Northwest Atlantic Fisheries Organization

Serial No. N1123

NAFO SCS Doc. 86/9

SCIENTIFIC COUNCIL MEETING - JUNE 1986

United States Research Report for 1985

by

R. O. Maurer, S. Murawski and F. M. Serchuk

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

A. Status of the Fisheries (Subareas 4-6 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. Haddock

USA landings from Subareas 4-6 were about 6,528 mt in 1985, a decrease of 44% from 1984. Landings from Georges Bank declined about 51% from 1984 to 4,272 mt in 1985. Poor recruitment since 1979 and high fishing mortality have kept this stock at low levels of abundance. Landings from the Gulf of Maine dropped 20% from 1984 to 2,232 mt in 1985. This stock has been declining since 1979.

2. Atlantic Cod

USA commercial landings from Subareas 3-6 declined 14% from 43,997 mt in 1984 to 37,651 mt in 1985, the lowest annual total since 1977. Compared to 1984, landings in Subarea 4 declined 83% (47 mt vs. 276 mt), landings in Subarea 5 declined 14% (37,252 mt vs. 43,251 mt), and landings in Subarea 6 declined 43% (268 mt vs. 470 mt). Landings from Subarea 3 ("Tail of the Bank") totaled 84 mt in 1985; no USA cod landings occurred in this region during 1984.

Landings in 1985 from the Georges Bank fishery (Div. 5Z + SA 6) totaled 26,828 mt., an 18% decrease from 1984. Otter trawl effort, which accounted for 86% of the 1985 landings, remained at the record high level attained in 1984. Commercial CPUE in 1985, however, declined by over 24% from 1984, and was the lowest in the 1964-1985 time series. USA research vessel catch-per-tow indices showed comparable trends; the autumn 1985 Georges Bank survey weight-per-tow value was the lowest observed.

Commercial age composition data indicate that the 1985 landings were dominated by the 1980 and 1983 year classes. Research vessel survey data indicate that the 1985 year class of cod on Georges Bank may be strong, although this evaluation was based solely on age Ø catch-per-tow data, and hence may not be a robust prediction of year class strength.

Gulf of Maine landings (Div. 5Y) in 1985 were 10,693 mt, 1% less than in 1984 (10,806 mt). Otter trawl effort, which accounted for 67% of the 1985 landings, increased to a record high level. Commercial CPUE in 1985 remained at the historically low level observed in 1984. USA research vessel indices indicated an increase in stock abundance from 1983 although this increase may be an artifact caused by a change in the survey trawl doors used in the 1985 surveys. Commercial age composition data indicate that the 1985 landings were dominated by the 1980-1982 year classes. Autumn 1985 research vessel age Ø catch-per-tow indices suggest that the 1985 year class may be above-average in strength.

3. Redfish

Subarea 3: Landings of redfish by USA vessels from the Grand Banks (Divisions 3N and 3O) equalled 189 tons in 1985. Fishing activity in Subarea 3 was limited to a relatively small region of the Grand Banks known as the "Tail of the Bank". Landings occurred only during the May through July period with the maximum in June. Initial sampling data suggest that most fish ranged in size from 24-28 cm (males) and 26-30 cm (females).

Subarea 4: Landings of redfish by USA vessels from Division 4X declined from 872 tons in 1984 to 31 tons in 1985. Landings were dominated by 33-43 cm fish, indicating continued reliance on the 1971 year class.

Subarea 5: Landings of redfish by USA vessels from Subarea 5 declined from 4,721 tons in 1984 to 4,158 tons in 1985, marking the sixth consecutive year of decline. The commercial CPUE index continued to decline, and bottom trawl survey abundance indices remained at historic low levels in 1985. The previously abundant 1971 year class is no longer a dominant feature in the age composition of the Subarea 5 landings. 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 approximately 44% of the total number landed in 1985.

