

Northwest Atlantic



Fisheries Organization

Serial No. N1304

NAFO SCS Doc. 87/12

SCIENTIFIC COUNCIL MEETING - JUNE 1987

United States Research Report for 1986

by

R. O. Maurer, M. D. Grosslein and F. M. Serchuk

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

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

Brief summaries are provided on the status of fisheries for major species of finfish and shellfish. More detailed information on these and other species is included in a report entitled, "Status of the Fishery Resources off the Northeastern United States" which is prepared annually by the Northeast Fisheries Center of the NMFS.

1. Atlantic Cod

USA commercial landings from Subarea 3-6 declined 27% from 37,651 mt in 1985 to 27,402 mt in 1986. Compared to 1985, landings in Subarea 3 increased 415% (433 mt vs 84mt), landings in Subarea 4 increased 91% (90 mt vs 47 mt), landings in Subarea 5 declined 28% (26,683 mt vs 37,250 mt), and Subarea 6 landings declined 24% (196 mt vs 270 mt).

Landings in 1986 from the Georges Bank fishery (Div. 5Z + SA 6) totaled 17,275 mt, the lowest since 1976, and 36% lower than in 1985 (26,828 mt). Nominal fishing effort in 1986 declined 23% from the record-high levels attained in 1984 and 1985. Commercial CPUE in 1986 was the lowest in the 1964-1986 time series. USA research vessel indices show that the stock abundance has declined to record-low levels; the autumn 1986 Georges Bank survey number-per-tow value (age 2+) was the lowest ever observed. Age composition data indicate that landings in 1986 were dominated by the 1983 year class. This year class, as well as fish from the strong 1985 cohort observed in the research vessel surveys, are expected to be dominant in the 1987 fishery.

Gulf of Maine (Div. 5Y) landings in 1986 were 10,313 mt, 15% less than in 1985, and the lowest annual catch since 1976. Otter trawl effort, which accounted for 69% of the 1986 landings, attained record-high levels while USA commercial CPUE declined to an all-time low. USA 1986 landings were dominated by the 1982 and 1983 year classes. Research vessel indices from both spring and autumn 1986 surveys were among the lowest recorded. The 1985 year class, which will recruit to the commercial fishery as "scrod" in 1987, appears to be average in strength.

2. Haddock

USA landings from Subareas 4-6 declined to 4,953 mt, a 24% decrease from 1985. Landings from Georges Bank declined from 4,272 mt in 1985 to 3,324 mt in 1986, a drop of 22%. Poor recruitment since 1979 and high

fishing mortality have kept this stock at low levels of abundance. Autumn 1986 USA research indices for age 0 fish were equal to the lowest values observed in the 24 year series. Landings from the Gulf of Maine dropped from 2,232 mt in 1985 to 1,590 mt in 1986, a 29% decrease. This stock has continued to decline since 1979.

3. Redfish

Subarea 3

Landings of redfish by USA vessels from the "Tail of the Bank" (Divisions 3N and 30) declined sharply from 189 tons in 1985 to 6 tons in 1986.

Subarea 4

Landings of redfish by USA vessels from Division 4X increased from 31 tons in 1985 to 62 tons in 1986. Landings were dominated by 30-42 cm fish, although the appearance of smaller fish between 22 and 26 cm suggest recruitment of the 1978 year class.

Subarea 5

Landings of redfish by USA vessels from Subarea 5 declined from 4,163 tons in 1985 to 2,914 tons in 1986, marking the seventh consecutive year of decline. Redfish are now taken primarily as by-catch incidental to other species in the Gulf of Maine groundfish fishery. The commercial CPUE index continued to decline, although autumn bottom trawl survey abundance indices increased slightly in 1986. Commercial length and age sample data suggest that the 1978 year class, which began to recruit to the fishery in substantial numbers in 1983, accounted for over 50% of the total number landed in 1986.

4. Pollock

Subarea 4

USA commercial landings of pollock from Division 4X increased from 152 tons in 1985 to 234 tons in 1986.

Subarea 5

USA commercial landings from Subarea 5 increased from 19,186 tons in 1985 to 24,112 tons in 1986, surpassing all previous record high levels. Commercial CPUE indices, however, declined in both 1985 and 1986. Recent NEFC bottom trawl survey indices also remain below levels evident during the mid-to-late 1970's. Age composition data indicate that landings are still dominated by the 1979 year class, although fish from the 1982 year class have begun to recruit to the fishery.

