Subareas 2-6) has been increasing since 1981 and is currently at record-high levels (> 2.5 million t). Rebuilding of the mackerel stock has occurred because of low fishing mortality rates coupled with outstanding recruitment from the 1982 year class and relatively strong recruitment from the 1984-1988 year classes.

11. Butterfish

USA landings declined 21% from 4,612 t in 1993 to 3,641 t in 1994. 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.

12. Squids

USA landings of long-finned squid, *Loligo pealei*, increased 1% from 22,273 t in 1993 to 22,577 t in 1994. Research survey abundance indices suggest that stock abundance increased in 1994.

USA landings of short-finned squid, *Illex illecebrosus*, increased 2% from 18,012 t in 1993 to 18,350 t in 1994, a record-high. Despite recent increases in landings, research survey indices suggest that stock abundance has remained relatively stable since 1991.

13. Sea Scallops

USA commercial landings in 1994 were 7,613 t (meats), 4% greater than in 1993 (7,352 t). Results from the 1994 sea scallop survey indicate that the abundance of exploitable-sized scallops in the USA Georges Bank region remains at near-record low levels, while in the Mid-Atlantic region, exploitable stock abundance has increased to near record-high levels. Recruitment of the 1990 and 1991 year classes was poor on Georges Bank, but very good throughout the Mid-Atlantic region.

B. Special Research Studies1. Environmental Studiesa) Hydrographic Studies

An atlas describing the 1993 oceanographic conditions on the Northeast Continental Shelf was completed and published (Northeast Fisheries Science Center Reference Document 94-11).

b) Plankton Studies

Plankton communities and their environments in the Gulf of Maine, Georges Bank, Southern New England, and Mid-Atlantic Bight regions of the Northeast Continental Shelf were monitored, assessed and indexed based on six ecosystem surveys and 36 ship-of-opportunity surveys conducted in 1994.

The TRACOR Acoustic Profiling System (TAPS) was successfully used aboard the *R/V Columbus Iselin* in a GLOBEC study of the stratification process on Georges Bank in May 1994. Data on the fine scale distribution of zooplankton were collected from 36 casts across Georges Bank. Eleven "yoyo" casts were also accomplished (during which the instrumentation was lowered repeatedly at a slow rate for up to an hour) to study the spatial dimensions of the patch structure of the plankton community.

A laboratory study was completed comparing the growth, in five different culture media, of five strains of *Tetraselmis* which have been shown to be superior in oyster diets.

c) Benthic Studies

Semiannual monitoring and data analysis continued in a study of the recovery of the inner New York Bight sewage sludge dumpsite, which closed in 1987.

Studies continued on monitoring the fate of very large sets of soft-shell clams (*Mya arenaria*) that occurred in 1993 and 1994 in the Hudson-Raritan estuary (New York/New Jersey), and in documenting associated environmental conditions.

Field work was completed on a long-term interagency study of a concrete artificial reef in Delaware Bay, built to mitigate habitat loss. Preliminary results indicate that the abundance of benthic communities were enhanced by the reef and that the reef provided increased food and shelter for several species of fish (e.g., tautog and black sea bass).

A report was published on brittlestar population structure and predation by fish in the Gulf of Maine.

d) Other Environmental Studies

GLOBEC Study: Fieldwork for the first U.S. GLOBEC Georges Bank Program was initiated in spring 1994 to evaluate methods and sampling protocols prior to the intensive 1995 field season. The Program's focus is on evaluating the seasonal evolution of water column stratification and its effect on the food chain dynamics of the target species, *Calanus finmarchicus*, *Pseudocalanus* sp., and cod and haddock larvae. During April-June 1994, a series of Bank-wide surveys was conducted on the hydrography of the Bank and on the spatial/temporal/bathymetric distribution and abundance patterns of the target species. Test moorings were deployed 3-6 May and recovered 28 June - 1 July. Sea surface temperature maps from AVHRR satellite data were available throughout the study, and three overflights were made between 30 May and 8 June to collect airborne LIDAR fluorescence measurements.

Site studies of the vertical distribution of larval and pelagic juvenile cod and haddock - and their predators - in relation to water column stratification were conducted on the southern flank of Georges Bank in May 1994 during two *R/V Albatross IV* cruises using MOCNESS. The first cruise, 2-13 May, concentrated on the vital rates of the invertebrate predators, while the second cruise, 17-28 May, focused on the larval fish.

