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United States Research Report for 1995

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 were developed to prorate total reported landings by species among areas. Since these procedures have not been fully developed and implemented, reported landings are not available by NAFO Division for either 1994 or 1995. In this report, therefore, total USA commercial landings are presented by species, and are considered provisional.

1. Atlantic Cod

USA commercial landings of Atlantic cod (*Gadus morhua*) declined 22% from 17,545 t in 1994 to 13,626 t in 1995. Total landings in 1995 were the lowest in 35 years (i.e., since 1960). Research vessel survey indices in 1995 indicate that the Gulf of Maine (Div. 5Y) and Georges Bank (Div. 5Z and Subarea 6) stocks increased slightly, but still remain at or near their lowest recorded levels (Figures 1 and 2).

2. <u>Haddock</u>

USA landings of haddock (*Melanogrammus aeglefinus*) increased 25% from 328 t in 1994 to 410 t in 1995, but still equalled the second lowest level on record. Research vessel survey indices in 1995 indicated that both the Gulf of Maine (Div. 5Y) and Georges Bank (Div. 5Z) stocks still remained near record-low levels. Spawning biomass of the Georges Bank stock increased in 1995 and is expected to increase slightly in 1996 due to improved recruitment from the 1992 year class. However, stock size levels still remain quite low compared to historic levels (Figures 3 and 4).

3. <u>Redfish</u>

USA landings of redfish (*Sebastes* spp.) remained constant at 440 t in 1994 and 1995. 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 (Figure 5).

4. Pollock (4VWX + 5 stock)

USA landings of pollock (*Pollachius virens*) declined 10% from 3,749 t in 1994 to 3,358 t in 1995, the lowest annual catch since 1968. Spawning stock biomass increased from 89,000 t 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. Research vessel indices suggest that pollock biomass in Subarea 5 has declined to a record low (Figure 6).

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5. <u>Yellowtail Flounder</u>

USA landings of yellowtail flounder (*Pleuronectes ferrugineus*) declined 38% from 3,098 t in 1994 to a record low of 1,916 t in 1995. Research vessel survey indices suggest that the current size of the Georges Bank stock is only 10% of that observed in the 1960s, while the abundance of the Southern New England stock is only 5% of that during the late 1960s (Figures 7 and 8). The Georges Bank stock remains in an overexploited state, with few age groups present in the population, while the Southern New England stock is considered to have collapsed.

6. <u>Other Flounders</u>

USA commercial landings of flounders (other than yellowtail flounder) from Subareas 3-6 in 1995 totalled 16,103 t, 5% lower than in 1994. American plaice (*Hippoglossoides platessoides*) (29%), summer flounder (*Paralichthys dentatus*) (29%), winter flounder (*Pseudopleuronectes americanus*) (24%), witch flounder (*Glyptocephalus cynoglossus*) (14%), and windowpane flounder (*Scophthalmus aquosus*) (5%) accounted for virtually all of the 'other flounder' landings in 1995. Compared to 1994, commercial landings in 1995 were lower for American plaice (-8%), summer flounder (-7%) and witch flounder (-17%), but higher for winter flounder (+7%) and windowpane flounder (+5%). Research vessel biomass indices in 1995 increased for winter flounder and remained constant for American plaice. Biomass indices remained at or near record-low levels for witch flounder, summer flounder and windowpane flounder (Figures 9-13).

7. <u>Silver Hake</u>

USA landings of silver hake (*Merluccius bilinearis*) declined 22% from 16,038 t in 1994 to 12,465 t in 1995. Research survey biomass indices for the Gulf of Maine - Northern Georges Bank stock, which increased throughout the 1980s, have been quite variable since 1990. Survey indices for the Southern Georges Bank - Mid-Atlantic stock have declined in recent years and are now near historically low levels (Figures 14 and 15). In both stocks, discards of juvenile fish have been relatively high.

8. Red Hake

USA landings of red hake (*Urophycis chuss*) decreased 33% from 1,701 t in 1994 to 1,135 t in 1995. 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 (Figures 16 and 17).

9. <u>Atlantic Herring</u>

USA landings of Atlantic herring (*Clupea harengus*) increased 38% from 49,928 t in 1994 to 68,771 t in 1995. 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 (Figure 18) and larval survey results and incidental commercial catches.

10. <u>Atlantic Mackerel</u>

USA commercial landings of Atlantic mackerel (*Scomber scombrus*) declined slightly from 8,918 t in 1994 to 8,391 t in 1995. Recreational landings increased from 1,140 t in 1994 to 1,288 t in 1995. The stock

(Subareas 2-6) is currently underexploited and total biomass remains at record-high levels in excess of 2 million t. Stock rebuilding since 1981, documented by research survey indices (Figure 19), has resulted from very low fishing mortality rates and the recruitment of several very good year classes (1982, 1987, 1988, 1991, and possibly 1993 cohorts).

11. <u>Butterfish</u>

USA landings of butterfish (*Peprilus triacanthus*) declined 50% from 3,632 t in 1994 to 1,826 t in 1995. 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. <u>Squids</u>

USA landings of long-finned squid (*Loligo pealei*) decreased 22% from 24,887 t in 1994 to 19,382 t in 1995. Minimum biomass estimates suggest that the offshore population size has increased in recent years relative to the inshore population.