5. Yellowtail Flounder

Subarea 3

USA landings from Divisions 3N and 30 decreased from 3,797 tons in 1985 to 2,562 tons in 1986 although the fishery did not commence until April, 1985. Yellowtail flounder was the dominant species landed by USA vessels fishing the "Tail of the Bank" in 1985 and 1986, representing 66% and 47% of the total demersal finfish catch from this area, respectively.

Subarea 5

USA landings increased from 6,841 tons in 1985 to 7,505 tons in 1986. A general increase in abundance and biomass occurred during the early 1980's due to improved recruitment of the 1979-1981 year classes. The 1982 and 1983 year classes were poor in contrast, but the 1984 year class appears to be slightly better. Since 1982, bottom trawl survey indices have steadily declined although the 1986 index increased slightly, particularly in the Southern New England area.

Subarea 6

USA landing decreased by 50% from 500 tons in 1985 to 248 tons in 1986.

6. Other flounders

USA landings of flounders (other than yellow-tail) from Subarea 3 increased from about 1,620 mt in 1985 to 2,170 mt in 1986. Landings from Subarea 4 increased somewhat to 150 mt in 1986 from 110 mt in 1985, but below the 290 mt landed in 1984. Landings from Subarea 5 declined nearly 25%, from 31,080 mt in 1985 to 23,630 mt in 1986. Landings from Subarea 6 declined 28% from 8,140 mt in 1985 to 5,840 mt in 1986.

Winter flounder (24% of total), summer flounder (29%), American plaice (19%), witch flounder (16%) and windowpane flounder (10%) comprised 99% of the other flounder landings. Winter flounder landings decreased 22% from 1985 to 1986, summer flounder landings declined only 1%, American plaice dropped 27%, and witch flounder landings decreased 19%. Windowpane flounder landings declined 22%. Survey indices for most of these flounder species indicate declines or likely declines as a result of near-record high effort levels.

7. Silver Hake

USA commercial landings from Subarea 5 in 1986 were 13,908 mt, a 1% increase from 1985, but continuing the low level of landings reported since 1980 and well below levels reported in the 1970's. While recruitment in 1983 and 1984 was only average in comparison to other years, the 1985 year-class appears to be quite strong. Fishing effort in Subarea 5 has remained at a reduced level and, as a result, it is unlikely that stock biomass will undergo any major decline in 1986 if landings remain at or slightly above current levels.

In Subarea 6, USA landings were 3859 mt in 1986, a 40% decrease from 1985, and much less than the 1970-1982 average. While recruitment in the last several years has been of only average strength, decreased fishing effort from distant water fleets has helped to steadily increase stock biomass from very low levels in the mid-1970's.

8. Red Hake

USA commercial landings from Subarea 5 were 1,800 mt in 1986, a 31% increase from 1985, continuing the increase begun in 1985, still well below levels reported in past years. Recruitment in the past several years has been of only average strength, but decreased fishing effort has resulted in an increase in stock biomass from low levels observed in the mid-1970's. Biomass should continue to steadily increase if landings remain at or slightly above their current level.

In Subarea 6, 1986 USA landings were only 297 mt, a 33% decrease from 1985. Landings since 1980 have been quite low due to decreased fishing effort as well as reduced stock abundance. Recruitment in recent years has been only average, but like Subarea 5, reduced effort has helped to slowly increase stock biomass from very low levels reached in the late 1970's.

9. Atlantic Herring

USA landings from Subarea 5 were 31,925 mt. Landings in the coastal Maine fixed gear fisheries (stop seines and weirs) were 2,026 mt, a 57% decrease relative to 1985 levels. Purse seine landings by Maine vessels in 1986 were 17,697 mt, a 78% increase relative to 1985. Landings in the fixed gear fisheries remain at historically low levels. The fixed gear fishery is highly dependent on recruitment; no strong year classes have recruited to the fishery since 1979. Landings from Division 5Z were 586 mt. in 1986, primarily from Subdivision 5Zw. There has been no directed herring fishery in Subdivision 5Ze since the collapse of the fishery in 1977. There is recent evidence of recovery of the Georges Bank population based on research vessel survey results. Herring landings in Subarea 6 in 1986 were 70 mt.

10. Atlantic Mackerel

USA commercial landings from Subareas 5 and 6 increased about 55% from 6,632 mt in 1985 to 10,264 mt in 1986. Landings continued to increase and were the highest since 1952. Total stock biomass (Subareas 2-6) was estimated to be about 1.5 million mt at the beginning of 1987. The 1981, 1982 and 1984 year-classes are all strong. The 1985 year-class may also be a strong one and will enter the fishery in 1987.

