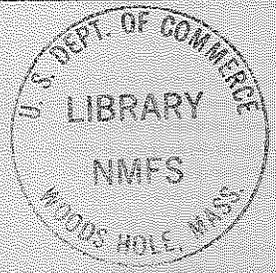




NORTHEAST FISHERIES CENTER

NEWSLETTER

MAY-JUNE 1981 2 OCT 1981



SPOTLIGHT:
 "FISH EGG/LARVAL SURVEYS IN THE NORTHWEST ATLANTIC" 1

PROGRAMS:

| | |
|----------------------------------------------------------|----|
| CENTER DIRECTORATE | 9 |
| RESOURCE ASSESSMENT DIVISION | 9 |
| MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM. | 15 |
| MARINE ECOSYSTEMS DIVISION | 15 |
| RESOURCE UTILIZATION DIVISION. | 25 |
| DIVISION OF ENVIRONMENTAL ASSESSMENT | 31 |
| AQUACULTURE DIVISION | 42 |
| PATHOBIOLOGY DIVISION. | 46 |
| NATIONAL SYSTEMATICS LABORATORY. | 53 |
| ATLANTIC ENVIRONMENTAL GROUP | 54 |

MISCELLANEOUS:

| | |
|----------------------------------------------|----|
| TRAVEL, MEETINGS, AND PRESENTATIONS. | 57 |
| SEMINARS | 68 |
| VISITORS | 68 |
| UNIVERSITY AFFAIRS | 70 |
| PERSONNEL. | 71 |
| EEO ACTIVITIES | 72 |
| PUBLIC AFFAIRS | 73 |



US DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST FISHERIES CENTER

RESEARCH ADMINISTRATION

CENTER DIRECTOR ROBERT L. EDWARDS
ASSISTANT CENTER DIRECTOR FOR FISHERIES MANAGEMENT/
WOODS HOLE LABORATORY DIRECTOR RICHARD C. HENNEMUTH
ASSISTANT CENTER DIRECTOR FOR ENVIRONMENTAL MANAGEMENT/
SANDY HOOK LABORATORY DIRECTOR CARL J. SINDERMANN
CENTER OPERATIONS OFFICER HERBERT STERN, JR.
CENTER PLANNING OFFICER GEORGE J. RIDGWAY
RESOURCE ASSESSMENT DIVISION CHIEF BRADFORD E. BROWN
MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM CHIEF RICHARD A. COOPER
MARINE ECOSYSTEMS DIVISION CHIEF/
NARRAGANSETT LABORATORY DIRECTOR KENNETH SHERMAN
RESOURCE UTILIZATION DIVISION CHIEF/
GLOUCESTER LABORATORY DIRECTOR LOUIS J. RONSIVALLI
DIVISION OF ENVIRONMENTAL ASSESSMENT CHIEF JOHN B. PEARCE
AQUACULTURE DIVISION CHIEF/
MILFORD LABORATORY DIRECTOR JAMES E. HANKS
PATHOBIOLOGY DIVISION CHIEF/
OXFORD LABORATORY DIRECTOR AARON ROSENFELD
NATIONAL SYSTEMATICS LABORATORY DIRECTOR DANIEL M. COHEN
ATLANTIC ENVIRONMENTAL GROUP DIRECTOR MERTON C. INGHAM

"NORTHEAST FISHERIES CENTER NEWSLETTER"

THE "NORTHEAST FISHERIES CENTER NEWSLETTER" IS A MONTHLY NARRATIVE REPORT ON THE RESEARCH AND DEVELOPMENT ACTIVITIES OF THE NORTHEAST FISHERIES CENTER (NEFC). SUBMISSIONS TO THIS REPORT ARE PREPARED BY THE ABOVE RESEARCH ADMINISTRATORS, AND COMPILED AND EDITED BY JON A. GIBSON, TECHNICAL WRITER-EDITOR, NEFC.

THIS REPORT DOES NOT CONSTITUTE A PUBLICATION AND IS FOR INFORMATION ONLY. ALL DATA HEREIN ARE CONSIDERED TO BE PROVISIONAL. REFERENCE TO TRADE NAMES IN THIS REPORT DOES NOT IMPLY ENDORSEMENT BY THE NATIONAL MARINE FISHERIES SERVICE, NOAA.

TO CANCEL DELIVERY OF THIS REPORT IN THE EVENT YOU NO LONGER NEED TO RECEIVE IT, OR TO CHANGE THE DELIVERY ADDRESS IF YOU ARE MOVING BUT STILL NEED TO RECEIVE IT, PLEASE NOTIFY US BY WRITING: JON A. GIBSON, "NORTHEAST FISHERIES CENTER NEWSLETTER," NORTHEAST FISHERIES CENTER, NATIONAL MARINE FISHERIES SERVICE, NOAA, WATER ST., WOODS HOLE, MA 02543.

Editor's Note: The author of the following spotlight has published a more in-depth, yet even more popularized, account of this topic. Those interested in further nontechnical reading should consult: "What Studies of Young Fish Tell About Fish Populations," by W. G. Smith (Underwater Naturalist, Fall 1980).

FISH EGG/LARVAL SURVEYS IN THE NORTHWEST ATLANTIC

by

Wallace G. Smith, Chief
Ichthyoplankton Investigation, Marine Ecosystems Division

INTRODUCTION

Significance

Wild fluctuations in the size of coastal fish populations can and do occur, often because of year-to-year differences in the survival of eggs and larvae, the most vulnerable stages in the life cycle. When environmental conditions surrounding the eggs and larvae are "right," a larger year class ultimately recruits to the catchable-sized population; when they are not, few of the developing young become recruits. Even though spawning females produce huge numbers of eggs (thousands to millions per individual depending upon the species), because the developing young are at the mercy of their environment, the size of the spawning population is no guarantee of year-class success. Large spawning populations can produce weak year classes and, conversely, small spawning populations can produce strong year classes.

But what are "right" and "wrong" environmental conditions? That is one of the questions that Northeast Fisheries Center (NEFC) scientists are attempting to answer through a broad-based marine ecosystem program known as MARMAP (Marine Resources Monitoring, Assessment, and Prediction). The program's studies include: (1) what environmental conditions fish eggs need to develop and hatch successfully, (2) what young larvae eat and what eats them, (3) what temperatures and salinities can be tolerated, and (4) how ocean currents and weather influence distribution and survival. In addition, that aspect of the program pertaining to fish eggs/larvae currently provides estimates of the adult spawning biomass and holds promise for providing predictions of future recruitment levels, a much sought-after potential of major significance to commercial/recreational fishermen, as well as to fishery managers/scientists.

The ability to estimate adult spawning biomass from fish egg/larval surveys as noted initially above, provides fishery managers not only with a cross-check of current population size estimates of certain species as derived from other more traditional methods (such as virtual population analysis, or VPA), but also with a method to estimate the population size of those species for which traditional methods are not applicable. For example, sand lance, a species which has increased greatly in recent years off New England, are difficult to catch by conventional fishing methods. VPA procedures are ineffective here since they rely on significant catches by fishermen and on research vessel surveys. Their larvae, however, are

collected routinely in large numbers by our fish egg/larval surveys, and thus the surveys provide a means of estimating the adult spawning biomass.

The ability to predict recruitment from fish egg/larval surveys as noted secondarily above, provides commercial/recreational fishermen with a potential method for planning and investment based upon forecasts of relative strengths and weaknesses of future recruitment to certain species' populations. This is a conditional method, however, for larval survival varies greatly according to ocean temperatures (that is, by influencing the growth and reproduction of larvae's zooplanktonic prey), currents (that is, by influencing movement and distribution of larvae relative to their feeding grounds), and other factors. Other NEFC scientists, though, are working to eliminate the "conditional" aspect of this method.

For these reasons, as well as for others with more ultimate benefit, the NEFC conducts fish egg/larval surveys as part of MARMAP.

Comprehensiveness

Since 1977, MARMAP has developed into the world's most comprehensive fishery ecosystem study. In these past 4 yr, NEFC scientists, along with ornithologists from the Manomet (Massachusetts) Bird Observatory, mammalogists from the University of Rhode Island, and research vessels, gear, and personnel from several foreign countries, have cooperatively collected the kinds and amounts of ecological information needed to begin describing: (1) the structure of marine ecosystems, and (2) the biological and environmental interactions which control fish population size and composition in the Northwest Atlantic. In addition to fish egg/larval collections, there have been collections/observations of the other key components of the ecosystems: (1) water-column temperature, salinity, and circulation; (2) nutrients; (3) phytoplankton primary production; (4) zooplankton; (5) fish; (6) marine mammals; and (7) seabirds. These collections/observations are made at 180 stations located throughout a 260 000-km² area (Figure 1). For 1980, the fish egg/larval surveys covered 10 months, used 238 vessel days, and resulted in 2800 combined ichthyoplankton (that is, fish eggs/larvae) and zooplankton samples, and 50 000 observations among the aforementioned other key ecosystem components. Concurrent seasonal bottom trawl surveys monitored changes in the distribution, abundance, and feeding habits of adult fish populations and contributed to their population size estimates. Also, concurrent semiannual shellfish dredge surveys monitored changes in the distribution and abundance of sea scallop, surf clam, ocean quahog, and other benthic organism populations.

By integrating information from all activities within MARMAP, we are estimating population sizes of certain fish species, and approaching an understanding of the biological and environmental interactions within marine ecosystems which will allow us to predict the size of incoming year classes for the principal fish species off our Northeast and Middle Atlantic Coasts.

POPULATION ESTIMATES

Peter Berrien's (Ichthyoplankton Investigation, Sandy Hook Laboratory) recent analysis of Atlantic mackerel spawning (described below) shows the utility of this approach for estimating spawning population biomass independent of commercial/recreational catch statistics and research survey catches. Mr. Berrien has also recently completed a similar study on yellowtail flounder, and other Investigation members are working on silver hake, haddock, and bluefish.

Methods

Stock assessments based on spawning products require: (1) frequent, thorough samples of ichthyoplankton and accompanying water-column temperatures throughout the spawning grounds and seasons for the target fish species; (2) expertise in identifying the species and developmental stage of the fish eggs collected; (3) knowledge of the temperature-dependent developmental rates of the eggs as determined in the lab; (4) knowledge of the length-dependent fecundity (that is, egg productivity) of the adult females as determined in the field and lab; and (5) knowledge of the size distribution and sex ratio of adults in the target population as determined from commercial/recreational fishery catches and/or research vessel survey catches.

Certainly, the fundamental activity within this process is the fish egg/larval survey itself. The eggs/larvae are caught by towing fine-meshed nets obliquely through the water column at preselected stations scattered over the continental shelf. The nets are called "bongos" because that's what they look like. They are specially designed so that the towing wire does not interfere with the flow of water through the nets. Large bongos (61 cm in diameter) are used to collect fish eggs, larvae, and zooplankton. The apertures of the meshes in nets used on the 61-cm bongos are 0.505 mm and 0.333 mm (one net on each drum). Small bongos (20 cm in diameter) are used to collect minute phytoplankton and larval stages of zooplankton which pass through the meshes of the large bongos. Net meshes on the 20-cm bongos range from 0.053 mm to 0.265 mm, depending on their intended purpose.

A depth indicator is attached to the towing wire just below the large bongos to record the towing profile of the net through the water and the maximum depth of tow. By knowing the water depth and maintaining a constant angle in the wire during setting and retrieval, it is possible to fish the bongos to within a few meters of the bottom. Thus, nearly the entire water column is sampled to a maximum depth of 200 m.

In addition to the depth-recording device, flowmeters are attached to the bongo frames to measure the amount of water filtered by the nets and provide biologists with a means of quantifying the catches (that is, expressing the catch as so many organisms per unit of water filtered).

With all of these samples, expertise, and knowledge at hand, we then group the eggs according to stage of development to estimate mortality rates. For Atlantic mackerel, the resulting mortality rate was 12.98% per day for those eggs surviving at the start of each day. This mortality rate is subsequently used with the incubation rate and the survey frequency to back-calculate the number of eggs spawned per square meter of surface water per day in each subdivision, or stratum, of the survey area (Figure 2).

Results

Estimated areal densities of Atlantic mackerel eggs spawned per day, as derived from four egg/larval surveys during the 1977 spawning season, reveal that most eggs occurred near shore in Strata 4 and 7 and along the inner half of Strata 2 and 3 (Figure 3). Throughout the spawning season, spawning intensity moved north and east, occurring off New Jersey in late April, off New Jersey and Long Island in May, and

from Long Island to Nantucket Shoals in late May and early June. In the more northeastern Strata (3, 4, and 7), the peak in spawning intensity occurred a bit later in the season, or during the early part of June, and decreased to a negligible level during the latter half of the month.

Mackerel egg production was low (3.3 eggs/m²/day) throughout most of the Middle Atlantic Bight in mid-April, increased rapidly (76.3 eggs/m²/day) by late April, decreased to intermediate levels through May, and went to very low levels (0.4 eggs/m²/day) during June. Egg production over time is shown in Figure 4. In all, 54.3% of total production occurred in Stratum 2, 37.1% in Stratum 4, 12.4% in Stratum 3, 1.6% in Stratum 7, less than 0.02% in Strata 1 and 6, and 0.0% in Strata 5 and 8. TOTAL EGG PRODUCTION FOR THE SEASON WAS ESTIMATED AT 3.032×10^{14} OR 303.2 TRILLION EGGS! HOW MANY IS THAT? IF MACKEREL EGGS (WITH AN AVERAGE DIAMETER OF 1.13 mm) WERE LINED UP ALONG THE EQUATOR IN A SWATH ONE-EGG DEEP AND 1-m (OR 3.21-ft) WIDE, 303.2 TRILLION EGGS WOULD ENCIRCLE THE EARTH MORE THAN 9.5 TIMES!

Table 1 shows how we derive spawning population estimates. With information on the size distribution in commercial landings and recreational catches, and on the maturity rates and fecundity levels at any given size, the theoretical number of eggs spawned by females in the commercial landings and recreational catch is calculated and subsequently divided into the estimated total egg production (3.032×10^{14}). The resultant quotient is first doubled to adjust for the 1:1 sex ratio, and then multiplied by the number of mature females caught to achieve an estimate of the size of the spawning population (1.2247×10^9 fish). This estimate for Atlantic mackerel was within 12% of that derived through VPA by the Resource Assessment Division.

OTHER USES

In addition to using the results of fish egg/larval surveys for estimating spawning population biomass, the Marine Ecosystems Division is using this information as part of a study to determine the energy transfer rates through the food web, from the food-producing phytoplankton to the food-consuming zooplankton, ichthyoplankton, mid-sized fish predators (such as cods, flatfishes, and herrings), and large-sized predators in the ecosystem (such as sharks, tunas, billfishes, whales, porpoises, dolphins, and seals). Subsequent "spotlights" on the Division's activities will focus on the critical role such predator-prey relationships have played in modifying the species composition of the Northwest Atlantic from the more pristine conditions of the 1950's.

Table 1. Calculations for Atlantic mackerel spawning population estimate.

| Fork length (cm) | Total catch of fish (no. x 10 ³) (a) | Females in catch (no. x 10 ³) (b) | Females mature (%) (c) | Mature females in catch (no. x 10 ³) | Fecundity (no. eggs/female) | Theoretical egg production by catch (no. x 10 ¹²) | Mature females in population (no. x 10 ⁶) |
|------------------|--------------------------------------------------|-----------------------------------------------|------------------------|--------------------------------------------------|-----------------------------|---------------------------------------------------------------|-------------------------------------------------------|
| 14 | 16 | 8.0 | | | | | |
| 15 | 8 | 4.0 | | | | | |
| 16 | 8 | 4.0 | | | | | |
| 17 | 27 | 13.5 | | | | | |
| 18 | 100 | 50.0 | | | | | |
| 19 | 194 | 97.0 | | | | | |
| 20 | 231 | 115.5 | | | | | |
| 21 | 157 | 78.5 | | | | | |
| 22 | 124 | 62.0 | | | | | |
| 23 | 237 | 118.5 | | | | | |
| 24 | 890 | 445.0 | | | | | |
| 25 | 2320 | 1160.0 | | | | | |
| 26 | 4660 | 2330.0 | | | | | |
| 27 | 4961 | 2480.5 | | | | | |
| 28 | 4860 | 2430.0 | | | | | |
| 29 | 6696 | 3348.0 | 1.6 | 53.6 | 202085 | 0.0108 | 0.6485 |
| 30 | 16758 | 8379.0 | 13.4 | 1122.8 | 243871 | 0.2738 | 13.5843 |
| 31 | 27279 | 13639.5 | 45.2 | 6165.1 | 292489 | 1.8032 | 74.5889 |
| 32 | 26749 | 13374.5 | 80.0 | 10699.6 | 348780 | 3.7318 | 129.4499 |
| 33 | 21223 | 10610.5 | 96.2 | 10207.3 | 413658 | 4.2223 | 123.4938 |
| 34 | 15803 | 7901.5 | 99.6 | 7869.9 | 488112 | 3.8414 | 95.2146 |
| 35 | 8351 | 4175.5 | 100.0 | 4175.5 | 573209 | 2.3934 | 50.5176 |
| 36 | 6161 | 3080.5 | 100.0 | 3080.5 | 670102 | 2.0642 | 37.2697 |
| 37 | 5769 | 2884.5 | 100.0 | 2884.5 | 780028 | 2.2500 | 34.8983 |
| 38 | 3997 | 1998.5 | 100.0 | 1998.5 | 904316 | 1.8073 | 24.1790 |
| 39 | 2742 | 1371.0 | 100.0 | 1371.0 | 1044389 | 1.4319 | 16.5871 |
| 40 | 1517 | 758.5 | 100.0 | 758.5 | 1201768 | 0.9115 | 9.1768 |
| 41 | 383 | 191.5 | 100.0 | 191.5 | 1378078 | 0.2639 | 2.3169 |
| 42 | 70 | 35.0 | 100.0 | 35.0 | 1575049 | 0.0551 | 0.4235 |
| | $\Sigma = 162289$ | | | $\Sigma = 50613.3$ | | $\Sigma = 25.0608$ | $\Sigma = 612.3489$ |

(a) First quarter 1977 catch in Northwest Atlantic Fisheries Organization's Subareas 5 and 6.