USA landings of short-finned squid (*Illex illecebrosus*) decreased 23% from a record-high 20,227 t in 1994 to 15,490 t in 1995. Stock biomass estimates have remained relatively stable since 1991.

13. <u>Sea Scallops</u>

USA commercial landings of sea scallops (*Placopecten magellanicus*) in 1995 were 7,835 t (meats), 3% greater than in 1994 (7,613 t). Results from the 1995 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 peaked and is now declining from 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. Subsequent recruitment has been comparatively poor in all regions.

B. Special Research Studies

1. Environmental Studies

a) <u>Hydrographic Studies</u>

A report describing surface and bottom temperatures and surface salinities in the Middle Atlantic Bight and Gulf of Maine in 1995 was submitted as NAFO SCS Doc. 96/11.

b) <u>Benthic Studies</u>

Semi-annual monitoring and data analysis continued in a study of the recovery of the inner New York Bight sewage sludge dumpsite, which closed in 1987. A technical report was published on findings of the first three years of the dumpsite recovery study (1986-89), and a paper was prepared on longer-term trends in sediment metals, biogeochemistry, spores of *Clostridium perfringens* (a microbial indicator of sewage contamination) and benthic macrofauna.

Studies continued to track the fate of large sets of softshell clams (*Mya arenaria*) that occurred in 1993 and 1994 in the Hudson-Raritan estuary (New York/New Jersey) and to document associated environmental conditions until the clams attain market size. Clam mortalities were the result of fish and waterfowl predation, "tip-over" (clams leaving the sediment), smothering under sea lettuce (*Ulva lactuca*), heavy wave action, and possibly high temperatures.

Data analysis continued in a study of diets of dominant demersal finfish of the Sheepscot Estuary, Maine.

c) <u>Aquaculture</u>

Participation in a USA-China Marine Resources Project produced enzyme electrophoresis data on genetic differences among populations of bay scallops (*Argopecten irradians*), ranging from Canada to Florida. Some populations were found to be more genetically diverse than others. The results may have important implications in selecting broodstock for any future scallop enhancement efforts.

The Milford Laboratory recently re-established its presence in aquaculture research. At present, projects on the bay scallop and tautog (*Tautoga onitis*) are in place using disciplines of culture methodologies, nutrition, genetics, disease, and habitat evaluation.

d) <u>Other Environmental Studies</u>

A second year of field work was completed as part of a three-year cooperative study with Rutgers University to determine habitat-use patterns for juvenile fishes in three estuaries, Great Bay-Little Egg Harbor and the Hudson-Raritan systems in New Jersey and Long Island Sound in New York. In addition to measurements of somatic growth, fish tissues were analyzed for RNA/protein ratios. Stable isotope analyses of sediment, vegetation, and tissues were made to investigate trophic linkages.

Field surveys in the Arthur Kill area of the Hudson-Baritan estuary were undertaken in continuing cooperative studies with Rutgers University to evaluate the function of various structures (i.e., piers, pile fields, wrecks) as habitat for juvenile fishes.

A year-long laboratory study was begun to measure feeding rates, predator-prey interactions, growth, and activity of juvenile bluefish (*Pomatomus saltatrix*) held under simulated daily and seasonal changes in light and temperature.

A total of 2,267 American plaice were collected from the Gulf of Maine and 623 previously collected fish were radiographed for the presence of skeletal anomalies. These fish will be used as a baseline to assess potential future effects from the Massachusetts Bay sewage-outfall pipeline which is under construction.

A sediment-dosing system has been developed and tested for measuring the effects of suspended dredge material, including re-suspended toxicants, on embryos and larvae of winter flounder. Detrimental effects have been measured on embryos exposed to polluted urban-harbor sediments.

2. Biological Studies

a) <u>Age and Growth</u>

Approximately 42,700 age determinations were completed for 15 species of finfish and shellfish in support of assessment studies.

Atlantic cod and haddock otoliths and scales were exchanged with Canadian age readers in a continuing effort to maintain comparability of age determinations between the two countries.

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

An analysis of juvenile winter flounder otoliths collected from fish held in experimental enclosures from three sites along the northeastern United States was undertaken to analyze differences in growth rates between the areas.

A review of the fishery and biology of silver hake inhabiting the northwestern Atlantic was published in "Hake: Fisheries, ecology and markets".

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A report describing the age and growth of larval Atlantic herring collected from the Nantucket Shoals - Georges Bank region during 1976-77 compared with samples from the 1988-94 growing seasons by enumerating daily growth increments of sagittal otoliths and general model of larval growth was completed and submitted for publication.

b) Food Chain Studies

Studies of trophic dynamics based on an integrated program of long-term monitoring and process-oriented predation studies were continued in 1995. Examination of food habits of selected species has been carried out in several phases since 1963 in conjunction with standardized research vessel surveys. A recent series of process-oriented studies has been in progress since 1994 with funding from the NOAA Coastal Ocean Program (NCOP). Summaries for both series are provided below.