4. Pollock

Divisions 4VWX and Subarea 5: USA commercial landings of pollock from Division 4X decreased from 561 tons in 1984 to 152 tons in 1985. Landings from Subarea 5, after declining in 1982 and 1983, increased to 17,341 tons in 1984 and to 19,000 tons in 1985. Commercial landings for 1985 surpassed the previous record high levels of 18,200 tons attained in 1980 and 1981. Commercial CPUE indices continue to remain high relative to the early 1970's although recent NEFC bottom trawl survey indices remain below levels evident during the mid-to-late 1970's. Age composition data indicate that landings are dominated by the 1979 year class, and fish from the 1982 year class are expected to recruit to the fishery in 1986.

5. Yellowtail Flounder

USA landings of yellowtail flounder from Subareas 5 and 6 have declined precipitously from 33,100 mt in 1983 to only 7,300 mt in 1985, 72% below the long-term average for the (NEFC 1960-1984) time series. NEFC Survey indices have continued to decline since 1982, and in spring and autumn of 1985 were at all time lows for the time series (1963 and hence). Fishing mortality has remained well above F_{max} in recent years. A general increase in abundance and biomass occurred during the

early 1980's due to improved recruitment from 1979-81 year classes. The 1980 year class was by far the strongest of the three and dominated landings during 1982 and 1983; intense fishing pressure has diminished the contribution of this year class. The fishery is now heavily dependent upon incoming recruitment; thus poor recruitment from year classes subsequent to 1981 has led to declines in both landings and abundance. Survey pre-recruit indices of age 1 (1984 year class) yellowtail in the autumn of 1985 suggest possible improvement over 1984 but remain far below the long-term averages

6. Other Flounders

USA landings of flounders (other than yellowtail) from Subarea 3 increased substantially from 2 mt in 1984 to about 1,620 mt in 1985. Landings from Subarea 4 decreased 62% from about 290 mt in 1984 to about 110 mt in 1985. Landings from Subarea 5 declined about 10%, from 34,417 mt in 1984 to 31,080 mt in 1985. Landings from Subarea 6 declined 38% from 13,174 mt in 1984 to 8,140 mt in 1985.

Winter flounder (27% of total), summer flounder (26%), American plaice (20%), witch flounder (16%), and windowpane flounder (10%) comprised 99% of the other flounder landings. Winter flounder landings decreased 25% from 1984 to 1985, summer flounder landings declined 24%, American plaice dropped 18%, and witch flounder landings decreased 4%. Windowpane flounder landings increased 130%. Survey indices for most of these flounder species indicate declines or likely declines as a result of continued high landing levels.

7. Silver Hake

USA commercial landings from Subarea 5 in 1985 were 13,729 mt, a 3% decrease from 1984, continuing the low level of landings reported since 1980 and well below levels reported in the 1970's. While the 1982 year class appeared quite strong, recruitment in 1983 and 1984 was only average in strength in comparison to other years. 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 6,384 mt in 1985, a 5% decrease from 1984, slightly 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 1,374 mt in 1985, a 17% increase from 1983, halting a steady decline begun in 1982, but 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 in the mid-1970's. Biomass should continue to steadily increase if landings remain at or slightly above their current level.

In Subarea 6, 1985 USA landings were only 445 mt, a sharp 59% decrease from 1984, after an equally dramatic 49% increase in 1984 from the 1982-1983 average. 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 in 1985 were 25,859 mt, a 22% decrease from 1984 (33,356 mt). Landings in the coastal Maine fixed gear fisheries (stop seines and weirs) were 4,691 mt, a substantial increase over the 1984 level of 380 mt. Purse seine landings by Maine vessels in 1985 were 9,954 mt, a decline of 53% relative to 1984 levels. Landings by the fixed gear fisheries which traditionally account for most of the coastal Maine catch, remain low relative to historical levels. The fishery is dependent on recruitment and no strong year classes have been produced during the 1980's. Landings from Division 5Z were 162 mt in 1985, primarily from Subdivision 5Zw. There has been no directed herring fishery in Subdivision 5Ze since the collapse of the fishery in 1977. Herring landings from Subarea 6 were 55 mt in 1985.