(b) Calculated from total catch assuming a 1:1 sex ratio.

(c) Based on 1978 spring bottom trawl survey data.

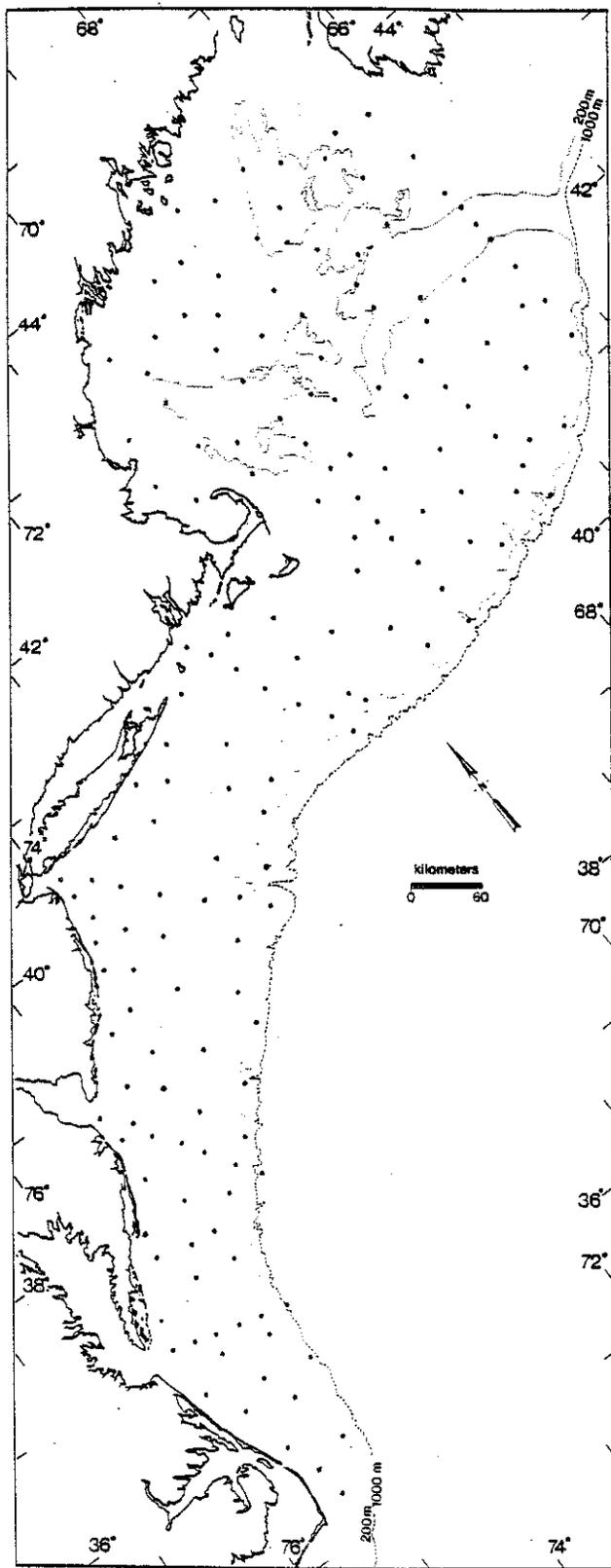


FIGURE 1. Survey area and typical station plan for MARMAP surveys off middle Atlantic and northeast coast of the United States.

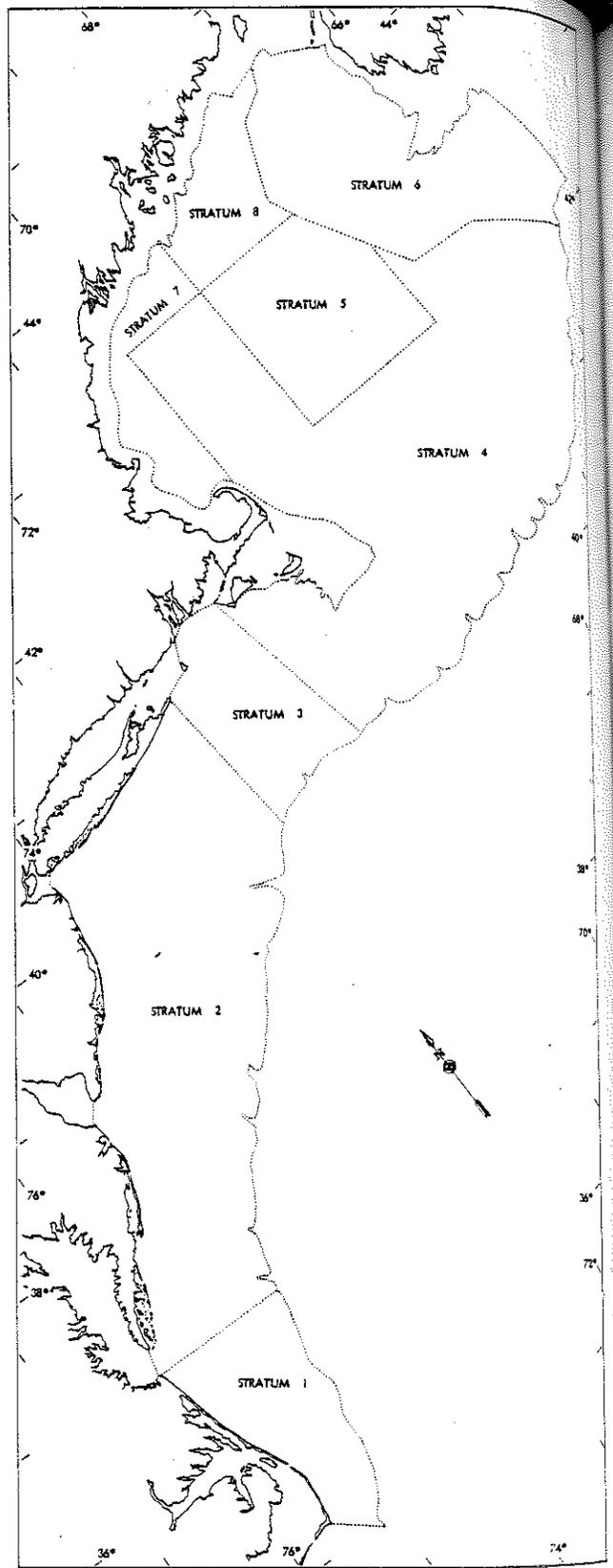


FIGURE 2. Stratum boundaries used to derive spawning population estimates for Atlantic mackerel from egg production.

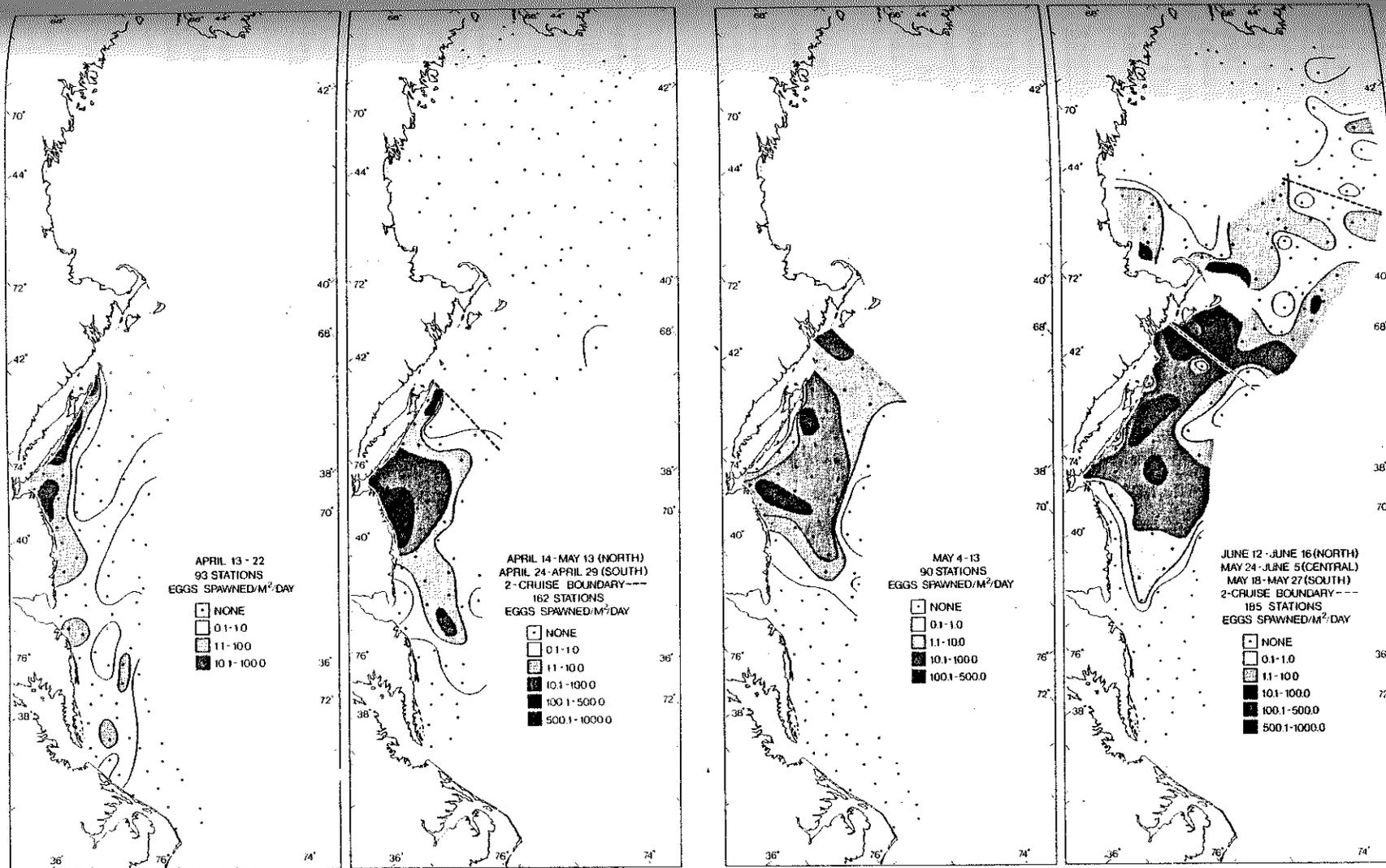


FIGURE 3. Distribution of Atlantic mackerel eggs during four surveys between mid-April and mid-June, 1977.

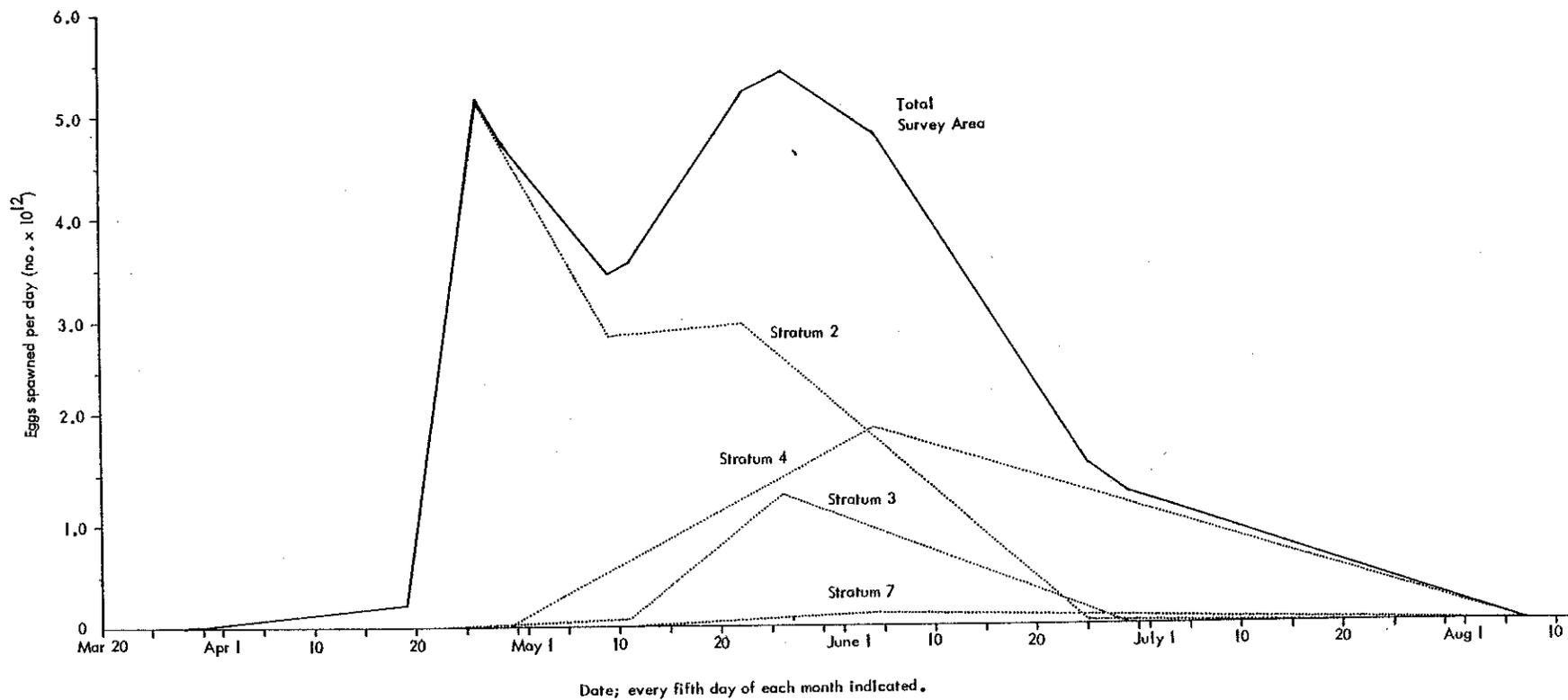


FIGURE 4. Estimated daily egg production in four strata and in the total survey area. Strata 1 and 6 are not shown; their contribution was insignificant.

CENTER DIRECTORATE

Fishery Technology

Louis Ronsivalli was one of the invited speakers at a spring 1981 conference by the New England Food and Drug Official's Association, held at Saco, Maine. This year's meeting commemorated the 75th anniversary of the nation's Food, Drug, and Cosmetic Act and its meat inspection laws. In his talk, Louis outlined the steps that must be taken by all of those handling fish and shellfish --from the fisherman to the consumer-- in order to assure the quality and wholesomeness of seafoods at the dinner table.

Special Scientific and Technical Projects

A joint project was started with Frank Ansuini, a consulting engineer specializing in materials and corrosion, to test degradable links in the Woods Hole Aquarium. These links are formulated to maintain full strength for a pre-set period, in this case 30 days, then rapidly fail within a few days. This project is an offshoot of the lobster ghost-trap work of a few years ago. A test rack has been set up and the test is now underway.

The old clam diesel/pump system has been reactivated and is now operational down on the Woods Hole wharf. Testing of various nozzle/manifold combinations is underway. We are also experimenting with the best means to measure flow.

The papers on the clam dredge design and the scallop survey dredge are in a holding pattern awaiting illustrations.