11. Butterfish

USA landings declined slightly from 4,626 mt in 1985 to 4,568 mt in 1986. About 80% of the 1986 total was from Subarea 5. The decline is attributed to decreased availability of marketable size butterfish on the traditional southern New England fishing grounds. Recruitment (Age 0 fish) to the butterfish stock declined in 1986, but the stock is near historic high levels.

12. Squid

USA landings of long-finned squid (Loligo pealei) from Subareas 5 and 6 increased from 10,155 mt in 1985 to 13,292 mt in 1986, 7531 mt from Subarea 5 and 5,748 mt from Subarea 6. Increases occurred in the shoreside fisheries, primarily in Subarea 5, while joint venture landings increased significantly. Landings during 1986 were again much greater than in any year prior to 1983. Catch-per-tow indices from the NEFC 1986 autumn research vessel trawl survey indicated that abundance in 1986 may be greater than the 1968-85 average level. USA landings of short-finned squid (Illex illecebrosus) from Subareas 5 and 6 increased slightly, from 4,997 mt in 1985 to 5,176 mt in 1986. Shoreside landings increased from the 1985 level, while joint venture landings declined by about 5%. Virtually all the 1986 landings were taken from Subarea 6. Catch-per-tow indices from the 1986 autumn survey were about 60% greater than that for 1985 but 18% below the recent (1982-85) period of low abundance, and 74% below the 1968-85 mean.

13. Sea Scallops

USA commercial landings from Subareas 5-6 in 1986 were 8,190 mt (meats), 21% greater than in 1985 (6,742) mt. The 1986 catch was the highest since 1983 and marked the first increase in annual landings since 1978. Georges Bank (Div. 5Z) landings [4,832 mt] increased 59% from 1985, while Gulf of Maine (Div. 5Y) landings [316 mt] declined by 25%. Mid-Atlantic (Subarea 6) landings in 1986 totaled 3,358 mt, 2% more than in 1985.

USA commercial CPUE indices in the Georges Bank and Mid-Atlantic fisheries increased for the first time since 1980 and 1983, respectively. CPUE values for the Gulf of Maine fishery, however, declined to new lows. Total USA scallop effort in 1986 remained at the record-high 1984/1985 levels although effort was shifted from the Mid-Atlantic (-28% from 1985) to the Georges Bank fishery (+24% from 1985).

Catch-per-tow values from the USA 1986 sea scallop research vessel survey indicate that the marked improvement in sea scallop abundance that was initially noted in 1985 has continued. Resource recovery from the record-low 1983/1984 conditions has rapidly occurred due to outstanding recruitment of the 1982 and 1983 year classes on both Georges Bank and in the Mid-Atlantic. Survey abundance indices in 1986 in both regions were among the highest ever recorded.

B. Special Research Studies (Subareas 4-6 inclusive)

1. Environmental Studies

a) Hydrography. Compiled annual reports summarizing environmental conditions in the Northwest Atlantic on the position and variability of the shelf/slope front, movements and paths of Gulf Stream warm core rings, and on bottom temperatures on the continental shelf and upper slope across the New York Bight.

Physical oceanographic measurements were made on four surveys of the continental shelf from Cape Hatteras to western Nova Scotia in January/February, April/May, May/June, August/September, and November/December.

Analysis of physical oceanographic data from the Gulf of Maine was completed and work was begun on a report describing variations in seasonal circulation.

A manuscript is in preparation describing the entrainment of water from the continental shelf by warm core rings using a combination of hydrographic data, current measurements and remotely-sensed surface temperature patterns.

The remaining arrays of current meter moorings from western Georges Bank and Great South Channel were recovered and analysis of the data began.

A current meter array was deployed in the upper Hudson Shelf Valley (about 15 Km off New Jersey) and recovered four months later as a system test before deploying 7 arrays in the area in May 1987.

b) Plankton Studies. During 1986 zooplankton was sampled on 9 surveys of the northeast continental shelf from Cape Hatteras, NC, to the Gulf of Maine, and 1 survey of the continental shelf between the Gulf of Maine and Florida. A total of 1297 stations were occupied with the MARMAP Bongo Net (.333 mm mesh) and the MARMAP Neuston Net (.505 mm mesh). Small mesh (.165 and .257 mm) Bongo

Nets were also deployed at alternate stations along six cross-shelf transects.

In addition monthly phyto- and zooplankton monitoring was done with the Hardy Continuous Plankton Recorder (.225x.234 mm mesh) along a transect between Boston, MA and Cape Sable, NS, and a transect from New York, NY towards Bermuda to the Gulf Stream, resulting in 498 samples.