10. Atlantic Mackerel

USA commercial landings from Subareas 5 and 6 increased about 12% from 5,954 mt in 1984 to 6,697 mt in 1985. Landings were the highest since 1952 and were caught primarily in Subarea 6. Total stock biomass (Subareas 2-6) was estimated to be about 1.5 million mt at the beginning of 1986, a 25% increase over 1985. This increase is due to improved recruitment since 1980, especially from the strong 1981 and 1982 year classes. The 1984 year class also appears to be strong and will enter the fishery in 1986.

11. Butterfish

USA landings decreased 60%, from 11,825 mt in 1984 to 4,739 mt in 1985. About 64% of the 1985 total was from Subarea 5. The decrease primarily reflected a reduced export market for small butterfish, and decreased availability of large butterfish during 1985. Recruitment to the butterfish stock in recent years has been strong. Discard rates of small butterfish continued to be relatively high, as new freezer-trawlers and some otter trawlers equipped with size-sorting machines to select marketable fish and discard sub-marketable sized fish at sea.

12. Squid

USA landings of long-finned squid (Loligo pealei) from Subareas 5 and 6 decreased from 11,592 mt in 1984 to 10,155 mt in 1985, 4,901 mt from Subarea 5 and 5,254 mt from Subarea 6. Reductions occurred in the shoreside fisheries, primarily in Subarea 6, while joint venture landings increased slightly. Landings during 1985 were, however, much greater than in any year prior to 1983. Catch-per-tow indices from the NEFC 1985 autumn research vessel trawl survey indicated that abundance in 1986 may be greater than the 1968-84 average level. USA landings of short-finned squid (Illex illecebrosus) from Subareas 5 and 6 declined substantially, from 9,547 mt in 1984 to 4,997 mt in 1985. Shoreside landings declined by about 25% from the 1984 level, while joint venture landings declined by about 17%. Virtually all the 1985 landings were taken from Subarea 6. Catch-per-tow indices from the 1985 autumn survey were about 90% below the average seen during the recent (1975-81) period of high abundance, but were comparable to those from the prior period of low abundance (1968-74).

13. Sea Scallops

USA landings declined 13% from 7,739 mt (meats) in 1984 to 6,742 mt in 1985, marking the seventh consecutive year of decline. The 1985 total was the lowest since 1975. Division 5Z landings (3,030 mt) declined 6% from 1984 while Divison 5Y landings (421 mt) declined by 38%. Subarea 6 landings in 1985 totaled 3,291 mt, 14% less than in 1984.

Commercial CPUE indices in 1985 in both the Georges Bank and Mid-Atlantic fisheries declined to new record low levels. Total USA scallop effort in 1985 was only slightly less (-3%) than the record high 1984 level. Catch-per-tow values from the USA 1985 sea scallop research vessel survey indicated that resource abundance has improved in the Mid-Atlantic region and the USA portion of Georges Bank due to strong recruitment of the 1982 year class. This increased abundance should be reflected in increased USA landings in the latter half of 1986 and during 1987 as scallops from the 1982 cohort recruit to the fishery.

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 water front, movements and paths of Gulf Stream warm core rings, sea surface temperature patterns, and on bottom temperatures on the continental shelf and upper slope off southern New England and across the New York Bight.

Prepared description on the coincidence of high catches of Illex squid off the northeastern United States during 1980-1982 and the proximity of the shelf water front. Sightings of beaked whales were also found to be concentrated near the front between shelf water and slope water.

Physical oceanographic measurements were made on five 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 the physical oceanographic data for the Gulf of Maine continued to produce an estimate of the near-surface seasonal circulation pattern. A manuscript was completed describing the evolution of the bottom water in the interior basins of the Gulf of Maine.