The NOAA R/V Albatross IV was outfitted with a removable gallows and deck block arrangement to allow the ship to tow two 8-ft scallop dredges simultaneously. After some initial problems with turnovers, the operational procedure was modified and the problems resolved. This capability to double-tow will now allow us to conduct much needed scallop gear studies within our present sea-day limitations.

Other work involved: providing assistance to the State of Maine in regards to shrimp survey trawls, preparing illustrations for a clam dredge publication, continuing to monitor Fred Serchuk's contribution towards completion of a joint mesh study, planning modifications to the CAMAC (computer-automated measurement and control) data logger, and answering requests for technical information.

RESOURCE ASSESSMENT DIVISION

Resource Surveys Investigation

Investigation activities focused upon completing the spring bottom trawl survey, processing survey data, conducting the sea scallop research vessel survey, and preparing for the upcoming summer bottom trawl survey and surf clam-ocean quahog survey.

The fourth leg of the 1981 spring bottom trawl survey, conducted with the NOAA R/V Delaware II on Georges Bank and in the eastern Gulf of Maine during 5-14

May, was staffed with Henry Jensen as Chief Scientist and Chuck Byrne and Elizabeth Bevacqua as participating scientists. The western Gulf of Maine was surveyed as a "piggyback" activity on the subsequent Delaware II MARMAP survey with Linda Despres-Patanjo and Malcolm Silverman as cruise participants.

During 9-19 June, the first leg of the 1981 sea scallop survey, covering the grounds between Cape Hatteras and Long Island, was performed aboard the Albatross IV with Linda Despres-Patanjo as Chief Scientist and Andrew Thoms as a participating scientist. The scallop grounds between Long Island and the southwest part of Georges Bank were surveyed during 23 June-2 July. On this second leg of the survey, Charles Byrne served as Chief Scientist with Eva Montiero, John Nicolas, and Dennis Hansford participating.

The 1981 summer bottom trawl survey began on 26 June aboard the Delaware II in the area off Chesapeake Bay. Darryl Christensen was Chief Scientist. This survey will not be as comprehensive in geographical coverage as previous summer surveys; more emphasis will be given to coverage of specific areas of interest.

The 1981 surf clam-ocean quahog survey will again cover portions of Georges Bank and the Scotian Shelf (as part of a cooperative investigation with Canada) in addition to the standard mid-Atlantic coverage.

Andrew Thoms is continuing preparations for the August surf clam-ocean quahog survey. He has been designated as the Contracting Officer's Technical Representative and serves as liaison between contracting officers and contractors working on the clam survey gear. In this capacity, Andy made a trip to Portland, Maine, to inspect the clam dredge ramp and offer structural recommendations.

Dennis Hansford completed digitizing the bottom trawl survey strata between Nova Scotia and Cape Fear, North Carolina, and is currently "debugging" the computerized data.

John Nicolas continued to refine the inventory system and is investigating materials research on international standards for twine and other net parts.

Carl Harrison participated in a lobster trawling survey with Charles Wheeler aboard the Woods Hole Laboratory's R/V Phalarope II on 12, 18, and 29 June.

James Crossen and John Suomala prepared an article titled "Spherical Reference Targets for Hydroacoustical Equipment Calibration" for the October 1981 meeting of the International Council for the Exploration of the Sea in Woods Hole.

Linda Despres-Patanjo and Robert Murchelano are preparing an abstract of a paper titled "Fish Health in the Western North Atlantic" to be presented by Linda at the Annual Meeting of the Eastern Fish Health Section of the American Fisheries Society in July.

Pat Twohig and Tom Azarovitz visited the South Carolina Marine Resources Institute in Charleston and spent 5 days aboard the NOAA R/V Oregon II measuring the fishing characteristics of the 3/4 Yankee otter trawl used by the state biologists on a MARMAP-funded bottom trawl survey.

Henry Jensen designed a new sea scallop trawl log which was successfully used during the summer sea scallop survey. The log combined the previous scallop, trash-composition, and fish logs into one log and is arranged to allow direct key-punching into the computer. The log also incorporates the new pilothouse data format which allows for additional navigational and gear data. The new log does away with the XBT (expendable bathythermograph) log, station data list, and the No. 1 card station list, all formerly transcribed and punched separately.

Elizabeth Bevacqua compiled length-frequency data on sand lance, by season and strata from 1978 to 1980, for Wally Smith. Liz also updated survey files for James Colvocoresses from the Virginia Institute of Marine Sciences (VIMS) for analysis work on spiny dogfish, goosefish, and inshore community structures.

Fishery Biology Investigation

Age and Growth

Vi Gifford and Kris Andrade completed second aging of third and fourth quarter 1973 commercial redfish samples. They also completed first and second agings of the first quarter 1974 commercial redfish samples. Vi also finished the first aging of second quarter 1974 commercial redfish samples.

Kris Andrade completed aging and summarizing the first quarter 1981 commercial haddock samples and provided coded age sheets to Fishery Assessment Investigation personnel. She also checked Doris Jimenez's aging of the first quarter 1981 commercial pollock samples, checked age sheets and summaries, and forwarded the data to the assessment staff. Kris cleared for placing on computer tape the haddock age data for the following surveys: Delaware II Cruise No. DE 81-01, Albatross IV Cruise No. AL 77-07, and Albatross IV Cruise No. AL 78-09.

Judy Penttila completed aging yellowtail flounder samples from the following bottom trawl surveys: Albatross IV Cruise No. AL 72-05 (summer), Albatross IV Cruise No. AL 72-08 (autumn), State of Maine 1980 spring survey, Delaware II Cruise No. DE 81-02 (spring), and assorted frozen samples from 1969 to 1979. Judy also completed expanded age sample sheets for Atlantic cod from Delaware II Cruises No. DE 80-07 (autumn) and DE 81-01 (winter), and provided aging summaries to the assessment staff of the 1979 commercial Atlantic cod samples for all four quarters.

Melinda Grace placed the third and fourth quarter 1973 commercial redfish age sample data on age sheets, and subsequently coded and summarized these data. She continued age-reading training on Atlantic cod samples from Delaware II Cruise No. DE 80-07 and compared her results with those of Judy Penttila and Doris Jimenez. Melinda also calculated mean length at age for expanded cod age samples from Delaware II Cruises No. DE 80-07 and DE 81-01, and coded and summarized yellowtail flounder data provided by Judy Penttila.

Ruben Millor and Melinda took scales and otoliths from frozen age samples collected from the 1981 spring bottom trawl survey (Delaware II Cruise No. DE 81-02).

Finfish

Sherry Sass, David Pyoas, and Mark Costa continued the larval winter flounder age and growth study, and the maintenance of algal and rotifer cultures. Sherry also worked with Maurice Crawford on aging surf clam chondrophores, and with Louise Dery on aging butterfish otoliths.

Alicia Kelly and Mark Costa sectioned silver hake otoliths from the 1981 spring bottom trawl survey, and completed scale impressions of all summer flounder scale samples taken to date. Alicia continued cataloging age and growth reprints and researched new references.

David Pyoas began a winter flounder aging project.

Brenda Fields returned from the University of Washington and began work on summer flounder stock separation using scale growth patterns. Brenda also met with Ambrose Jearld and John Ropes to discuss analysis of meat-weight data for surf clams and ocean quahogs.

Louise Dery aged red hake samples collected from the Gulf of Maine during the 1980 bottom trawl surveys, and aged and summarized Atlantic mackerel samples collected from 1980 commercial landings and the 1981 spring bottom trawl survey. Louise aged otoliths of the large European hake (Merluccius merluccius) received from Sergio Iglesias (at the Spanish Oceanographic Institute in Vigo), and calculated final growth rates for this species.

The Finfish Group also processed frozen Atlantic mackerel and Atlantic herring samples collected on the 1981 spring bottom trawl survey.

Doris Jimenez (Massachusetts Division of Marine Fisheries) completed analyses of Atlantic cod and pollock samples from the spring 1981 bottom trawl survey, from 1980 commercial landings, and spring 1981 Massachusetts inshore bottom trawl survey. Doris also spent a day at sea in May on the inshore bottom trawl survey as well as spending another day training a Young Adult Conservation Corps employee to mount and read rainbow smelt scales.

Shellfish

John Ropes processed the meats of about 1900 ocean quahogs and 1200 surf clams collected on Delaware II Cruise No. DE 80-06, to determine drained meat weight-shell length relationships. John concurrently made microscopic examinations of gonadal tissue squashes to determine sex and gonad condition. These data were assembled for automatic data processing; Brenda Fields is coordinating the analytical aspects of these studies.

John also continued tests on embedding ocean quahog shells and found that superior acetate peels resulted when shells were embedded in an epoxy (Epon 815). Experimentation with photomicrographic techniques have led John to project the image of whole acetate peels through an enlarger onto print paper in order to obtain the clearest prints possible. Some problems with contrast and definition, however, still remain to be resolved.

Maurice Crawford aged surf clam samples #30, 32, and 36 from the University of Maryland Eastern Shore. The Sort and Fastlook computer programs were completed for sample #36. Von Bertalanffy growth curves were constructed for samples #6-20, 23-29, 32, 34, and 35 as well as histograms depicting the percentage of dominant age groups in each sample.

Mark Costa continued to prepare and age surf clams from Delaware II Cruise No. DE 80-01. Mark also cleaned commercial sea scallop shell samples from New Bedford, Massachusetts, and Hampton, Virginia, and survey samples from Albatross IV Cruise No. AL 80-06.

Maurice and Mark participated in the 1981 sea scallop survey on Albatross IV during 23 June-2 July.

Fishery Assessment Investigation

Anne Lange, Ralph Mayo, and Steve Murawski continued their activities in the Northeast Fishery Management Task Force's (NFMTF) Study Group on the Biological Effects of Management Options.

Gordon Waring and Mike Fogarty continued working with Vaughn Anthony on three laboratory reference documents on Atlantic herring. Mike was also involved with summer flounder assessment activities as a member of the Scientific and Statistical (S&S) Committee of the Atlantic States Marine Fisheries Commission. Additionally, Mike participated as a member of the New England Fishery Management Council's (NEFMC) Lobster Fishery Management Plan Development Team. Gordon began his involvement in butterfish and spiny dogfish assessment activities with Emory Anderson.

Paul Wood and Robert Rak worked on sea scallop and American plaice assessments with Fred Serchuk.

Karen Johnson prepared an abstract for a paper on her multispecies virtual population analysis research to be presented at the October 1981 Statutory Meeting of ICES.

Anne Lange reviewed a king mackerel manuscript for the Southeast Fisheries Center.

Senior Assessment Scientists

Brad Brown devoted considerable effort to various research vessel survey program review activities, and to preparations for the three-tier commercial fisheries statistics collection system. Brad was also involved with questions on the Atlantic herring studies at the NEFC, stimulated in part by correspondence from Charlie Stinson to the Secretary of Commerce.

Fred Serchuk updated sea scallop size-frequency distribution data from commercial samples and research surveys through 1980. He also completed standardization of NEFC and Canadian sea scallop research survey catch-per-tow data using an 8-ft, lined scallop dredge as the standard sampling gear. Fred derived new sea scallop shell height-meat weight equations for both the Georges Bank and mid-Atlantic regions based on additional data obtained during the NEFC's 1980 sea scallop survey.

Fred also reviewed a manuscript submitted for publication in Fisheries and also reviewed the NMFS Agency Review Draft of the Shortnose Sturgeon Recovery Plan.

Mike Sissenwine, as leader of the NFMTF's Study Group on the Biological Effects of Management Options, coordinated preparation of five reports on the Study Group. Mike also coordinated a meeting on the three-tier commercial fisheries statistics collection system and prepared a report describing this system.

Emory Anderson completed drafts on the status of several species/stocks for the annual report on the status of the stocks. He also assembled material from the Division for the "1980 National Research Report" to NAFO. Emory reviewed a federal grant-in-aid report on state fisheries research for the Northeast Regional Office's (NERO) Federal Aid Branch.

Steve Clark initiated a stock assessment for pollock, and updated stock assessments for white hake, witch flounder, cusk, Atlantic wolffish, and total biomass in conjunction with Ralph Mayo and Loretta O'Brien.

Publications

Clark, S. H.; Anthony, V. C. An assessment of the Gulf of Maine northern shrimp resource. Proc. Int. Pandalid Shrimp Symp.; 1979 February 13-15; Kodiak, Alaska. c1981:217-223. (P)

Lange, A.M.T.; Sissenwine, M. P. Evidence of summer spawning of Illex illecebrosus off the northeast USA. Northw. Atl. Fish. Org., Sci. Counc. Res. Doc. (S)

Ropes, J.; Serchuk, F.; Murawski, S. Studies of ocean quahogs off Shinnecock Inlet, Long Island. Coast. Oceanogr. Climatol. News 3(3):31-32;1981. (P)

Reports

Fogarty, M. J. Review and assessment of the summer flounder (Paralichthys dentatus) population in the Northwest Atlantic. Woods Hole Lab. Ref. Doc. No. 81-11.

Fogarty, M. J.; Anthony, V. C.; Waring, G. T. Yield and recruitment simulations for Atlantic herring. Woods Hole Lab. Ref. Doc. No. 81-22.

Lange, A.M.T.,; Murawski, S. A.; Sissenwine, M. P.; Mayo, R. K.; Brown, B. E. Fishery trends off the NE coast of the USA, 1964-1980. Woods Hole Lab. Ref. Doc. No. 81-17.

Mayo, R. K.; Lange, A.M.T.; Murawski, S. A.; Sissenwine, M. P.; Brown, B. E. Estimation of discards in mixed trawl fisheries off the Northeast Coast of the US based on bottom trawl survey catches. Woods Hole Lab. Ref. Doc. No. 81-18.

Murawski, S. A.; Lange, A.M.T.; Mayo, R. K.; Sissenwine, M. P.; Brown, B. E.
Species similarity of otter trawl catches off the NE coast of the US.
Woods Hole Lab. Ref. Doc. No. 81-16.

Sissenwine, M. P. Multispecies aspects of otter trawl catches off the Northeast Coast, USA. Northeast Fish. Mgt. Task Force Doc.

MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

No report received. The February-August reports may be included in the July-August issue.

MARINE ECOSYSTEMS DIVISION

Apex Predators Investigation

The spring edition of our newsletter, "The Shark Tagger," was prepared and mailed to 2500 cooperative fishermen.

Four shark tournaments were sampled by project personnel this month. These were held at Bay Shore, New York; Moriches, New York; Brielle, New Jersey; and Bricktown, New Jersey. Approximately 400 boats participated in these tournaments. Tournament results included a total of 168 shortfin mako, 36 blue, 16 sandbar, 14 tiger, 9 thresher, 3 scalloped hammerhead, 2 dusky, and 1 white shark, as well as 1 bluefin tuna. Compared to previous years, there was a distinct change in species composition with shortfin makos replacing blues as the dominant shark species. The large number of thresher and tiger sharks was also unprecedented. June surface temperatures were generally warmer in the Middle Atlantic Bight, and the effects of a large Gulf Stream Eddy (No. 81-C) may in part explain the change in species composition of sharks this spring.

Catch information at the tournament included length, weight, and sex ratio data. Examinations of stomachs and samples of reproductive organs and vertebrae for age studies were also obtained. Results of stomach examinations showed that short-finned squid (*Illex illecebrosus*) was predominant in the blue shark, and also occurred in tiger and thresher sharks. Other food items included American sand lance, bluefish, goosfish, little skate, and a chunk of marine mammal flesh. Liver and flesh samples were taken from 20 blue, 17 mako, and 8 sandbar sharks to determine seasonal differences in caloric content. Approximately 100 sharks were tagged and released during the tournament. For June, a grand total of 1000 sharks were tagged by sport and commercial fishermen.

Casey and Hoey analyzed catch data for sharks and prepared species lists by region for several areas along the East Coast. These data, together with background information, were submitted to the Southeast Fisheries Center for use in developing a fishery management plan (FMP) for sharks.

Wes Pratt finished reading shortfin mako vertebrae and entered the data into an automatic data processing (ADP) file for back-calculation. Results of June-caught tournament makos will be added to the length-frequency data base, and two recaptured makos will be entered into the tag-recapture analysis.

Alan Lintala has brought our histological processing of reproductive samples up to a real-time basis. He is now working on the June 1981 tournaments.

In June, we received information on 23 tag returns including 15 from blue sharks, 4 from mako sharks, 2 from nurse sharks, and 1 each from tiger and sharpnose sharks. Six of these were returned at tournaments where staff biologists obtained accurate length and weight measurements. These measurements provided important growth data.