During 2-28 May, field studies of predation by larger pelagic fish (*i.e.*, Atlantic mackerel and Atlantic herring) on cod and haddock larvae were conducted using the *R/V Delaware II*.

A broad-scale survey of the Bank's velocity field using an ADCP was conducted during 31 May - 10 June with the *R/V Albatross IV*. During this survey, zooplankton populations were also sampled at 48 stations using MOCNESS vertically stratified hauls.

Zooplankton distributions and vital rates were studied during 24 May - 5 June and 7-16 June using the *R/V Endeavor*. Comparisons were made between well-mixed and stratified sampling sites using ARGOS drifters, CAD, MOCNESS, a plankton pump, a Video Plankton Recorder (VCR), and high-frequency acoustics (TAPS).

Shipboard experiments were conducted on zooplankton feeding, growth and development, egg production, larval cod feeding and growth, and immunological studies to identify specific prey in gut contents. Zooplankton and larval fish were preserved by various methods for laboratory studies of population genetics, metabolic/biochemical indices of growth, otolith ageing, and stomach contents.

Analyses were completed of samples collected in a study of contaminants in the edible tissues of recreationally important fish species (*e.g.*, summer flounder, bluefish, black sea bass, and tautog) harvested in the New York Bight Apex. Analyses were also completed of samples collected in a study of different lobster populations.

Fieldwork commenced on a three-year cooperative study with Rutgers University to determine habitat-use patterns for juvenile fishes. The study will evaluate the distribution, abundance, and growth of recently-settled estuarine dependent fishes (*i.e.*, winter flounder and tautog) in Great Bay-Little Egg Harbor and the Hudson-Raritan estuaries in New Jersey and in Long Island Sound along the Connecticut coast. Related studies, also with Rutgers University and using similar approaches, to evaluate the effects of large platforms (piers) in the lower Hudson River are in their final year.

A study of Newark Bay, conducted under contract by the U.S. Army Corps of Engineers, continued. The focus of this investigation is to characterize the physical properties, finfish, and megainvertebrates within the Bay. Thirty trawl tows were completed during January - March 1994.

2. Biological Studies

a) Groundfish/Northern Shrimp

Biological samples were collected during January-April 1994 to determine seasonal changes in distribution, abundance, growth, and reproductive parameters of juvenile groundfish and northern

shrimp populations in the inshore region of the Gulf of Maine. Gonads from Atlantic cod were also collected for histological analysis of spawning condition.

b) Herring

Analysis of herring age and growth samples collected during the 1993 autumn larval herring survey were completed.

Preliminary analysis of the 1992/93 larval herring data produced results similar to those recorded during the previous two seasons (*i.e.*, between-year abundance estimates were similar in all three subareas). For the sixth consecutive year, the center of spawning activity occurred on Nantucket Shoals. Although abundance estimates for 1992/93 were similar to those for the 1991/92 spawning season, larval production estimates were markedly higher, increasing five-fold from 1991/92. This increase was due to extremely high catches of larvae at four stations in the Nantucket Shoals subarea where a total of 77,240 larvae were taken. At three of these stations (sampled in the November cruise), estimated abundance levels ranged from 40,000 to >110,000 larvae per 10 m² surface area. Numbers such as these rarely occur in ichthyoplankton samples and, as such, they disproportionately influence back calculations.

c) Age and Growth

Approximately 27,000 age determinations were completed for 14 species of finfish and shellfish in support of assessment studies. In addition, an exchange of winter flounder otoliths was conducted with Canadian scientists of the DFO Gulf Region in a continuing effort to maintain comparability of age determinations between the two countries.

Growth parameters for goosefish were determined in a cooperative study with the University of Massachusetts. Growth rate analyses of longhorn sculpin are underway in another cooperative study with the same institution. Age structure processing techniques have been determined and development of ageing methods is proceeding.

A second year of experimental field work (utilizing enclosures in a local estuary) was completed in a study to validate the age and growth of larval winter flounder marked with oxytetracycline. Similar work is now underway with juvenile flounder. Preliminary results from these studies were presented at a Flatfish Biology Workshop in December 1994.

Processing and ageing of larval cod otoliths in order to examine daily growth rates continues.