Routine monitoring

Food habits samples were collected during NEFSC survey activities conducted during the winter, spring, and fall on the Northeastern and Mid-Atlantic continental shelf. Volumetric estimates of prey composition were made at sea for selected predators. During winter, 5,588 stomachs of 25 species were examined with special emphasis on elasmobranchs (dogfish and skates) and several species of piscivorous teleosts including three flounder species and two gadid species. A total of 7,875 stomach samples of 26 species was collected during NEFSC spring survey activities; spiny dogfish samples comprised nearly 25% of these samples. Other elasmobranchs and gadids again dominated the remaining samples. During the fall survey, diet composition of 8,085 fish comprising 38 species was determined. Again, elasmobranchs and piscivorous gadids dominated the samples collected.

NCOP Georges Bank predation study

Process-oriented predation studies were conducted during spring and summer on Georges Bank to quantify the role of predation in fish community dynamics. This work was designed to complement predation-process studies conducted under the U.S. GLOBEC Northwest Atlantic/Georges Bank Program with emphasis on the role of invertebrate predators.

Stomach samples were collected during four predation process cruises conducted aboard a chartered commercial fishing vessel (F/V Katahdin). The process-oriented cruises were preceded by a preliminary cruise (KT 9501) in which hydroacoustic and midwater trawl gear was tested. The process-oriented cruises focused on predation on the early life stages of cod and haddock. Stomachs of 4,762 specimens of over 25 species of fish and souid were examined at sea or preserved for laboratory analysis on cruises KT 9502 (Parts I and II) and KT 9504 on Georges Bank with an emphasis on pelagic piscivores (including Atlantic mackerel and herring). The distributions of ichthyoplankton and zooplankton were simultaneously mapped during plankton surveys to quantify prey availability. In addition, samples were taken from 1,283 stomachs and frozen in liquid nitrogen for later testing with DNA and polyclonal antibody probes. Tissue specimen samples of prey groups were obtained for cross-reactivity testing with DNA and polyclonal antibody probes. The cruises were coordinated with GLOBEC research on the role of invertebrate predators on target prey species. An additional predation-process cruise was completed in late July (KT 9505) with a focus on demersal predators (including elasmobranchs, gadids, and piscivorous flatfishes); a total of 3,277 stomachs were examined at sea or preserved for laboratory. analysis. A total of 164 samples were frozen in liquid nitrogen for analysis using DNA and polyclonal antibody probes.

During the 1995 field season, use of hydroacoustic techniques was initiated for assessing the biomass of pelagic fish using a Simrad EK500 echosounder. Hydroacoustic transects were carried out with a towed body transducer at a frequency of 38 kH (with ancillary observations at 120 kH). Echointegration was carried out using Simrad BI500 software.

The use of midwater trawls was also initiated for assessing herring and mackerel abundance and for stomach sample collection using a Schuman pelagic trawl. This trawl permitted enhanced sampling for herring and mackerel relative to the bottom trawls used during the 1994 field season. Use of the bottom trawl was continued for late summer cruises when attention shifted to a suite of demersal predatory fish following the settlement of cod and haddock.

c) <u>Marine Mammals</u>

Harbor porpoise

NEFSC conducted a springtime distribution survey of harbor porpoise (*Phocoena*) along the Mid-Atlantic coast in March 1995. A shipboard sighting survey was conducted during July/August 1995 in the Gulf of Maine/Bay of Fundy area. Aerial surveys were also conducted during August/ September 1995. Data were collected to estimate abundance and distribution and to investigate fall distribution patterns of harbor porpoise. Studies were done to evaluate various long-term monitoring schemes and to compare shipboard and aerial platforms when used in line-transect surveys for harbor porpoise.

A computerized data entry package called "PINGLE" was developed during the above March cruise and used as the primary data entry method during the above summer cruises.

Field testing of satellite tags on harbor porpoise was conducted during the summer of 1995 on Grand Manan Island in Canada. Six harbor porpoise were tagged with ARGOS transmitters re-designed for a lower profile. Data were collected on movement and diving patterns as these animals undertook their annual migration. Daily positions for one harbor porpoise continued for 212 days.

Right whales

The New England Aquarium, Boston, MA continues to maintain the North Atlantic right whale (Eubalaena glacialis) photographic-identification catalog.

The University of Rhode Island continues to maintain the computer database for right whales in waters of the Western North Atlantic which has been updated through 1995.

Collection of skin samples from 66% of the North Atlantic right whale population was completed in June 1995. Analyses of DNA from 33% of the population were also completed in June 1995.

Based on work from the 1992 and 1993 wintering seasons, a Southeastern U.S. Implementation Team for the Recovery of the Northern Right Whales is now in effect. Funding was also provided for mathematical modeling of ship hulls, with respect to evaluating the potential for collisions with right whales on their calving and wintering grounds in the coastal waters of the southeastern United States.

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Figure 4. NEFSC autumn bottom trawl survey biomass indices for Gulf of Maine haddock.





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Figure 16. NEFSC autumn bottom trawl survey biomass indices for northern red hake.



Figure 12. NEFSC autumn bottom trawl survey biomass indices for Georges Bank winter flounder.

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

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