Of the blue shark recaptures, only one was free for 12 mo, seven were free from 9 to 11 mo, and the remainder were free for less than 30 days. Four of the fifteen recaptures traveled distances greater than 100 mi. The rate of travel for one of these was 27.3 mi/day (300 mi westerly in 11 days) which is one of the fastest rates shown by a tagged blue shark. The longest distance traveled was 2150 mi in 10 mo by a blue shark tagged by Captain Frank Mundus off Montauk, New York, and recaptured 430 mi east of Trinidad by a Korean longliner. This is the second recapture from this longliner (he returned a longfin mako last year), and in both cases he has taken the time to measure the fish for us.

Two of the four mako recaptures were tagged off Cape Hatteras and moved north-east to the Southern New England Coast and the Middle Atlantic Bight. The other two makos were tagged by Stephen Connett aboard the R/V Geronimo and moved in a westerly direction from south of Nantucket inshore to the Middle Atlantic Bight off Long Island. Good growth information along with two "backbone" samples were obtained from these recaptures.

The tiger shark, sharpnose shark, and nurse shark recaptures showed very little movement even though time at liberty exceeded 1 yr in all-cases. Excellent growth information with measurements at both tagging and recapture was obtained from one of the nurse shark recaptures.

Larval Fish Dynamics Investigation

Population Processes

All of May was spent preparing for Albatross IV Cruise No. AL 81-05 which was carried out during 18-30 May by members of the Larval Fish Dynamics and Plankton Ecology Investigations (i.e., Greg Lough, Dave Potter, George Bolz, Roz Cohen, Hal Merry, Peter Donnelly, Randy Goodlett, Philip LeBlanc, Donna Busch, Joe Kane, and Jacquelyn Frisella). Bill Michaels (Benthic Dynamics Investigation) and Roger Clifford (Manned Undersea Research and Technology Program) also participated in the cruise.

A broad patch of mostly haddock larvae with fewer Atlantic cod larvae was located by grid-survey sampling with bongo nets on the southeastern part of Georges Bank (centered on 41°00'N, 67°20'W). The patch resided for the most part between the 60-m and 100-m bottom contours (the well-mixed shoal region and the shelf/slope front region), and extended about 30 mi in a northeast-southeast direction, paralleling the bottom contours in this region. Larval gadid densities ranged from about 100 to 1500/10 m² within the patch. The mean length of the haddock larvae was 6 mm and cod larvae 10 mm, indicating that these larvae most likely were from the same populations observed on the previous cruise [Albatross IV Cruise No. AL 81-03 (23 April - 1 May)] which were originally located to the northeast. The highest

densities of larvae appeared to be located at mid-depth stations (60-80 m) with indications that larvae were being transported in a general southwest direction as well as into the shoaler regions (<60 m) just east of Little Georges. The dominant zooplankters were Calanus finmarchicus copepodites, Pseudocalanus sp. copepodites and adults, and Oithona sp. copepodites and adults. A dense hydroid bloom was observed in waters less than 60 m deep. The water column was well stratified at the beginning of the cruise in waters deeper than 60 m, with surface temperatures at 10°C and bottom temperatures at 6°C. At the first fine-scale station (40°55.5'N, 67°13.5'W), which had an 80-m bottom depth, a strong thermocline was observed from 10 to 20 m. Fish larvae and the larger zooplankton were observed to reside predominantly in the upper 20 m of the water column, associated with the thermocline. Also, the chlorophyll-a vertical profiles showed an increased concentration above 20 m (2-3 mg/m³) compared to deeper depths (0.7 mg/m³).

A storm swept the area with high northeasterly winds (35-40 knots). Upon resuming operations at the same site 2 days later, we found the entire water column well mixed (ca. 7°C). The fish larvae and zooplankton now were distributed throughout the water column without any apparent stratification as observed prior to the storm. Chlorophyll-a values were uniformly low (<1 mg/m³) from surface to bottom. After 48 hr on the same site, there was some surface warming. A shallow thermocline formed at about 5 m, which suggested that at this rate it would take about 2-3 wk of calm, sunny weather for the water column to restratify to the same degree observed prior to the storm.

A shoal water station (50-m deep) was occupied for 24 hr at 41°06.6'N, 67°35.6'W, in the region where gadid larvae were believed to be carried into the shoaler part of Georges Bank. Observations made here showed the water column to be well mixed and the larval fish and zooplankton to be distributed broadly throughout the water column. Chlorophyll-a vertical profile concentrations were somewhat higher at the shoal station (1-2 mg/m³) with a noticeable increase in the bottom few meters. Fifty percent of the chlorophyll-a values were attributed to the nanoplankton component (<20 μm) which agreed with the particle-size distribution observed in the water-bottle samples. The dominant netphytoplankton species (>64 μ) were Chaetoceros sp., Peridinium sp., and Ceratium sp.

Drogue studies were conducted for 24.8 hr at the first fine-scale station (80 m) and at the shoaler station (50 m) located to the northwest. Both drogues were set to drift at 20 m. At the end of two tidal cycles, residual current drift at the deeper station was estimated as 13.7 cm/sec to the east, and at the shoaler station 3.9 cm/sec to the northeast.

Four MOCNESS-10 (10-m version of the standard multiple opening-closing net and environmental sensing system) haul stations were made at the end of the cruise (28 and 29 May) on a transect from the southeast to northwest corners of the original grid survey. Relatively few organisms were collected in the MOCNESS-10 hauls at any station; however, a number of juvenile fishes and one squid were retained. At the southeast station (40°46'N, 67°00'W, 100-m bottom depth), high temperature (>20°C) and salinity (35.74 ‰) values were observed in the upper 15 m. The temperature profiles at this station were extremely variable and changed rapidly within a few kilometers of hauling distance down to a depth of 50-70 m where the temperature was 6.3°C isothermal to the bottom. This warmer surface layer extended onto the bank at least 10 nautical miles inside of the 100-m contour

(80-90 m bottom depth) to the site of the first fine-scale station work at the beginning of the cruise. Following the cruise, it was learned from AEG (Woody Chamberlin) that Gulf Stream Eddy 81-C was reforming near the southern edge of Georges Bank which would explain the high-temperature water residing there as well as the northeasterly set of the drogues observed the previous week. Warm-core rings typically have a clockwise circulation when well organized.

Marine birds were collected using the ship's launch on 25, 27, and 29 May. Red phalaropes were feeding primarily on gadid eggs, but some were selecting Calanus adults, copepodites, and larval fish. Wilson's petrels were feeding on adult Pseudocalanus and Calanus copepodites. Greater shearwaters had parts of squid in their stomachs, indicating they were feeding at night. Red phalaropes were most abundant in shelf-break areas and appeared in greatest densities at the shelf/slope front prior to the storm of 22-24 May. The day after the storm, large flocks (hundreds) were recorded further onto the bank. Storm petrels were common throughout the cruise, but there was no apparent correlation with their distribution and the shelf/slope front.

Greg Lough prepared an ICES Larval Fish Ecology Working Group report on larval haddock and Atlantic cod survival studies on Georges Bank to be presented by Ken Sherman in Lowestoft during 1-3 July 1981, and he helped George Bolz and Rosalind Cohen prepare abstracts of papers for the annual ICES meeting on: (1) ichthyoplankton abundance, diversity, and spatial patterns in the Georges Bank-Nantucket Shoals area for the autumn and winter seasons of 1971-77 (Bolz and Lough); and (2) larval Atlantic herring food habits over the spawning seasons of 1974-76 (Cohen and Lough).

Roz Cohen completed final manuscript revisions on the copepod length-weight relationships which were accepted by the Journal of Northwest Atlantic Fishery Science and also a manuscript on the use of particle counters in plankton research which was a term paper requirement for Dr. Peter Wiebe's course on "Zooplankton Ecology" at the Woods Hole Oceanographic Institution (WHOI).

Experimental Studies

All larvae received this year as part of the NMFS-US Fish and Wildlife Service (USFWS) study of the effects of existing contaminant burdens on the viability of striped bass larvae, have been reared through the initial 28-day period. These included fish from the Anticoke River, the Choptank River, and the Brook Hatchery. Daily mortality counts were taken on two replicates from each spawn through day 28. Mortality appeared to be much lower than last year. Samples were taken for analysis of RNA, DNA, protein, and nucleotide content on days 7, 10, 14, 21, and 28. Moribund fish were sampled daily. Analysis of samples for RNA, DNA, and protein content is continuing and should be completed within a month. Development of methods for separation and quantitation of nucleotides in larval tissue using high-performance liquid chromatography is in progress. This procedure will allow us to estimate the adenylate energy charge and the size of the total adenylate pool. The adenylate energy charge is a measure of the status of energy-yielding and energy-using processes in an organism and has been used as an indicator of condition in a wide variety of organisms.

Construction of the swim speed/stamina testing apparatus was completed and initial testing begun. Joel Bodammer from the Oxford Laboratory spent a week at

the Narragansett Laboratory working with striped bass larvae. Samples of starved and fed larvae were preserved for studies of ultrastructure at Oxford.

Sorting and counting of plankton samples from Soviet R/V Evrika Cruise No. 80-02 were continued. Additional Atlantic cod and haddock larvae were collected and frozen for biochemical analysis on the second larval dynamics process-oriented cruise.

Larry Buckley completed the first draft of a paper, "Some Effects of Temperature on Growth and Biochemical Composition of Larval Winter Flounder (Pseudopleuronectes americanus)," for the fall ICES meeting.

Ecosystem Dynamics Investigation

Wendell Hahm ran simulations with the computer model GEORGE to assess the sensitivity of the system to feeding, fishing, and recruitment parameters. Further work with the feeding interaction program, FEED, aided in the selection of size-class intervals for prey species. Ed Cohen completed calculations of food requirements for five species of fish by age (Atlantic cod, haddock, silver hake, pollock, and yellowtail flounder) on Georges Bank. The yearly consumption of these species, by age, was also determined and compared to benthos, zooplankton, and fish production. The five species eat about 12% of the yearly production of the zooplankton and benthos, and twice the production of the fish stocks on Georges Bank. There are indications that juvenile silver hake are a predominant prey of adult silver hake. Ed Cohen also determined the initial conditions of fish and invertebrate biomass production for GEORGE, and supplied growth equations from the literature for the five species in the model.

Marv Grosslein completed drafts of sections on fish fauna and fish production for the chapter of the Elsevier Scientific Publishing Co.'s book on shelf ecosystems; he also reviewed a paper on California estuarine faunal studies and a Sea Grant proposal for ecosystem studies in the Gulf of Maine.

Mike Pennington completed his ICES paper on the variability of egg abundance estimates from plankton surveys, and together with Marv Grosslein, prepared a proposal for contract work by Woolcott Smith (a WHOI statistician) this summer on multivariate time-series analysis of stock/recruitment and environmental data. Mike also completed a paper for ICES on estimating average food consumption from stomach contents of fish caught on MARMAP surveys.

Ed Cohen worked on two manuscripts for ICES--one on estimates of food consumption for five major fish species on Georges Bank using Pennington's generalized model, and one on the use of food habits studies in multispecies assessments.

Wendell Hahm worked with Joan Browder (Southeast Fisheries Center), Tom Leschine (WHOI), and Jack Finn (University of Massachusetts) on flow analysis of Browder's shrimp fishery model for the Gulf of Mexico. Wendell modified Finn's flow analysis programs to run on the WHOI computer, and he also modified GEORGE to generate output flow matrices to the FLOW program for analysis.

John Hauser completed debugging the Fager/Table/Diversity Index program for Roz Cohen and produced Fager/Diversity data for 15 cruises from the 1971-77 larval

Atlantic herring surveys under the auspices of the International Commission for the Northwest Atlantic Fisheries (precursor of NAFO). John also prepared an additional program to produce Fager/Diversity data for copepods only and generated these outputs for the same 15 cruises.

Marv Grosslein helped draft an NEFC-WHOI Cooperative Research Agreement which includes descriptions and budgets for several projects (experimental enclosures, warm-core rings and related apex predator studies, and the Georges Bank monograph); he was the official NOAA/NMFS member of a Sea Grant site review team at WHOI. Marv Grosslein also drafted the Marine Ecosystems Division portion of the FY 1982-83 MARMAP Program Development Plan. As NEFC representative, Marv Grosslein participated in a number of meetings of the Editorial Subcommittee of the Georges Bank Study Committee, and assisted with the development of the outline, format, writing teams, etc., for the joint NMFS-WHOI-etc., monograph on Georges Bank.

Benthic Dynamics Investigation

Tom Morris reviewed the literature on fish meristics and morphology relative to feeding ecology, and began making measurements on frozen fish specimens he requested from the spring bottom trawl survey.

Ray Bowman completed first drafts of papers dealing with: (1) the distribution and abundance of 15 juvenile fish species from the Northwest Atlantic for 1975-79, and (2) the stomach contents of 24 fish species from Cape Cod or Massachusetts Bays caught during 1972-78, as part of the Massachusetts Bay Biome Program. Ray also analyzed stomach content data from 369 fish obtained during Albatross IV Cruise No. AL 81-02.

Rene Eppi, a summer employee, began analyzing the stomach contents of flatfishes collected on Soviet R/V Evrika Cruise No. 80-05.

Bill Michaels completed his work on the vertical distribution and biology of the chaetognath Sagitta elegans on northeastern Georges Bank and presented the results at an Ecology of Oceanic Zooplankton class he is attending; he is continuing the analysis of 1973-76 feeding ecology data. Bill participated on Albatross IV Cruise No. AL 81-05 during part of the month.

Brian Powers, a volunteer from Holderness School in Plymouth, New Hampshire, assisted in the analysis of spring 1981 feeding ecology data.

Roger Theroux continued editing the final draft of the northern benthic biomass report and completed a draft of the "Benthos" section for the "Continental Shelf Ecosystem Off the Northeast Coast of the US" chapter for the Elsevier Scientific Publishing Co.'s series on world ecosystems. Roger also did some further editing of the laboratory reference document by Don Maurer and Roland Wigley on the macrobenthos of the "mudpatch" south of Martha's Vineyard. He also translated several ICES abstracts into French for Mike Pennington and Greg Lough.

Ray Bowman continued work on food habits data with focus on diet overlap studies on samples collected aboard the Polish R/V Wieczno off Cape Cod in 1976, and yellowtail flounder feeding periodicity from Evrika samples taken in 1980. Ray prepared an outline on the status of information for food habits of juvenile fishes and completed a rough draft of a paper on sources of variability in fish feeding studies.

Four summer students began work in the Benthic Dynamics Investigation during June. John Malone (Roger Williams College) will assist Roger Theroux in invertebrate studies, and René Eppi and Wendy Stephenson (State University of New York at Stony Brook) and Judy Scanlon (Roger Williams College) will assist Ray Bowman with food habits research.

Ichthyoplankton Investigation

Our spring survey on Delaware II got underway towards the close of the month. We began in the Gulf of Maine where personnel from the Resource Assessment Division completed their spring bottom trawl survey while we were sampling ichthyoplankton. Because of limited quarters for scientific personnel on Delaware II, nutrients and primary productivity measurements were not taken on the first leg of the survey. Ichthyoplankton catches along the western part of the Gulf were dominated by eggs and larvae of Atlantic mackerel. Young fish were scarce to absent in the eastern and central Gulf. After a 2-day break at the end of the month, the survey will resume on Georges Bank with the standard suite of MARMAP Survey I collections. John Sibunka, Chief Scientist, and John Antonellis are representing this investigation.

Our May-June MARMAP survey ended off Chincoteague, Virginia, on 18 June when an untimely vessel breakdown caused the Delaware II to put in at the National Ocean Survey's Atlantic Marine Center in Norfolk, Virginia, 2 days before the cruise was scheduled to end. Temporary repairs were not possible so the survey did not resume. Atlantic mackerel larvae occurred sporadically in low densities in the Gulf of Maine. On Georges Bank we found light-to-moderate concentrations of larvae of Atlantic mackerel, yellowtail flounder, Atlantic cod, haddock, and Urophycis spp. hakes. Silver hake, fourbeard rockling, Atlantic mackerel, and yellowtail flounder larvae numerically dominated off Southern New England where larvae of warmwater species (carangids and bothids) occurred at stations along the shelf break. At the close of the month, Don McMillan and Doris Finan were participating on the traditional summer bottom trawl survey to collect plankton samples in the Middle Atlantic Bight. They will be replaced by Myron Silverman and Tom McKenney when the cruise resumes after the July 4th break.

Our lab efforts largely represent a continuation of work from last month. Final charts depicting the distribution and abundance of larvae collected during 1977-79 are in preparation for yellowtail flounder, silver hake, bluefish, and Urophycis spp. hakes. Pete Berrien completed an assessment of the spawning stock biomass for yellowtail flounder based on survey collections of eggs in 1977. Cindy Fahay finished a similar assessment for silver hake, using eggs collected in 1979. Each has prepared a research document for the fall ICES meeting at Woods Hole. Assessments of bluefish and haddock are in progress.