Analyses continued on scale samples from winter flounder collected during a 12 month biological sampling program. These analyses utilize an image analysis system to measure inter-annulus distances and marginal increments to assess seasonal growth patterns. Processing was completed of gonads from winter flounder in a study to evaluate fecundity.

A manuscript was submitted for publication on the use of otolith microstructure in determining spawning seasonality and first year growth of white hake, *Urophycis tenuis*, in the Gulf of Maine - Georges Bank region. Analyses of otolith microstructure indicated that the white hake spawn during the early spring in the Gulf of Maine. A strong check located near the nucleus of the otolith (which could potentially be misinterpreted as the first annulus), appeared to be formed at about 90 days.

A report describing juvenile white hake growth was completed, and a complementary age validation study of white hake was near completion.

d) Food Chain Studies

A total of 4,490 stomachs from 23 species of fish were processed at sea during the winter bottom trawl survey, and 3,758 stomachs from 24 species of fish were processed at-sea during the last two legs of the spring 1994 bottom survey.

Three special food habits cruises were conducted on Georges Bank focusing on the trophodynamic role of pelagic fish predators (particularly herring, mackerel, silver hake, and spiny dogfish).

Approximately 4,500 stomachs were examined from 20 predator species. Distributions of ichthyoplankton and zooplankton was also mapped to quantify prey availability. In addition, 900 stomachs were preserved in liquid nitrogen for subsequent testing with polyclonal antibody probes and DNA-based methods.

During a predation process cruise on Georges Bank in August 1994, 924 stomachs from 22 species of fish were processed at-sea, and 820 stomachs from 12 species were preserved for laboratory analysis. To identify prey in well-digested stomach contents, samples were also collected and stored in liquid nitrogen for biochemical analysis.

A total of 2,021 stomach samples were examined at-sea during the 1994 autumn bottom trawl survey.

Data from a study of the effects of mackerel predation on the composition of the zooplankton community were processed and statistical analyses initiated.

e) Marine Mammals

Harbor Porpoise

Revised estimates of by-catch were determined from analyses of harbor porpoise by-catch from 1990-1993 in the New England sink gillnet fishery. The methodology and results from this study have been submitted for publication.

A harbor porpoise acoustic alarm experiment was conducted during autumn 1994 to evaluate the efficacy of acoustic alarms in reducing incidental takes of harbor porpoise in the Gulf of Maine sink gillnet fishery.

Right Whale

A right whale workshop was held in Woods Hole during 3-7 October 1994 to peer-review NEFSC-funded research on right whales and provide guidance on future research directions.

The right whale database at the University of Rhode Island was updated through April 1993.

A report was completed on the northern right whale population in Cape Cod waters during 1979-1992.

f) Disease Studies

A study was completed assessing the utility of various computer programs in the classification of marine bacterial pathogens. Of 96 combinations evaluated, the association coefficient known as K_2 paired with the UPGMA clustering method gave the best result. The data base developed for this study, coupled with the "best" computer program, strengthens the ability to effectively classify new bacterial pathogens from the marine environment.

Data analyses and a manuscript were completed summarizing the findings of a two-year field study of shell disease in offshore lobster stocks residing in canyons near the 106-Mile Dumpsite.

A collaborative study was initiated with scientists from the Maryland Department of Natural Resources on the occurrence of possible natural resistance in oysters to the disease agent, *Perkinsus marinus*.

Studies continued to determine the causes of Juvenile Oyster Disease (JOD). Histological examination of seed oysters collected on 8 July 1994 from a hatchery in New York showed the most intense JOD syndrome in the current three years of study. Protists infections of the mantle were seen in 90% of the samples, excessive conchiolin deposition in 88%, and 39% of the oysters sampled died. Mortalities reached 70% in a sample collected only three weeks later on 29 July. A comparable sample collected at another hatchery on 7 June had 10% protist infections, 7% conchiolin, and zero mortality.

4. Miscellaneous Studies

a) Systematics Studies

A Gulf of Maine Systematics cruise was conducted with the *R/V Albatross IV* in May 1994. Participants included NMFS and Smithsonian scientists. The goals were to look for rare and unusual deepwater bottom and midwater fishes, to check the keys and descriptions in the manuscript revision of Bigelow and Schroeder against fresh specimens, and to collect cephalopods for DNA analysis. A total of 57 species of fishes and 6 species of cephalopods were collected. Two fish species collected were new records for the Gulf of Maine proper.