- c) Benthic Studies. The last scheduled sampling of sediments and benthos at 25 stations on the Northeast Shelf was completed (the sampling began in 1978). Monthly benthic sampling was part of a multidisciplinary study of the responses of a sewage sludge-affected area to phaseout of sludge dumping.

Studies were begun to 1) develop "spawner sanctuaries" for hard clams, Mercenaria mercenaria, in Barnegat Bay, NJ, in an effort to reverse declines in clam populations, and 2) to inspect oyster beds of Delaware Bay and determine ways to rehabilitate them (e.g., silt removal).

Manuscripts were completed on: 1) former and present distribution of soft clams and eelgrass in Raritan Bay; 2) research and management strategies for increasing shellfish supplies; 3) effects of sulfide and low oxygen on settling of larvae benthic invertebrates; and 4) energy contents of various depth-related groups of fish and invertebrate species beyond the Northeast shelf.

- d. Environmental Quality. A comprehensive study was initiated in July to document changes in living marine resources and their habitats during and following the period in which sewage sludge dumping is phased out at an ocean site twelve miles offshore of the New York metropolitan area. Biological, chemical, and physical oceanographic measures have been integrated to provide a comprehensive and statistically valid approach to assessing these changes. Scientific trawling and benthic sampling are part of these protocols.

Results from the first six months of the 12-mile dump site study have shown that little skate, winter flounder and silver hake were the most numerous demersal finfish; butterfish the most abundant semipelagics in the trawl catches. Rock crab, American lobster and longfin squid were the most abundant macroinvertebrates. Seasonal changes in availability were evident. From the 165 trawl collections made from July through December, 1500, winter flounder, red and silver hake and lobster stomach contents were analyzed. Lobster stomachs contained a 60% incidence of human artifacts, i.e. "hairballs" and cloth fibers. Some 400 winter flounder were tagged and released to initiate a study for determining relationships of dumpsite fish with nearby estuarine populations.

Manuscripts were complete on: 1) Sublethal effects of oiled sediment on the burrowing and feeding of bloodworms, and 2) Size-related changes in avoidance of low dissolved oxygen by red hake.

Long Island studies have shown significant variation in winter flounder reproductive efficiency. These results are based on a sampling of eggs, embryos, and yolk-sac larvae collected during the 1986 spawning season at six sites in the Sound subject to various kinds and amounts of pollution. (Hempstead and Shoreham in New York, and Hammonasset, Milford, New Haven (Morris Cove), and Norwalk in Connecticut). Using the criteria of fertilization success, prehatch mortality, larval malfunction, and size at hatch, the Shoreham embryos and larvae had a five-fold greater survival rate than those from Morris Cove.

Studies on the effects of heavy-metal contaminants on sea scallop physiology yielded information on how two metals--cadmium and copper--interact (i.e. synergize) to change their separate toxicities. Earlier studies had shown that cadmium is normally detoxified by the scallop kidney. When even a small amount of copper is present though, the copper displaces the cadmium from the binding protein, releasing the cadmium to interfere with the scallop's ability to control other heavy metals such as zinc and manganese.

These findings indicate that pollutant-effect studies that look at one heavy metal at a time, and do not consider the synergistic effects of multiple contaminants (i.e., what is usually found in degraded habitats), can consistently underestimate the physiological harm to marine organisms.

A Long Island Sound hard clam recruitment study was initiated in 1986 to investigate the factors that influence population dynamics of this important species. The approach was to monitor biologically significant life-history stages of hard clams around the perimeter of Long Island Sound. Growth, survival, and settlement were measured by maintaining juvenile clams in predator-free cages and deploying sediment-filled trays to collect first-year clams. Water quality data were collected, as well as animal, sediment, and tissue samples for physiological, chemical, biochemical, and microbiological analyses. Additionally, focused experiments were performed at one station to study specific recruitment processes, such as the effect of population density on predation intensity. Initial results indicate statistically different growth rates of clams from different stations and that settlement of first-year clams occurred at all stations. No evidence of lasting physiological stress was detected in clams at any of the sites. Focused experiments produced data that will help model factors and interactions that determine recruitment success.

Controlled feeding experiments with the hard clam, Mercenaria mercenaria, revealed considerable differences in nutritional value between algal species. The most accelerated growth responses were obtained with Isochrysis sp. (Tahiti strain), I. galbana or Tetraselmis maculata as foods.