Plankton Ecology Investigation

Joe Kane spent May at sea aboard the Gloucester Laboratory's R/V Gloria Michelle, sampling plankton in shallow water during a Nantucket Shoals experiment, and aboard Albatross IV Cruise No. AL 81-05.

Jack Green was aboard Albatross IV during the Nantucket Shoals experiment, and with the assistance of Amy Friedlander and Janet Hess, sampled zooplankton

around Nantucket Shoals. The remainder of the month was spent in sorting and storing gear and preparing for an ICES contribution.

Krill samples taken along the north side of Elephant Island (Antarctic) have been volumized and early and adult stages have been separated. Aliquots are being made in preparation for processing with the Bausch and Lomb Image Analyzer as well as for microscopic verification. Bad weather ruined an attempt to field-test the acoustically operated opening and closing plankton samplers from the Gloria Michelle. Another try will be made in early June.

Donna Busch acted as rapporteur for a meeting of Standing Committees on Recruitment Processes and Ecosystem Productivity held at Narragansett on 3 June. She contributed chlorophyll-a data for inclusion in an ICES working group paper on larval fish studies, and in an ICES paper on copepod grazing rates. She also revised a contribution to a book chapter on the continental shelf ecosystem off the Northeast Coast of the United States.

Joe Kane has continued his work on larval Atlantic cod and haddock feeding from Eureka Cruise No. 81-02. Joe met with Peter Donnelly, Randy Goodlet, and Phil LeBlanc to discuss the techniques Joe is using for his identification of larvae and gut contents. Paul Foffanoff and Randy Goodlet discussed taxonomy of nauplii from pump samples.

Biostatistics

Lorrie Sullivan ran approximately 100 ichthyoplankton dominance reports covering 1977-80 by survey and by area for Wally Smith. Tom Plichta continued statistical analysis work for the apex predators studies.

Paula Caito came on board for the summer. She will be converting data from the MARMAP Information System (MIS) to unit-record tape files so that we can move the data to a new computer. Lorrie Sullivan, Paula Caito, and Steve Eldridge updated 245 stations with information on zero abundance of larvae. Lorrie Sullivan then re-extracted all 1977-80 ichthyoplankton data from the MIS, assigned area and season codes, and ran Fager statistics (indexes of dominance) by area, by season, and by year for Wally Smith. Tom Plichta continued applying the Statistical Analysis System to shark data for Jack Casey. Tom Plichta, Steve Eldridge, and Bob Sand: (1) corrected flowmeter serial numbers and added calibration factors to eight master files; (2) updated the zooplankton count key in several master files; (3) corrected severe structural error in four master files involving aliquot and measured number of ichthyoplankton larvae; (4) put in, quality checked, and edited station information and gear information for the AL8101 master file; and (5) put in, quality checked, and edited ichthyoplankton larvae data for the YV7702 master file.

Fishery Oceanography Investigation

During May, the first leg of a MARMAP cruise was completed on Delaware II Cruise No. DE 81-03 with Tom Laughton and Bob Backman making the hydrographic observations. Analysis of the salinity samples from the earlier MARMAP cruise on the NOAA R/V Kelez and the larval dynamics cruise on Albatross IV was also completed.

Derek Sutton and Steve Ramp have begun processing wind data from NOAA Buoy 44003 for use in continued analysis of the "flux-line" current measurements. Figures of the numerous hydrographic sections made during this same experiment were also completed during May.

During June, the third leg of the MARMAP survey (Delaware II Cruise No. DE 81-03) was completed with Dan Patanjo and Bob Backman making the hydrographic measurements. The salinity samples and bottom temperature plots for the entire cruise were also completed. Investigators from the Lamont-Doherty Geophysical Observatory, Ric Fairbanks and Ted Baker, expressed interest in the MARMAP sampling and took samples from the salinity bottles of Delaware II Cruise No. DE 81-03 for their studies. They use an oxygen-isotope (^{18}O) technique for performing water mass analysis in coastal areas. The ^{18}O which enters the system primarily through coastal runoff, is a conservative property and may be used as a tracer.

The cruise plan for the fall warm-core eddy cruise (Albatross IV Cruise No. AL 81-11) during 21 September-6 October, has been completed and preparations for the cruise are continuing. Ron Schlitz and David Mountain met with Peter Wiebe and Terry Joyce of WHOI and Glenn Flierl of the Massachusetts Institute of Technology to coordinate sampling between NEFC and these National Science Foundation-funded investigators. The Fishery Oceanography Investigation's cooperative education employees exchanged roles with Bob Backman returning to school and Chris Nadeau returning to the group. Jim King, a student fellow, also returned for the summer.

Publications

- Berman, M. S.; Jeffries, H. P.; Lambert, R. M.; Sherman, K. Environmental gradients on a coastal megalopolis II: size frequency distributions in zooplankton. Int. Counc. Explor. Sea, Comm. Mem.
- Berrien, P. Comments on efficiency of NEFC surveys. Paper prepared for ICES Larval Fish Ecology Working Group meeting. Lowestoft, Suffolk, United Kingdom; 1981 July 1-3.
- Bolz, G. R.; Lough, R. G. Ichthyoplankton abundance, diversity and spatial pattern in the Georges Bank-Nantucket Shoals area, autumn and winter seasons 1971-1977. Int. Counc. Explor. Sea, Comm. Mem.
- Buckley, L. J. Some effects of temperature on growth and biochemical composition of larval winter flounder (Pseudopleuronectes americanus). Int. Counc. Explor. Sea, Comm. Mem. (Submitted to Demersal Fish Committee.)
- Cohen, R. E.; Lough, R. G. Larval herring food habits over three spawning seasons (1974-1976) in the Georges Bank-Nantucket Shoals area. Int. Counc. Explor. Sea, Comm. Mem.
- Cohen, R. E., Lough, R. G. Proposed length-weight relationships for several dominant copepods in Georges Bank-Gulf of Maine area. J. Northw. Atl. Fish. Sci. (In press.) (A)

- Green, J. Aspects of Calanus finmarchicus trophodynamics in the area of high larval haddock abundance in spring on Georges Bank. Int. Council. Explor. Sea, Comm. Mem.
- Hoey, J.; Casey, J. Species composition and catch rates from selected longline fisheries in the western North Atlantic. Int. Council. Explor. Sea, Comm. Mem.
- Kohler, N.; Stillwell, C. Food habits of the blue shark in the western North Atlantic. Int. Council. Explor. Sea, Comm. Mem.
- Langton, R. Diet overlap of some Northwest Atlantic fishes. Int. Council. Explor. Sea, Comm. Mem. (Submitted to Demersal Fish Committee.)
- Laurence, G. C.; Howell, W. H. Descriptive embryology and the influence of temperature and salinity on early development and survival of yellowtail flounder (Limanda ferruginea). Mar. Ecol., Prog. Ser. (A)
- Lough, R. G.; Laurence, G. C. Larval haddock and cod survival studies on Georges Bank. Paper prepared for ICES Larval Fish Ecology Working Group meeting. Lowestoft, Suffolk, United Kingdom; 1981 July 1-3. 17 p.
- Obenchain-Fahay, C. L. Silver hake, Merluccius bilinearis, estimates of egg abundance and population size during spring 1979 in Gulf of Maine, Georges Bank, Southern New England and Middle Atlantic Bight water. Int. Council. Explor. Sea, Comm. Mem. (Submitted to, but subsequently withdrawn from, Demersal Fish Committee.)
- O'Reilly, J. E.; Busch, D. A. Preliminary estimates of the annual phytoplankton primary production for the Northwest Atlantic shelf (Middle Atlantic Bight, Georges Bank, Gulf of Maine). Int. Council. Explor. Sea, Comm. Mem.
- Pastuszak, M.; Wright, R. W.; Patanjo, D. One year of nutrient distribution in the Georges Bank region in relation to hydrography, 1975-1976. Int. Council. Explor. Sea, Comm. Mem. (Submitted to Hydrography Committee.)
- Pennington, M.; Berrien, P. L. Measuring the effects of the variability of egg densities over space and time on egg abundance estimates. Paper prepared for ICES Larval Fish Ecology Working Group meeting. Lowestoft, Suffolk, United Kingdom; 1981 July 1-3.
- Pratt, H. W. Disappearance of soft coral in Narragansett Bay. Coast. Oceanogr. Climatol. News 3(3):26-27; 1981. (P)
- Ramp, S.; Beardsley, R.; Schlitz, R. Eulerian current measurements in four warm core rings near the shelf break south of Cape Cod. Paper presented to American Geophysical Union Spring Meeting. Baltimore, Md.; 1981 May 25-29.
- Schlitz, R. Processes that contribute to the nutrient supply along the northern side of Georges Bank. Can. J. Fish. Aquat. Sci. (S)

Schlitz, R.; Cohen, E. A nitrogen budget for the Gulf of Maine. Int. Council. Explor. Sea, Comm. Mem. (Submitted to Hydrography Committee.)

Sherman, K.; Jones, C.; Sullivan, L.; Smith, W.; Berrien, P.; and Ejsymont, L. Congruent shifts in sand eel abundance in western and eastern North Atlantic ecosystems. Nature 291(5815):486-489;1981. (P)

Skud, B. E. Interactions between pelagic fishes and the relation of dominance to environmental conditions. Int. Council. Explor. Sea, Comm. Mem. (Submitted to Biological Oceanography Committee.)

Smith, W.; McMillan, D.; Wells, A. Changes in northeastern ichthyoplankton populations may be weather related. Coast. Oceanogr. Climatol. News 3(3): 32-33;1981. (P)

Smith, W. G.; McMillan, D. G.; Wells, A. The distribution, abundance, and production of Atlantic cod and haddock larvae off northeastern United States in 1978-79 and 1979-80. Int. Council. Explor. Sea, Comm. Mem. (Submitted to Demersal Fish Committee.)

Stillwell, C. Daily ration of the shortfin mako (Isurus oxyrinchus) in the northwestern Atlantic. Int. Council. Explor. Sea, Comm. Mem.

Stillwell, C.; Kohler, N. Food, feeding habits and estimates of daily ration of the shortfin mako (Isurus oxyrinchus) in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. (S)

Reports

Cohen, R. E. The use of particle counters in zooplankton research. Woods Hole Lab. Ref. Doc. No. 81-21. 18 p.

Lough, R. G. Larval fish trophodynamic studies on Georges Bank. Woods Hole Lab. Ref. Doc. No. 81-19. 41 p.

RESOURCE UTILIZATION DIVISION

Sampling, Harvesting, and Processing Systems Development Investigation

Research Vessel Activity

The Gloria Michelle engaged in the first two cruises of the year. Cruise GM 81-01, the Nantucket Shoals experiment, was for the purpose of studying the dynamics of phytoplankton patches on Nantucket Shoals (a joint effort with NASA). The tests consisted of sampling chlorophyll, total suspended solids, organic fluorescence, phytoplankton, nutrients, and salinity. Cruise GM 81-02, an Ocean Pulse Program (OPP) benthic ecology study, was for the purpose of conducting the Northeast Monitoring Program (NEMP) diving survey of Ocean Pulse monitoring sites with our Manned Undersea Research and Technology Program personnel on Pigeon Hill, Jeffreys Ledge, and off Block Island, Rhode Island. The crew reported both cruises were carried out with complete success.

The NOAA Fleet Inspection Office has conducted the initial vessel safety inspection of the Gloria Michelle.

The Gloucester Laboratory's other research vessel, the Rorqual, has been declared surplus. The Massachusetts Maritime Academy has indicated some interest in the vessel and a determination of its usefulness to their fisheries training program will be made.

Engineering Assistance to Other Center Programs

The contract to rebuild our shellfish assessment dredge's fixed-ramp assembly was awarded to Golten Ship Repair, Inc., of Portland, Maine. Andy Thoms from the Woods Hole Laboratory and Vern Nulk and Dan Baker from the Gloucester Laboratory went to Portland to consult with Mr. Herbert Hansen on some technical problems with the ramp assembly. It is expected that the work will be complete well before the July deadline.

Bob Van Twuyver and Dan Baker completed the May trip on the M/V Marine Evangeline for AEG.

The new notched cutting board is being introduced in local plants. Instructions were given in its use and an evaluation will be made when the workers have adapted themselves to its use. It has the proven potential to increase filleting yields by about 2%.

Tom Connors is familiarizing himself with the computer terminal and its language in order to assist in a fish plant computerization program.

Manuscripts

A first draft of, "Conservation of Energy In a New England Fishing Vessel," (Gloucester Laboratory MS. G-497) is complete.

Technology Transfer Investigation

Shellfish Analysis

Wild surf clams collected in Narragansett Bay at Point Judith were analyzed for lipids and sterols. The results of the analysis will be compared to aquacultured surf clams. Rather than concentrating on total sterol and fatty acid contents, we are shifting emphasis to the determination of the source of the fatty acid. We should be able to determine if the highly polyunsaturated fatty acids are being contributed from the phospholipids or wax esters. An intensive literature search was conducted prior to the bench work.

Work is continuing on the blue mussel and red crab storage study as well as on the study of the effects of seasonal variation on the composition of blue mussels.

Atlantic cod

A storage study to determine the shelf life of cod fillets dipped in potassium sorbate was completed. Dipping in potassium sorbate, in effect, doubled the shelf life of these fillets. The experiment will be repeated to corroborate results.

Deep-sea Red Crab

Preliminary experiments are being conducted on cleaning, blanching, and freezing of red crab for later machine extraction of the meats. This procedure simulates conditions where a fisherman has a surplus of crab and wishes to hold them for processing at a later time. At this point, freezing of cleaned, blanched bodies seems to be a feasible alternative to immediate processing, although further work must be done to determine blanching and second cook times.

Short-finned Squid

A time-motion study was conducted at a local squid processing plant in order to determine the economics of producing squid rings. Twelve workers were used to process 1400 lb of short-finned squid into 447 lb of finished squid rings. The cost per pound of finished product was \$1.25. Packaging and freezing were done separately and cost \$.04/lb.

Blue Crab

A study of the feasibility of pasteurizing blue crab meats is continuing.

Assured Quality of Frozen Fish Fillets

A third trip was made to the supermarket chain in the Albany, New York, area selling the "U.S. Grade A" frozen fish fillets. Frozen samples were brought back to the Gloucester Laboratory for examination. The surface temperatures of the frozen fish varied from -5°C (21°F) to -19°C (-2°F)-- much too high to maintain high quality frozen fish for any length of time. We are attempting to improve this situation.

The energy consumption of the new frozen-food vending machine is being monitored. The initial results show that very little energy is needed to maintain 0°F even when the small doors in front of this freezer are opened 70 times (for 18 sec each) each day to dispense the frozen fish. However, when the large door is opened for 8 min (4 min twice a day) to fill the unit, approximately 10% more energy is needed to maintain the temperature of the fish in the freezer. The machine is also being tested for its potential advantage to protect the product quality.

Manuscripts

Two manuscripts were completed and are in first draft form. Both were authored by Judith Krzynowek, Kate Wiggin, and Pat Donahue. They will be submitted to the Journal of Food Science. The articles are: "The Sterol and Fatty Acid Content of Four Species of Crabs Found in the Northeast United States," and "The Effect of Storage and Rearing Conditions on the Sterol and Fatty Acid Content of Surf Clams (*Spisula solidissima*)."

Product Quality, Safety, and Standards Investigation

Product Quality

Dogfish fillets which had been in frozen storage at 0°F for 25 wk were tested. Neither the results of chemical tests nor of taste-panel inspection indicate the

formation of any ammonia in any sample. Though rancidity is one of the most objectionable features of this fish, the pattern of its formation does not appear to be too consistent, and vacuum packaging does not seem to be offering much advantage. Amine and pH values have not changed significantly throughout this test period.

Tim Gleason, a biology student at Bates College, spent 5 wk during May and June at the Gloucester Laboratory. To satisfy the requirements for a Short-Term Internship Program, Tim completed a project which involved comparing two methods of measuring the ammonia content of dogfish. One method, a rapid kit technique, merely estimated the amount of ammonia in the sample using a comparator block, while the other method, an accurate spectrophotometric technique (Vyncke), made a precise measurement. Tim's results showed that in most cases (71%), the values for the Vyncke analysis were found to be within the range estimated by the kit technique. Another 24% of the values obtained via Vyncke's method were within one range of that determined by the kit.

Five mutant tester strains of Salmonella typhimurium for conducting the Ames' mutagenicity test were received. Master plates were prepared for current usage, and frozen permanents (stored at -80°F) were prepared for future use. The fresh cultures were subjected to the following: (1) plated on minimal agar with and without histidine to ensure that the strains still retained their histidine requirements, (2) checked for deep rough character by testing for sensitivity to crystal violet, (3) checked for presence of ampicillin-resistant R factor, and (4) checked for uvr-B deletion by irradiating with ultraviolet. The tester strains were found to have retained all these mutations. In addition, the characteristic reversion pattern of each strain was confirmed in the presence of known mutagens. Thus, the cultures we received are satisfactory for conducting mutagenicity testing.