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 array of current meter moorings from western Georges Bank and Great South Channel were recovered in November and analysis of the data began.

b) Plankton Studies

Nine ichthyoplankton surveys were completed in coastal waters from Cape Hatteras to the Gulf of Maine in 1985. We occupied 1,450 stations, collected 3,276 plankton samples and made more than 34,000 ancillary observations and measurements in

support of our marine ecosystem research. Survey efforts were intensive in the Middle Atlantic Bight for the second consecutive year, with coverage extending south of Cape Hatteras as far as Charleston, S.C. on four surveys, to sample bluefish eggs and larvae for assessment purposes. Abundance estimates of sampling remained high with concentrations centered off southern New England. Atlantic herring spawning beds on Georges Bank were dormant for the 7th consecutive year.

c) Benthic and Environment Studies

Semiannual sampling of sediments and benthic macrofauna was continued at ten stations on the Northeast shelf, with annual sampling at another six stations, as part of the Northeast Monitoring Program. A spatially more intensive survey of the New York Bight was also completed. The Bight data establish a baseline for determining changes with cessation (scheduled for December 1987) of sewage sludge disposal there.

Studies were completed on 1) the water column, sediments and biota of an acid waste dumpsite in the New York Bight; 2) the long-term recovery of the Bight's benthos after the 1976 anoxia; 3) factors influencing density, growth and mortality of surf clams in the Bight; 4) scientific and management methods for increasing production of estuarine shellfish; 5) concentrations of trace metals and organic contaminants in ocean quahogs collected over much of the northeast U.S. continental shelf; 6) production by benthic fauna on Georges Bank; and 7) energy contents of many predator and prey species in northeastern shelf and slope waters.

Experiments on the impact of oiled sediments on a key benthic prey species, the bloodworm, demonstrated that following exposures to environmentally relevant levels of oil (522-2,879 ug g^{-1} wet weight), burrowing behavior and emergence were significantly affected. These results are similar to those obtained in a previous study on sandworms. These changes in behavior could reduce the survival of these species by increasing their vulnerability to predation. In addition, prey consumption for bloodworms was impaired, allowing exposure which could lead to reduced growth and survival under chronic exposures.

A study on the behavioral responses of juvenile, immature and adult red hake to hypoxia was completed. All three groups exhibited the capability to avoid low DO, however, they differed in the DO concentration at which and the way avoidance was manifested. While avoidance would remove these animals from the potentially lethal effects of hypoxia, they would still be vulnerable to the additional risks and stresses associated with finding alternate habitats.

A Federal Survey of PCBs in Atlantic Coast bluefish was initiated late in 1984 and has continued to the present. This Congressionally mandated interagency research program is being coordinated by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service in cooperaion with the U.S. Food and Drug Administraiton and the U.S. Environmental Protection Agency to determine the nature of the problem and any associated public health risk. A sampling strategy, statistically

formulated on the life history of the bluefish as well as the historical levels of PCBs found in the species, has been initiated and completed.

To date, all field sampling, biological collection, organic analyses, data entry, and preliminary report writing phases of this program have been completed on schedule. A total of 4,258 individual bluefish were collected in a temporal-spatial framework at 12 sampling sites between Florida and Massachusetts during 1985. These samples represent 696 five-fish composite samples, 513 specimens for individual analysis, and 175 young-of-the-year ("snapper") for 25 fish composite samples. At present, we are waiting for final agency approvals for release of these data to Congress later in 1986.

Continued analysis of the extensive historical benthic data base and completed reports on Cumacea and the ecology of Cerianthids from Cape Hatteras to Nova Scotia. A report describing photographic systems utilized in the study of sea-bottom populations was issued.

A study was designed to measure the impact of contaminants, including heavy metals, PCBs and PAHs on the reproductive success of winter flounder in Long Island Sound. Sexually mature flounder were collected at six sites in Long Island Sound ranging from contaminated (Hempstead, New York) to relatively clean (Shoreham, New York) stations. The eggs were fertilized and cultured in the laboratory. This effort focuses on water column and sediment chemistry, levels of pollutants in pre- and post-fertilization fish eggs, cytogenetic analyses of embryos and larvae, egg hatchability, and larval development.