Samples from stations in Long Island Sound were studied with light and epifluorescence microscopy; differences in relative abundance of various algal taxonomic groups were both seasonal and geographical. Centric diatoms dominated the algal assemblages at western stations during the cold water months of March and November, whereas pennate diatoms were most common at eastern stations during these months. In contrast, in June and August, chlorophytes, cryptophytes, and dinoflagellates constituted relatively larger portions of the phytoplankton, especially in central to western stations.

An evaluation of a rapid, miniaturized, biochemical test system for identification of marine bacteria was completed. Results showed that the miniaturized test system was often better than the conventional tube test system in identifying potential pathogens of marine bivalves.

2. Fish Biology Studies

- a) Age and Growth. Approximately 46,000 age determinations were completed for 17 species of finfish and shellfish. Early life history studies for winter flounder were

continued with particular reference to otolith development and growth as evidenced by daily growth increments. Research on investigation of growth differences for yellowtail flounder from four areas was completed. A population biology study of witch flounder was completed which included validation of an ageing methodology, growth, mortality, maturation, fecundity, length-weight relationships, and distribution. Preparation of a technical manual describing age determination methods in use at the Fishery Biology Investigation, NEFC, Woods Hole, MA, was continued.

- b) Stock Identification. The final report was completed on an automatic optical Fourier transform analysis comparing haddock scale images from two geographic areas.
- c) Research Vessel Surveys. The NEFC conducted routine spring and autumn bottom trawl surveys from Cape Lookout, North Carolina to Nova Scotia during March-April and September-November, respectively, a clam dredge survey during June and July, and a sea scallop dredge survey during July and August. A research fishery for mackerel was conducted during Jan-May from Cape Hatteras to Georges Bank in cooperation with Poland using two factory trawlers (ADMIRAL ACRCISZEWSKI and LUTJAN). A trawl survey for northern shrimp was conducted in August in the western Gulf of Maine in cooperation with the states of Maine, New Hampshire and Massachusetts.

In 1986, juvenile gadoid studies (0-group) were conducted on Georges Bank in June, July, and August to determine their distribution, abundance, and ecology during their transition from the pelagic to demersal habitats. Cod juveniles only were found on eastern Georges Bank, and by mid July, they were localized on the northeastern part. Very few haddock juveniles were observed this year. In June, the Canadian research vessel Lady Hammond coordinated pelagic gear comparison studies with the NEFC'S R/V Albatross IV. In August, the NEFC'S R/V DELAWARE II conducted studies with the Johnson-Sea-Link submersible on northeastern Georges Bank. Submersible observations of juvenile cod (4-8 cm SL) revealed them to be randomly distributed very near the bottom (<30 cm) by day, essentially maintaining their position relative to the bottom in the strong tidal current (0.5-1.0 knots) by swimming into the current. After sunset, they were observed to make feeding forays off the bottom up to 5m in the water column. Stomach analyses showed them to be feeding primarily on euphasiids. At times on the submersible transects, juvenile cod densities reached 5-15/100m², several orders of magnitude higher than the apparent density sampled by the research bottom trawl.

- d) Food Habits Studies. Gut contents of about 17,000 fish were examined at sea in 1986; most of these data were collected on the spring and fall groundfish surveys, and the juvenile gadoid studies on George Bank from May-August. About half of the total sample came from Georges Bank, and the most heavily sampled species were fish predators including spiny dogfish, silver hake and cod. Sand lance was again the most common fish prey observed in the diet of larger fish. Frequency of occurrence of sand lance in stomachs ranged from 10-15% during spring and summer, but dropped to less than 5% in autumn. Despite the increase in mackerel abundance the frequency of occurrence of mackerel was less than 0.1% overall, and was noticeable only in the diet of dogfish and silver hake.

- 3. Gear and Selectivity Studies. A study to determine the fishing power of the R/V DELAWARE II relative to that of the R/V ALBATROSS IV is continuing. As part of this study, paired tows were made on the eastern portion of Georges Bank during February 18-27, 1986.

A study to evaluate the effects of the use of different trawl doors on the performance and catch rates of NEFC standardized survey bottom trawls is continuing. As part of this study, experiments were conducted using the R/V Delaware II during August 12-21 and October 15-23 and using the Albatross IV during Dec 1-17.

A project was begun to evaluate the selectivity of a rigid cage scallop dredge. Preliminary tests compared a rigid cage made of square wire mesh with a typical commercial dredge constructed of 3 inch rings. Comparisons have also been made of different size square mesh on the rigid cage. This study is continuing in 1987.