We are again engaged in a cooperative study with the USFWS in order to resolve the assertion by some consumers that American shad taken from different rivers during their annual spring spawning run have acquired objectionable tastes; characteristic of the area where caught. Fillets from frozen, freshly caught shad from the Connecticut River, Hudson River, York River, and Delaware River are being compared via triangle taste tests to determine whether or not significant flavor differences do exist.

Several attempts were made to solubilize our membrane-bound red hake muscle TMAO-ase preparation using sodium dodecyl sulfate (SDS), a detergent. In each case, progressively more enzyme activity was lost with increasing SDS concentration as compared to a control TMAO-ase preparation containing no SDS. This is in opposition to another laboratory's finding that treatment of red hake kidney lysosomal membrane-bound TMAO-ase with 1% SDS approximately doubles enzyme activity. Alternative methods of solubilization are being evaluated.

The deadline for completion of the Association of Official Analytical Chemists (AOAC)-sponsored collaborative study of the agarose gel isoelectric focusing method has expired. Two out of 14 collaborators have yet to report their final results and thus will be eliminated from the study. The results, thus far received, are somewhat disappointing. There was an average of 83% correct. Seven out of 12 collaborators had 95-100% correct identifications and one collaborator had 80% correct. The remaining four collaborators, however, averaged only 57% correct.

After consultation with the AOAC General Referee, a decision will be made as to the future status of the method. It seems likely that further modifications in the method will be required and then another collaborative study.

A preliminary experiment was completed in which the effect of various oxygen-nitrogen atmospheres on dimethylamine (DMA) and formaldehyde (FA) production in minced red hake was tested. As expected, DMA production was maximal with storage in 100% nitrogen. There was no DMA or FA production with storage in 100% oxygen, but considerable oxidative rancidity developed. The relationship between these seemingly opposing problems (textural toughening and oxidative rancidity) will require further investigation.

Manuscripts

Two papers have been accepted for presentation at the upcoming meeting of the International Institute of Refrigeration and will be published in the proceedings of the meeting. They are: "Dimethylamine and Formaldehyde Production in Fresh Red Hake (Urophycis chuss): The Effect of Packaging Material Oxygen Permeability and Cellular Damage," by R. C. Lundstrom, F. F. Correia, and K. A. Wilhelm; and "Frozen Storage Stability of Red Hake Fillet Blocks," by J. J. Licciardello, E. M. Ravesi, R. C. Lundstrom, K. A. Wilhelm, F. F. Correia, and M. G. Allsup.

Another paper, "Induction of Enzymatic Dimethylamine and Formaldehyde Production in Minced American Plaice and Blackback Flounder Mixed with Red Hake TMAO-ase," by Lundstrom, Correia, and Wilhelm, is being prepared for presentation at the American Food Technologists Conference and will be submitted to the Journal of Food Science for publication.

The manuscript, "Extended Fresh Storage of Fishery Products with Modified Atmospheres --A Survey," by Kurt Wilhelm, has been submitted to Marine Fisheries Review for publication.

Product Safety

Polychlorinated Biphenyls

All samples received from Texas A&M University from the winter collection of 1981 have been worked up and analyzed for polychlorinated biphenyls (PCB's).

All samples collected from Los Angeles Harbor, Horseshoe Kelp, and Catalina Island have been worked up and analyzed for PCB's.

All white perch samples collected from the Cape May Peninsula have been worked up and analyzed. There was a significant difference in PCB results from those collected from PCB-laden waters (Hudson River).

The final report is nearing completion. It will be submitted to the Program Manager of the National Microconstituents Task shortly.

Polynuclear Aromatics

A great deal of work has gone into the maintenance of the Perkin-Elmer Series 3B High Performance Liquid Chromatograph. Modification of the Injection-Mode has been accomplished. A new method for the extraction of lipophilic substances, replacing the time-consuming laborious extraction with separatory funnels, was successful. This will enable the dimethylsulfoxide solvent to be replaced with acetonitrile. A mixture of acetonitrile and water is the mobile phase being used for the separation of polynuclear aromatics. Having the final extract in acetonitrile will obviate many problems in the analysis of polynuclear aromatics (PAH's). I was successful in finding one excitation and emission wavelength for the detection of PAH's by fluorescence. Before, it was necessary to have an operator watching the instrument to make the change at the appropriate time. Three separate excitation and emission wavelengths were used previously. The only PAH's not being detected are acenaphthylene and indeno-1, 1, 3-cd pyrene. These are being detected by ultra-violet light.

Manuscripts

Work was started on a manuscript on PCB's. The introduction, methodology, and bibliography have been written.

Product Standardization

Drafts of "Proposed U.S. General Standards for Grades of Fish Steaks" and "Proposed U.S. General Standards for Grades of Shrimp" are being currently reviewed by the NMFS Central Office. The standards will be published as a "Notice of Proposed Rulemaking" in the Federal Register. Initial drafts of "Instructions for Grading" with these standards are being prepared.

An initial draft of the "Proposed U.S. Standard for Grades of Frozen Fish Portions and Fish Sticks" has been distributed for review and comment to the USDC Inspection Service and others who are interested.

We have reviewed and commented on a draft final report titled, "Consumer and Instrumental Edibility Measures for Grouping of Fish Species," from the US Army's Natick (Massachusetts) Laboratories. We also reviewed and commented on a supplement to this report which compared 17 species from the families Lutjanidae and Scorpaenidae.

The US Army Academy of Health Sciences has transferred the preparing activity responsibility for Federal Standard 369: "Sanitation Standards for Fish Plants" to the Gloucester Laboratory. The transfer is based upon the "Memorandum of Agreement" between the USDA and USDC regarding preparation of fishery products standardization documents.

John Ryan and Joseph Carver presented three fishery products at the 13-14 May meeting of the Armed Forces Product Evaluation Committee held at the US Army's Natick Laboratories. These products were: (1) cusk fillets; (2) surf burger composed of Atlantic cod, pollock, silver hake, clams, shrimp, and crab meat; and (3) fish portions containing Pacific hake. The cusk fillets were well received.

Copies of a market research and analysis questionnaire were received from the USDA and distributed to 25 large food service organizations and to 41 state instit-

utions. When complete, results will be statistically evaluated and incorporated into the "Commercial Item Description for Canned Salmon." A second series of questionnaires is being prepared for breaded portions.

A study was done on drained weight determination of block frozen shrimp according to the AOAC method used in the proposed "U.S. Grade Standard for Shrimp." When recovered, drained weight of the shrimp was compared with input weight. Considerable variation in results among individual samples was obtained. When all 15 samples were averaged, input weight agreed closely with recovered weight.

Technical Assistance

Information and technical assistance were provided in the following areas: nutritional value of fish, fish processing and sanitation, fish storage, smooth dogfish, minced fish, fish dealers, quality standards, mussels, use of alginates in minced fish, sources of supply of fish frames for a deboning operation, salting of anchovies, identity of species of spiny lobsters, objective methods for texture determination, grading seafood, fish preparation and distribution, labeling of grenadier, use of the Torrymeter and other quality tests, storage life of frozen fish, bluefish, use of a modified fish heading and gutting machine, the use of chlorine in a processing plant, trawl nets, shipping fresh fish in insulated containers, fish hold design, vessel corrosion, tuna pounds, tub trawling and gill-netting, and fish pots.

DIVISION OF ENVIRONMENTAL ASSESSMENT

Biological Oceanography of Stressed Ecosystems Investigation

Seabed Metabolism

Bill Phoel and Steve Spina participated in a cruise to the Bering Sea aboard the University of Alaska's R/V Alpha Helix to obtain rates of seabed oxygen consumption and nutrient regeneration for comparisons with NEMP/OPP station values. The plan of the cruise was to occupy a series of stations along a 500-km transect across the southeast Bering Sea shelf in order to investigate the processes that contribute to the production of enormous numbers of animals in secondary and higher trophic levels in the vast region of the sea extending over the outer continental shelf.

Vertical casts for conductivity, salinity, temperature, and depth were made at all stations, and seabed metabolism measurements were obtained from eight stations approximately 65 km apart (from 8.5 m of depth inshore to 161 m of depth offshore). Cores for phaeo-pigment profiles with sediment depth were obtained at nine stations and provided to Brookhaven National Laboratory (BNL).

At two stations (#7 and #11), moored current meters, previously deployed by the University of Washington, were recovered and both floating and moored sediment traps were deployed by BNL to determine the flux of organic material from the water column to the benthos.

Seabed metabolism measurements were obtained at the sediment trap sites in order to investigate the correlation between the flux of organic matter to the seabed and the oxygen consumption rates of, and nutrient flux rates by, the seabed.

The rationale for this experiment was to compare the measurements from this extremely productive wide shelf with those from the narrower East Coast shelf and Georges Bank.

While upwelling is an important source of nutrients on the outer Bering Sea shelf, it may contribute few of the nutrients necessary to support the high productivity of the middle and inner shelves. Three fronts have been found to exist which divide the shelf into the outer, middle, and inner components. If upwelling does indeed contribute minimally to the nutrient requirements of the middle and inner shelves, then regenerative processes in the water column and sediments must be the source of these nutrients; by measuring the rate of nutrient regeneration by the seabed, its contribution to primary productivity can be estimated.

By converting oxygen consumption to carbon utilization we should be able to estimate that fraction of pelagic production which is consumed by the seabed and compare this relatively pristine area with both impacted and unimpacted East Coast areas.

An article regarding Bill's development of a diving system for polluted water was published in the May issue of Soundings, a popular monthly concerned with boating and the water environment.

Total Plankton Respiration

Jim Thomas and Craig Robertson participated in the Nantucket Shoals experiment from 5 to 16 May to survey the distribution of total plankton respiration around Nantucket Shoals as influenced by upwelling from the Gulf of Maine and turbulence on the Shoals themselves. It appears that respiration during this period was relatively low to moderate and nearly homogeneous vertically due to mixing, except west of the Shoals. Values were 6-8 ml-O₂·m⁻³·hr⁻¹ in the Gulf of Maine, 1-3 ml-O₂·m⁻³·hr⁻¹ on top of the Shoals, 10-14 ml-O₂·m⁻³·hr⁻¹ in near-surface water, and 5-8 ml-O₂·m⁻³·hr⁻¹ in subpycnocline water on the western side of the Shoals. An upwelling area on the northeastern side of the Shoals was defined based on temperature. Surprisingly, the lowest respiration measurements occurred where turbulence was highest over the top of the Shoals. Analysis of the data and comparison with phytoplankton productivity, biomass, and species composition will continue.

Additionally, our Subtask is completing a paper, "Total Plankton Respiration in the Chesapeake Bay Plume" for the proceedings of the Superflux Symposium.

Phytoplankton Growth Potential

Algal assay of water samples from NEMP/OPP stations was continued. Data on 16 samples from four stations revealed a consistent metals scarcity followed in importance by nitrogen limitation. There was also occasional partial limitation by phosphorus. The metal deficiency was relieved completely or partially by iron; additions of manganese occasionally had slight effect.

The pronounced trace metal limitations of phytoplankton growth in most of the NEMP/OPP samples assayed thus far have prompted increasing attention to this aspect. After initial runs, the assay was expanded to include tests of a chelator, EDTA (ethylenediaminetetraacetate), and single additions of iron and manganese.

Iron proved to be most important in relieving the metal limitation. It now seems timely and prudent, however, to minimize a possible major experimental error, namely, loss of metal from the seawater through adsorption on culture vessel walls. A silicopolymer treatment of the glassware was recommended by Dr. Stanton Erickson of the EPA's Gulf Breeze (Florida) Laboratory.

We hosted a visiting scientist from Sweden, Dr. Lars Edler of Lund University. Dr. Edler is visiting several laboratories in this country to review known information on phytoplankton blooms and related low-oxygen events. A bloom in which *Ceratium tripos* was one of the dominant species occurred off the western coast of Sweden in autumn 1980. The bloom may have been the cause of bottom-water hypoxia and consequent mortalities of bottom animals and avoidance of the area by Atlantic cod. Dr. Edler presented a seminar on the bloom and discussed the ecology of similar events in the New York Bight, as well as monitoring strategy, with Sandy Hook Laboratory staff members and scientists from other New York and New Jersey laboratories.

Phytoplankton Community Structure

A paper, "Phytoplankton Community Structure in Northeastern Waters of the United States. II. November 1978," by Dr. Harold G. Marshall of Old Dominion University and Myra S. Cohn of the Sandy Hook Laboratory, listing phytoplankton species identified during that month from Cape Hatteras to Nova Scotian waters was sent to Dr. E. M. Hulbert at WHOI for review prior to being submitted for publication as a NOAA Technical Memorandum NMFS-F/NEC. Dr. Hulbert's comments have been received and are highly favorable overall. These comments are being addressed.

Samples were collected on the Nantucket Shoals experiment cruise and will be processed at Old Dominion University. One hundred-twelve samples from this 21 May-17 June 1981 survey have been concentrated and stored in vials waiting to be analyzed.

Myra Cohn has completed examination of phytoplankton community structure for samples collected on the winter 1979 OPP survey (3-18 December 1979). The data have been submitted for computer analysis along with Dr. Harold Marshall's data from the same survey.

Remote Sensing

A joint NEFC/NASA Nantucket Shoals experiment was conducted during 5-16 May 1981. NASA flew two aircraft: (1) a NASA P-3 carrying an Airborne Oceanographic Lidar fluoroscensor, L and C-band microwave sensors for salinity and temperature, a Multichannel Ocean Color Scanner for chlorophyll and suspended sediment, a PRT-5 for temperature, and a T-11 camera to take color and infrared photographs; and (2) a NASA Learjet carrying an Ocean Color Scanner for chlorophyll and suspended sediment. Six different research vessels participated in the experiment to gather sea truth and examine the water column vertically to enhance the interpretability of the remote sensing. The objectives of the experiment were to: (1) quantify the variability of thermal and phytoplankton features over spatial scales of 0.01-100 km and temporal scales of 0.1-10 days; (2) determine the feasibility of using passive and active remote-sensing techniques to verify, calibrate, and augment satellite imagery (Coastal Zone Color Scanner) for temperature, chlorophyll, suspended solids, and light attenuation; (3) quantify relationships between physical and biological processes controlling plankton patchiness and the ecosystem structure on Nantucket Shoals; (4) investigate relationships between Lagrangian and Eulerian current measurements in a region of complex bottom topography; and (5) examine the importance

of persistent upwelling-related production on marine ecosystem structure and function. The experimental program was based on the realization that aircraft remote sensors can provide the synoptic coverage required as a prerequisite to relate spatial distributions of biological and physical properties with spatial and temporal variations in biological and physical process rates that are time consuming to measure and can only be measured on a in-situ surface ship platform. Based on early results, the experiment was a complete success. A data exchange meeting is planned for late July 1981.

Additionally, this Subtask is completing a major technical report concerning all of the oceanographic measurements made during Superflux 1980.

Environmental Chemistry Investigation

During the April-May OPP survey aboard the NOAA R/V Kelez (Cruise No. KE 81-04/05) samples of sediment were collected in triplicate at 30 stations for trace metal analyses. Three additional stations in the proposed drilling area on Georges Bank were established and sampled for trace metals. Samples of tissues from sea scallop (300 samples), yellowtail flounder (115 samples), winter flounder (71 samples), windowpane (30 samples), and ocean quahogs (18 samples) were also collected during this survey for trace metal analyses.

We received samples of sediments and particulate material, caught in floating and stationary sediment traps, for metal analyses by members of the BNL and Bill Phillips of the Sandy Hook Laboratory during their March Hudson River plume study aboard the WHOI R/V Knorr. Additional noncontaminating hot plates and fume hoods were constructed to increase sample handling capabilities.

Trace metal analyses continued on sea scallops collected during OPP surveys on Delaware II Cruise No. DE 80-09 and Albatross IV Cruise No. AL 80-07. Data on trace metals in sediments and tissue collected during the August 1980 NEMP survey of contaminants in the New York Bight were submitted for keypunching. Vincent Zdanowicz and Tony Ruiz completed setup and calibration of a new mercury analyzer, and prepared and cleaned sample containers to be used for trace metal and hydrocarbon samples to be collected during the July OPP survey.

Approximately 7000 analyses of seawater nutrients (nitrate, nitrite, phosphate and silicate) were made in May and June, completing sample analysis for Albatross IV Cruises No. AL 80-10, AL 80-12, and AL 81-01, and Delaware II Cruise No. DE 80-01. Also, 450 seawater filtrates from the recent Delaware II Cruise No. DE 81-03 were analyzed for ammonium.