A study was completed in which juvenile oysters were reared under controlled conditions on diets of two algal species, each of which was cultured in high concentratins of cadmium. Feeding Cd-contaminated algal foods resulted in significantly increased oyster mortality within a 12-week period. However, surviving oysters derived nutritional support from the metal-contaminated algae as evidenced by cumulative weight increases. These results corroborate our earlier findings with larval oysters, which also indicated that Cd-contaminated phytoplankton affect survival, but not growth of grazing mollusks.

Preliminary trials were conducted on combined effects of low levels of PCBs and aromatic hydrocarbon on fertilization and early development of oysters under environmentally realistic variations of temperature and salinity. In addition, a test on post-spawn maturation will be used in a field monitoring study on effects of pollution on the reproductive potential of clams and oysters in Long Island Sound on a scope that would allow estimates of recruitment effects.

2. Fish Biology Studies

a) Age and Growth

About 40,000 age determinations were completed for 15 species of finfish and shellfish. Studies to establish the correspondnce between otolith growth patterns, sub-annual age increments and length of winter flounder were conducted. Research on investigation of growth and density-dependence for

yellowtail flounder was begun. Preparation of a technical manual describing age determination methods in use at the Fishery Biology Investigation, Woods Hole, was started.

b) Stock Identification

Stock discrimination studies are being conducted on Atlantic herring in cooperation with the University of Massachusetts using mophometric and electrophoretic techniques. Methods of stock identification of Atlantic salmon and striped bass were evaluated by the University of Rhode Island under contract to the NEFC. Support was provided by the NEFC to the Atlantic salmon tagging program conducted by the Maine Sea Run Salmon Commission and the United States Fish and Wildlife Service. A stock discriminaton study of silver hake was completed which used morphometric data subjected to discriminant function analysis.

Additional samples were analyzed to complete an automatic optical Fourier transform analysis comparing haddock scale images from two geographic areas.

c) Population Studies

During 1985, studies on populations of apex predators resulted in several journal publications dealing with migrations of the blue shark, age and growth of the sandbar shark and the feeding ecology of the sandbar shark and swordfish.

Over 6,000 apex predators were tagged in 1985 via the Cooperative Shark Tagging Program.

d) 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, and a sea scallop dredge survey during July and August. In addition, the NEFC conducted a trawl survey for yellowtail flounder during February in southern New England. A trawl survey for Atlantic herring and butterfish was conducted during October-November in southern New England and northern Georges Bank aboard the R/V WIECZNO in cooperation with the Polish Sea Fisheries Institute. A research fishery for mackerel was conducted during February-May from Cape Hatteras to Georges Bank in cooperation with Poland using two factory trawlers (ADMIRAL ARCISZEWSKI 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.

Juvenile gadoid surveys were carried out in July and August on Georges Bank. During July, comparisons were made between the 10 m MOCNESS and IYGPT trawls. There was no difference in the model length frequency of the juvenile cod caught with either net. No juvenile haddock were caught by the MOCNESS and only 22 juvenile haddock were distributed all over the bank outside the well-mixed area in July. By August, the bulk of the haddock shifted to eastern portion of the bank. Cod were generally distributed more to the east than haddock in July. In August, most cod juveniles were on the Northeast Peak and along the northern edge of the bank.

e) Food Habits Studies

Gut contents of approximately 19,000 fish were examined at sea in 1985, of which more than half were piscivorous species from the Georges Bank region. Sand lance was again a dominant prey among the fish eaters in 1985, including those examined during summer and autumn when 0-group haddock and cod were particularly abundant.

Completed analysis of available data on squid gut contents and estimated food consumption of squids off northeastern United States (see NAFO Sci. Co. Studies No.9:117-124).

Summarized diet of pre-recruit stages of 17 species of fish for 1973-1976 data series and examined the effects of regurgitation in food studies.

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, an experiment using the R/V DELAWARE II, and the same protocol as was used in 1984, will be conducted during August 12-20, 1986.