Robert Fitzgerald, Jim Duggan, Ralph Bruno, and Jim Nickols participated in the May-June MARMAP survey on Delaware II Cruise No. DE 81-03. Concentrations of chlorophyll-a and phaeophytin-a were measured in netphytoplankton (>20 μm) and nanophytoplankton (<20 μm) throughout the water column at 148 stations, and primary productivity was measured throughout the euphotic layer at 25 stations.

Jay O'Reilly and Chris Evans-Zetlin prepared a paper for the October ICES meeting titled "The Relationship Between Surface and Average Water Column Concentrations of Chlorophyll-a in the Northwestern Atlantic Shelf Water." Jay O'Reilly and Donna Busch (Narragansett Laboratory) prepared an ICES paper titled "Preliminary

Estimates of the Annual Phytoplankton Primary Production for the Northwestern Atlantic Shelf (Middle Atlantic Bight, Georges Bank, Gulf of Maine)."

Dr. Steven Esser of the New Jersey Marine Sciences Consortium and Jay O'Reilly continued to monitor spring densities of Ceratium tripos and other large species of phytoplankton. A report was published in the spring issue of Coastal Oceanography and Climatology News.

Behavior of Marine Fishes and Invertebrates Investigation

For the past 20 mo, this Investigation has studied the behavioral ecology and life history of juvenile red hake. The program has included a monthly sampling program of juvenile red hake living in symbiotic association with sea scallops. The 1.5-yr sampling program, completed in June, demonstrated that the hake inhabited the scallops on a seasonal basis. The first recruits to the scallop bed initially descended from the plankton in early fall; recruits continued to descend to the benthos through early winter. The heaviest recruitment occurred in October and November. Individual juveniles outgrew the symbiotic association within 2-3 mo; most hake emigrated from the scallop bed by early summer. During the summer months no hake were present on the scallop grounds.

Preparations are underway for a study on the sublethal effects of oiled sediment on selected behaviors of the sand worms Nereis succinea and N. virens. This study, done in cooperation with Battelle, Pacific Northwest Laboratories, and funded through the OPP, is a continuation of a research effort by this Investigation to determine the effects of petroleum hydrocarbons on selected key marine invertebrates and fishes. Techniques previously developed for the blue crab and Dungeness crab will be modified to use in determining possible interference with normal chemosensory capabilities, an important component in these species' feeding behavior.

Coastal Ecosystems Investigation

Benthic Community Structure

Clyde MacKenzie and Dave Radosh continued their in-situ studies of the surf clam bed off Rockaway, Long Island. Suction samples were collected to assess growth, predation, and nonpredatory mortality. Trays with azoic sediments were deployed to test changes in design from last year's experiments on effects of sediment contaminant levels on clam spatfall, and to prepare for similar studies this summer. Some clams were transferred from Rockaway to off Swinburne Island in lower New York Bay to determine changes in contaminant uptake in these more polluted waters.

We continued work on a report integrating all data from our summer 1980 survey of contaminant fates and effects in the New York Bight. Don Gadbois of the Gloucester Laboratory provided data on PCB's in winter flounder, windowpane, red hake, sea scallops, American lobsters, and rock crabs. Only for the latter species did body burdens correspond to areas known to have elevated contaminant levels or inputs. In general, results were similar to those of the regionwide Gulf (of Mexico) and Atlantic Survey sampling, in which low levels were found in target species over most of the continental shelf. We are now planning for the summer 1981 resampling of the Bight.

The renewal of the benthic sorting contract with Quantitative Ecology was completed. The contractor has finished sample processing for the July 1980 cruise, and is making good progress on the December 1980 samples; thus the time lag between sampling and availability of data has been reduced. We also worked on extensions of contracts for benthic studies by the Bigelow Laboratory of Ocean Science in West Boothbay Harbor, Maine, and the Universities of Delaware and New Hampshire.

We participated in an NEFC program review which was also intended to provide material for a publication describing our activities to the public. We contributed to a NOAA statement on the advisability of an experiment to determine effects of filling a borrow pit in Lower Bay, New York, with dredge spoils. Information on the benthos of Raritan Bay was provided to the New Jersey Bureau of Marine Fisheries. We supplied Sheldon Pratt of URI with information on distribution of contaminants and amphipods in the Hudson Shelf Valley. Data on macrofauna of the "mud patch", a possible sink for contaminants from Georges Bank oil drilling, were sent to Don Maurer of the University of Delaware, to aid in his assessment of the relation of drilling to the benthos. We provided Don's group with equipment for grab sampling and blueprints for construction of grab stands. We aided the Behavior of Marine Fishes and Invertebrates Investigation in identifying polychaetes to be used in studies of biological impacts of oil pollution.

Benthic Energetics and Ocean Pulse Coordination

Jan Ward returned from maternity leave and resumed her work on life histories of important benthic species. Dot Jeffress has continued to process New York Bight apex benthic samples to determine biomass; she has completed over 20 of the 120 samples. Russ Terranova continued with calorimetry; he has refined a technique for analyzing very oily material such as shark or cod livers, so as to be able to provide reproducible results with low variance. Frank Steimle has spent most of his energy on OPP coordination, especially developing monitoring cruise schedules, planning this summer's cruises, and serving as Chief Scientist on the spring survey. Plans are being developed to transfer some of these cruise coordination tasks to a NOAA Corps Officer (Lt. Denise Hollomon) who is being assigned for that purpose early this fall. Frank worked with the Sandy Hook Laboratory ADP Unit in developing additional programs to analyze benthic data into size classes. Bruce Baker began work as a summer aide.

Physiological Effects of Pollutant Stress Investigation

Physioecology

Studies of surf clams and sea scallops exposed to either copper or silver in a diluter system continue. Samples of both clams and scallops were removed after 6 mo of exposure for chemical-uptake analyses.

Field-collected blue mussels exposed to mercury at 0, 5, and 10 $\mu\text{g}/\text{l}$ for 1 mo were spawned. Eggs of each exposure group were fertilized with sperm from the same group and allowed to develop for 48 hr in untreated seawater. After 48 hr, the larvae of each exposure group were screened and concentrated, centrifuged, frozen, and then sent to Dr. G. Roesijadi of Battelle, Pacific Northwest Laboratories, in Sequim, Washington, for metallothionein analysis.

Juvenile and adult blue mussels exposed to silver at 0, 5, 25, and 50 $\mu\text{g}/\ell$ for 6 mo were sampled for chemical-uptake analyses. In addition, the adults were spawned and the embryos were cultured for 48 hr in either silver-treated seawater or clean seawater.

Studies of the effects of eight heavy metals on blue mussel embryos were initiated. Three range-finding tests were completed.

We participated in an international Artemia intercalibration exercise to determine the toxicity of two contaminants on survival of early larvae. Results were sent to the coordinator of the exercise, S. L. Leonhard, of the Canadian Freshwater Institute in Winnipeg, Canada.

Lab-reared blue mussels exposed to either copper or silver in a diluter system continue to be measured on a monthly basis.

Tests on young adult blue mussels exposed to either mercury, silver, cadmium, or copper for 96 hr have been completed and lethal concentration values appear in Table 1. The order of toxicity was $\text{Cu} > \text{Ag} = \text{Hg} > \text{Cd}$.

Table 1. Heavy metal toxicity to young adult blue mussels after 96 hr.

| Metal | Lethal concentrations (a) | | |
|-------|---------------------------|------------------|------------------|
| | LC ₅ | LC ₅₀ | LC ₉₅ |
| Cu | 0.071 | 0.122 | 0.209 |
| Ag | 0.101 | 0.159 | 0.249 |
| Hg | 0.113 | 0.161 | 0.245 |
| Cd | 0.305 | 0.960 | 2.390 |

(a) Lethal concentrations are in mg/ℓ .

Considerable time was spent refabricating diluters to a new design and installing two new sand filter systems.

Chemistry

We assisted Joel Bodammer of the Oxford Laboratory in preparing stock solutions of copper for bioassay experiments with larval fish performed at the Narragansett Laboratory. Copper stock solutions were prepared here so that we could analyze the stock to ensure their integrity. We also analyzed the control seawater used in the experiments for the presence of copper.

We completed the analyses of nearly 300 tissue samples from sea scallops exposed to 10 ppb of silver in flowing seawater, and found that although control scallops accumulated copper in the kidney after the 60 and 90-day exposures, the silver-exposed scallops did not. These data are summarized in Table 2. The implications of these results are being examined and additional studies are planned.

Table 2. Silver and copper uptake in tissues of sea scallops exposed to 10 ppb silver in long-term flow-through systems.

| Metal | Assay time (days) | Sample date & ambient temperature | Experimental mode | Tissue uptake levels ^(a) | | | |
|--------|-------------------|-----------------------------------|-------------------|-------------------------------------|--------|-------|--------|
| | | | | Digestive mass | Muscle | Gill | Kidney |
| Silver | 30 | 8 Jan 81 -1°C | Control | 1.11 | 0.01 | 0.01 | 0.97 |
| | | | Exposed | 20.33 | 0.77 | 0.74 | 7.53 |
| | 60 | 4 Feb 81 5.5°C | Control | 2.46 | 0.06 | 0.36 | 0.86 |
| | | | Exposed | 34.2 | 1.61 | 1.09 | 14.77 |
| | 90 | 6 Mar 81 6.8°C | Control | 0.74 | 0.03 | 0.02 | 0.70 |
| | | | Exposed | 37.7 | 2.49 | 5.65 | 41.08 |
| Copper | 30 | 8 Jan 81 -1°C | Control | 64.6 | 0.60 | 1.22 | 104 |
| | | | Exposed | 65.6 | 0.49 | 13.45 | 173 |
| | 60 | 4 Feb 81 5.5°C | Control | 126.1 | 1.57 | 3.02 | 285 |
| | | | Exposed | 74.6 | 0.80 | 5.06 | 81 |
| | 90 | 6 Mar 81 6.8°C | Control | 75.3 | 1.53 | 2.9 | 308 |
| | | | Exposed | 75.5 | 0.83 | 10.6 | 90 |

(a) Tissue uptake levels are mean values in ppm of wet weight.

We recently sampled windowpane stomachs from two of our Long Island Sound "mini" Ocean Pulse stations; those stations representing the "best" and the "worst" conditions in the Sound. PCB analyses of 10 stomach samples (contents included) from each location showed no significant difference in concentrations (levels ranged from 0.05 to 0.1 ppm in wet weight). Levels of PCB's in stomach samples without contents were lower. It thus appears that PCB's may be uniformly distributed throughout the Sound, since it is assumed that windowpane food is localized in distribution and not migratory. Studies will continue to examine seasonal differences and changes in food habits of the windowpane.

Physiology

An additional exposure of American lobsters to cadmium for 30 days was completed this month. The respiration measurements from these animals corroborated the findings of an earlier study and will be useful in this experiment comparing lobsters exposed to cadmium via the water column against those exposed by means of cadmium-tainted food.

We have begun a new series of cooperative studies with the EPA's Narragansett Laboratory, using blue mussels held in bags along a transect in Narragansett Bay. This study is a continuation of an effort started 2 yr ago and will include monthly sampling from May until October. A number of biochemical and physiological monitoring techniques will be used and evaluated again this year. The first set of animals has been retrieved and initial measurements have been completed.

Twenty windowpane were collected from each of three Long Island Sound Ocean Pulse stations in April, May, and June. Hematological measurements were completed on these fish. A considerable amount of time was spent this period working on two year's worth of these data for a paper to be presented at the fall ICES meeting in Woods Hole.

We participated in the spring NEMP/OPP survey on the Kelez from 23 April to 8 May and sampled 96 sea scallops and 45 yellowtail flounder for metabolic and hematological measurements. Most of the lab analyses have now been completed. We are now preparing for the July and August NEMP/OPP surveys on the Albatross IV.

The Environmental Statistics Investigation has prepared format sheets for our OPP data and we have initiated the preparation of these data for computerization. Selected cruise data were sent to the Investigation at Sandy Hook for keypunching.

A series of long-term silver exposures of sea scallops was completed this reporting period; 30, 60, and 90-day exposures resulted in significant metabolic changes. Further tests will be performed in the fall when water temperature is more suitable for maintaining sea scallops.

Biochemistry

Analyses were completed on sea scallop adductor muscle samples from: (1) bottom trawl surveys on Albatross IV Cruise No. AL 80-08 and Delaware II Cruise No. DE 80-07 (which included animals from the deepwater stations in the Gulf of Maine), (2) the 30-day and 60-day silver exposure study, (3) the April and May collections off New Jersey (monthly baseline monitoring), and (4) most of the stations sampled during the

recent OPP survey on Kelez Cruise No. KE 81-04/05. Kidney analyses were also completed for the New Jersey animals. The June sampling of that population, courtesy of Sandy Hook Laboratory personnel, has been received and is archived at -80°C. The purpose of this long-term cooperative study is to gather seasonal data on metabolic patterns and metal concentrations in a single population of sea scallops, the better to interpret observations both in the lab and field.

Currently we are repeating the 3-mo exposure of sea scallops to 10 ppb of silver, primarily to discover how silver exposure affects tissue uptake of copper, background levels of which are on the order of 5 ppb. Because this exposure period extends into the summer months, we'll also be able to observe the effects of abnormally high ambient temperatures on biochemical pathways of energy expenditure. Takedowns for 60, 78, and 90 days were completed. Several kidneys from the 90-day exposure were shipped frozen to Dr. Guri Roesijadi of Battelle, Pacific Northwest Laboratories, for metallothionein analysis, and others were delivered to Dr. Thomas Gilbert of the New England Aquarium in Boston for examination for calcium-phosphate concretions. We are particularly interested in such metal-sequestering mechanisms in the scallop kidney, in the light of the Chemistry Subtask's uptake data for the earlier study (see Table 2).

The cooperative study of field-exposed blue mussels, performed with EPA's Narragansett Laboratory, was begun a month later than planned, but will extend at least into November. The first month's sampling was completed in June. We plan to examine these animals for muscle PK:GlutDH and MDH:PK ratios, which thus far have proven to be a good stress index in the sea scallop. John Blackstock of the Scottish Marine Biological Association, located in Dunstaffnage, reports that they also reflect pollutant stress in the polychaete Glycera alba.

Biochemical data for the first OPP survey (on NOAA R/V Researcher Cruise No. RE 78-04) and for one of the most recent (on Delaware II Cruise No. DE 80-09) have been keypunched and entered into the computer. Other OPP biochemical data have been prepared for entry onto computer formats.

Two abstracts were accepted, one for the annual meeting of the National Shellfisheries Association, and the other for the forthcoming Statutory Meeting of ICES.

Anaerobic Bacteriology/Metabolism

Lab work has been directed to the characterization of the many bacterial isolates, some 300, obtained from samples collected during Kelez Cruise No. KE 81-04/05, conducted during 25 April - 9 May. Samples were obtained from 24 stations for bacteriological analyses; they consisted of top and bottom waters, sediments, finfish and shellfish (i.e., Atlantic cod, windowpane, and sea scallops), and plankton. Participation in the cruise allowed us to do water-column bacteriology since this must be done aboard ship.

Although we use both selective and differential media for determination of Clostridium perfringens and the Vibrio group, it is still necessary to identify the isolates on the plates to determine whether the groups being selected for are being obtained. It is necessary to do this since the procedures being used have not been specifically developed for marine bacteriology. As shown by the results of this cruise and others, the procedures used have been specific for C. perfringens. More specific diversity in clostridial count is observed at some stations seasonally.

Procedures for the rapid identification of these species are being evaluated. Results of our work on C. perfringens in the Northwest Atlantic have been presented at a national meeting and are being prepared for formal publication.

The methodology used for the Vibrio group is not as specific as that for C. perfringens. All species of Vibrio of interest, with one exception, are being detected by our procedures, although other related species also appear consistently. It is necessary, therefore, to characterize more isolates to obtain an adequate profile of the sample. The other bacteria being detected by our Vibrio procedures are of interest to fisheries scientists as pathogens, hence they are contributing to our data base.

During the past cruise we observed low Vibrio counts. As seen previously, this occurs when water temperature is low; counts then increase with increasing water temperature. How an organism that grows best at 35°C can survive and grow in the ocean environment is not completely understood. Since vibriosis is of concern to fisheries scientists, some insights to the problem will be gained from our monitoring program.

The Environmental Statistics Investigation has prepared format sheets for our OPP data and we have initiated the preparation of these data for computerization.

Publications

- Caracciolo, J. V.; Steimle, F. W., Jr. An atlas of the distribution and abundance of dominant benthic invertebrates in the New York Bight apex, with reviews of their life histories. NOAA Tech. Rep. NMFS-SSRF. (A)
- Mahoney, J. B. Effects of trace metals on growth of a phytoflagellate, Olisthodiscus luteus. Bull. N. J. Acad. Sci. (S)
- Pearson, W. H.; Sugarman, P. C.; Woodruff, D. C.; Olla, B. L. Impairment of the chemosensory antennular flicking response in the Dungeness crab, Cancer magister, by petroleum hydrocarbons. Fish. Bull. (US). (A)
- Phoel, W. C. NOAA's requirements and capabilities for diving in polluted water. Mar. Tech. Soc. Spec. Symp. Issue. (A)
- Phoel, W. C.; Draxler, A. F. J. In situ measurements of nitrogen excretion and oxygen consumption as determinations of stress in Asterias vulgaris. Bermingham, N.; Blaise, C.; Coulture, P.; Hummel, B.; Jaubert, G.; Speyer, M. eds. Proc. 7th Ann. Aquat. Toxic. Workshop; 1980 November 5-7; Montreal, Quebec: Can. Tech. Rep. Fish. Aquat. Sci. 990; 1981. 519 p. (P)
- Thomas, J. P. Chesapeake Bay plume study -- a review of the Superflux Symposium. Coast. Ocean. Pollut. Assess. News 1(2):24; 1981. (P)

AQUACULTURE DIVISION

Aspects of Nutritional Requirements of Mollusks Investigation

Experimental Feeding of American Oysters

Experimental feeding studies are being conducted on oyster spat for three different purposes: (1) to repeat a previous study that indicated that Tetraselmis maculata was the best food source among five species; (2) to determine the food value of a freshwater cryptomonad flagellate (Chilomonas paramecium) that had been adapted to tolerate some seawater in the culture media -- since this flagellate stores abundant supplies of starch, it seemed that it might make an excellent food source; and (3) to determine the relationship between protein-nitrogen concentrations in the algae, amount of protein fed to the spat, and growth of the spat.

Observations on growth increases of spat were made on a weekly basis for 13 wk. Results did confirm previous experiments in which growth of spat receiving T. maculata exceeded that of all other food sources. During the entire 13 wk, growth of oysters receiving Pyramimonas grossi was only slightly behind, i.e., spat attained 97.4% of the growth of T. maculata. In other species, growth of spat, as compared to T. maculata, was as follows: Monochrysis lutheri, 85%; Isochrysis galbana, 57.6%; the cryptomonad C. paramecium, 49.6%; and the non-fed control, 16%.

Protein-nitrogen determinations showed that in 10^6 cells, T. maculata, P. grossi, and C. paramecium contained 5-7 times as much protein as the smaller species I. galbana or M. lutheri. This suggests that the protein value of the cells affects growth of the oysters, with the exception of C. paramecium which seems to have a high protein content per cell, but yields little growth of oysters. The explanation for this lies in the fact that oysters being fed C. paramecium received fewer cells each day than the other species.

Upon feeding of C. paramecium to the spat, an interesting and previously unobserved phenomenon developed. The oyster shells had a pale yellow nacre, as opposed to the pale gray-brown dull coloration which appeared on the shells of oysters fed other algae. The results here represent our initial studies relating protein-nitrogen concentrations to algal food value and will need considerably more investigation.

Culture of Algae

All algae in the collection that are cultured in natural and artificial seawater growth media, as well as cultures on solid media, were transferred according to schedule. Large-volume cultures of important food species were also subcultured to maintain the supply of inocula that were needed for replacing 13 culture carboys.

At the present time, the species and number of carboys of each are as follows: Monochrysis lutheri, 6; Isochrysis galbana, 9; Phaedactylum tricornutum, 1; Pseudoisochrysis paradoxica, 1; Pyramimonas grossi, 3; Dunaliella euchlora, 4; Tetraselmis tertiolecta, 4; and pennate diatoms (unidentified), 2. During the period covered by this report, 3133 liters of algal larval foods and 2339 liters of algal juvenile foods were harvested. These algal foods were distributed to the various Investigations as follows: Spawning and Rearing of Mollusks, 2035 liters; Aquacultural Genetics, 1990 liters; Physiological Effects of Pollutant Stress, 861 liters; and Diseases of Larval Mollusks, 44 liters.

Requests for stock cultures were received and cultures sent to Bruce Wein of the University of Massachusetts, and Professor Lucas of the Université de Bretagne Occidentale in France.

Spawning and Rearing of Mollusks Investigation

Some positive results have been obtained in an experiment to determine how early in the year small bay scallop seed can be put into Long Island Sound without sacrificing viability. Hatchery-reared scallops, 8 mm in length, placed in suspended pearl nets in April at an ambient water temperature of 5°C, were all alive and had grown to 20 mm by June when the water temperature reached 15°C. We had previously thought that growth rate and survival of bay scallop seed at these temperatures would be low. These results mean that hatchery seed produced in early spring can be immediately planted out, greatly reducing hatchery holding capacity and heating and feeding costs.

We successfully produced about 30 000 bay scallop seed, 25 mm in length, for a lantern-net grow-out experiment to begin in July. We will investigate a combination of stocking density and handling frequency factors with these animals. We expect to demonstrate single-season growth to market size (50 mm) in this test.

We provided 40 000 excess bay scallop seed to the Town of Groton, Connecticut, for grow-out studies in their waters.

Results of an experiment designed to monitor shell length and body weight of surf clams held at different temperatures have indicated distinct trends. The experiment was conducted from mid-winter, a period of general dormancy for these bivalves, to early summer so that the process of gametogenesis could be studied.

Groups of clams maintained at 18°C or 21°C had no shell or body weight growth between December and March. In February, clams held at 15°C and at ambient temperatures (2°C) showed increase in body weight, and growth in length commenced in March. By late April, clams at ambient temperature (10°C) decreased in overall growth rate in comparison with clams held at higher temperatures.

The level of naturally occurring phytoplankton was monitored during this period and appears to govern growth at given temperatures. If increased metabolism at elevated temperature is not fueled with adequate nutrition, there can be no growth. If nutrition is adequate, growth will increase to some level as the temperature increases.

The group of clams maintained at 15°C exhibited the most consistent increase in weight and length over the entire experimental period. No precocious gonad development was induced until February, when natural phytoplankton became abundant. A significant increase in body weight, related to gametogenesis, preceded the increase in shell length. An analysis of the histological changes during gametogenesis is currently being prepared for the different experimental groups.

Aquacultural Genetics Investigation

Cytologic and Cytogenetic Effects of Contaminants

The micronucleus test for chromosome mutation has been used in two additional collections of windowpane blood from three Long Island Sound "mini" Ocean Pulse stations. Fish at the clean station, without exception, show no cytologic evidence of physiologic stress in their erythrocytes as do some at the contaminated stations and micronuclear incidences that are exceedingly low. Somewhat higher incidences, on the average, occur in fish from the moderately and heavily contaminated stations with a few fish at these two stations showing much higher incidences. There may be no statistically significant difference in values from these two stations, although there seems to be a tendency for fish from the "dirtier" station to be somewhat, though not consistently, higher than from the intermediate station. These flatfish are essentially nonmigratory, but probably move in and out of variously contaminated though adjacent, waters. Altogether, this set of three stations has been sampled six times over a period of 1 yr, cells from 600 fish have been scored, and an average of 2000 erythrocytes read per fish. In the course of making this first application of the micronucleus test to fish, methodology has been modified and improved for circulating fish blood.

As an extension of this work, erythropoiesis has been examined in fish kidney tissue. Methodology for application of the micronucleus test to immature and mature erythrocytes and erythroblasts of the fish kidneys, as sampled at sea, has also been developed. Examination of about 20 flounder kidneys showed that the micronuclear incidence, as scored in the mature erythrocytes yet unreleased to circulation, is about the same or slightly higher than that scored in circulating erythrocytes. Immature kidney cells had incidences four times as high as circulating erythrocytes.

Overall, it seems the kidney erythropoietic cells may be a more sensitive monitor or experimental indicator of chromosome mutation than circulating erythrocytes. However, the circulating erythrocytes reflect the conditions of erythropoiesis over a period of several months prior to sampling. As such, they have the potential of providing useful information in certain circumstances in the field and in the lab tests as well.

Further work on this test concerned examination of erythrocytes from larval sand lance. Micronucleated erythrocytes in these larval fish occur about three times as often as in the variety of adult fish studies. Sand lance adults, however, have not yet been examined.

All of these data, as well as those demonstrating the induction of micronuclei in fish erythropoiesis in salmon as a basis for the field work, are to be subjected to appropriate statistical analyses, in particular those from the field studies. Photomicrographs are being prepared. A series of three papers is intended for publication detailing: (1) methods, (2) experimental results with a known mutagen, and (3) field studies.

An effort will be made to adapt and apply the method to fish liver cells provided they have a sufficiently high mitotic turnover. Liver may better show any effects of environmental mutagens than blood-forming tissues due to the role of the liver in detoxification of chemicals which accordingly fail to reach other tissues to the degree they are concentrated in the liver.

Fewer Atlantic cod were sampled on the last cruise in which our Investigation participated, so not much additional data are available on micronuclear incidences in cod erythrocytes. It still appears that cod overall have a somewhat higher background incidence than other fish studied, and that active PEN (piscine erythrocytic necrosis) viral infections increase micronuclear incidences. This could be either the result of chromosome breakage induced by the virus or due to a disturbance of the mitotic spindle in infected cells. Several stages of erythropoiesis, as well as circulating blood, have been examined in one infected fish. Appropriate methodology and rigid scoring criteria avoid confusion between viral inclusion bodies and micronuclei. However, mitoses are also being directly examined in the infected fish to confirm micronuclear data.

Examination of both finfish and shellfish sperm have led to the conclusion that the sperm mutation test can also be applied successfully to fish, and in a monitoring, as well as experimental mode. Ordinary light microscopic methods are adequate for finfish, but the scanning electron microscope must be used to score abnormalities of the oyster sperm. Oyster sperm are among the smallest sperm known. Oysters midway through gametogenesis have been exposed to three concentrations of cadmium for about 30 days in further efforts to check suitability of the test. More background experimental work is to be done in fish before the test is recommended for monitoring.

Cruise Participation

Dean Perry sampled sand lance larvae and amphipods on the OPP survey on Kelez Cruise No. KE 81-04/05.

Andy Hebert has prepared for the OPP survey on Albatross IV Cruise No. AL 81-07. Fish larvae, fish kidneys and liver, and amphipods will be sampled, prepared, and fixed for genetic studies underway.

Other Activities

A. Longwell is preparing a background paper for the updated National Academy of Science's "Review on Petroleum in the Marine Environment."

Investigation personnel will participate in a study of egg viability of Atlantic mackerel relative to contaminant load of the gonad. Developing eggs will be examined cytologically for chromosome and mitotic irregularities and for abnormal cell differentiation, and grossly for teratogenic effects. This participation is at the request of H. Rosenthal of the Federal Republic of Germany who has been sampling mackerel in the Gulf of St. Lawrence in collaboration with the chemist, Mr. Richard Addison, at Canada's Bedford Institute of Oceanography. Related studies have been made in European waters by Dr. Rosenthal.

Aquacultural Genetics and Breeding of the American Oyster

A few of the American oysters from Florida --intended for geographic hybridization-- spawned after being maintained in a small-scale, refrigerated, recirculating unit. Apparently, the unit is working well. Survival of the Florida animals has been satisfactory. The lower-than-ambient temperature has prevented unwanted spawning in the trays, but allowed spawning after deliberate stimulation. Larvae of a hybrid cross between the Florida and local Long Island Sound oysters have survived to the setting stage.

In contrast, very few larvae from several full-sib crosses have survived. One of these inbred crosses showed evidence of the gametic incompatibility observed and reported a few years ago when attempting to develop inbred lines. In this recent cross, two attempts to "refertilize" the eggs with sib sperm were unsuccessful, while embryos of contemporary outcrosses from the same eggs proceeded to develop normally. The reciprocal control could not be made as there was no unrelated female available. A culture set up from the full-sib cross provided no larvae, confirming that fertilization was ineffective, not merely delayed. Cytological examination of these eggs corroborated the breeding results and light-microscopic observations. There was no fertilization or cleavage and a deteriorating nucleus was seen in most eggs of the inbred cross.

Full sibs comprised most of the groups being used in a second grow-out experiment. Growth of juvenile inbred oysters placed in an offshore field site, in a tray suspended from the dock, and in the tank raceway, is being compared.

Other Activities

A. Longwell participated as the US member in the ICES Mariculture Committee's Genetics Working Group. Considerable time was spent on the Working Group's report to be presented to the Mariculture Committee at the Statutory Meeting in Woods Hole this October. As a Mariculture Committee member, A. Longwell (along with J. Ryther of WHOI) has been concerned with the invitation and presentation of papers to the Mariculture Committee during the October meeting.

A collaborative test of isoelectric focusing techniques for identification of fish was conducted at the request of R. Lundstrom of the Gloucester Laboratory.

Publications

Longwell, A. Artificial and competitive natural production of oysters and marine finfish in the U.S. as determinants of the need for or impracticality of breed improvements. Paper prepared for ICES Working Group on Genetics meeting. Copenhagen, Denmark; 1981 May. 11 p.

Longwell, A. Bibliography of genetic and related papers on the oysters. Paper prepared for ICES Working Group on Genetics meeting. Copenhagen, Denmark; 1981 May. 14 p., 140 citations.

Longwell, A. Genetic and genetic-related research on aquaculture organisms in the U.S. and related subjects. Paper prepared for ICES Working Group on Genetics meeting. Copenhagen, Denmark; 1981 May. 7 p.

Wikfors, G.; Ukeles, R. Growth of estuarine unicellular algae in media with excess copper, cadmium, or zinc and effects of metal-contaminated algal food upon Crassostrea virginica larvae. Mar. Ecol., Prog. Ser. (S)

PATHOBIOLOGY DIVISION

Comparative Invertebrate Pathology Investigation

In Ocean Pulse Program activities, benthic amphipods collected on Kelez Cruise No. KE 81-04/05 have been identified and checked for abnormalities visible with the

dissecting microscope. They are now being sorted and packaged for histological processing. Numbers of amphipods from most stations were much larger than in previous surveys. Oviparous females were lacking of Ampelisca agassizi, the most important common species. However, there were many vitellogenic females, indicating that the July cruise should have an ample supply of this stage. A microsporidian that attacks the dorsal abdominal muscles of A. agassizi was present in specimens collected at 6 of 11 stations. Prevalence ranged from 2 to 40%. As previously, this microsporidian was absent or rare in A. agassizi collected at the more southern stations.

A summarization of the field studies on the occurrence and distribution of focal gill melanization in euphausiids was presented at the Oxford Laboratory Program Review. The summary presented data gathered from five Deepwater Dumpsite (DWD) 106 cruises, one OPP cruise, one Puerto Rico dumpsite cruise, and fractions of samples from 11 MARMAP cruises. Significant differences in specimens from Puerto Rico and the mid- and Northwest Atlantic were observed, i.e., 2000 euphausiids from Puerto Rico showed 0.2% melanization whereas over 6000 specimens from the mid- and Northwest Atlantic showed 15.8% focal gill melanization, indicating this is not a phenomenon common to all euphausiids in all locations. There also appeared to be differences between deep ocean euphausiids (collected on DWD 106 cruises) and shelf-water specimens (collected on MARMAP cruises). When the prevalence of melanization was plotted at each station in the mid- and Northwest Atlantic, stations within the Gulf of Maine and Georges Bank areas consistently showed less than 20% prevalence with a mean of 7.2%. In contrast, stations within and around DWD 106 had prevalences of 0 to 80% with a mean of 20.6%. Further analysis of data according to species, however, indicates that there are significant differences in the prevalence of focal gill melanization among the species examined. It appears that melanization in Meganyctiphanes norvegica has a prevalence less than 1.0%, whereas the prevalence in Euphausia krohnii or Nematoscelis megalops can be 20-60%. E. krohnii and N. megalops were the dominant organisms examined from the DWD 106 cruises and gill melanization prevalences were high. Specimens of M. norvegica collected on DWD 106 cruises still had very low occurrences of gill melanization. M. norvegica was the predominant euphausiid examined in the samples from the Gulf of Maine and Georges Bank stations and the observed prevalence of focal gill melanization was low. However, eight stations in this region were composed primarily of other species, none of which had prevalences greater than 20%. This fact still may be important in comparison with some of the high prevalences of melanization in these species collected in and around DWD 106. Although it is unclear what are all factors which contribute to such high prevalences of gill melanization, the prevalence/distribution pattern observed in the Northwest Atlantic euphausiids seems to be related more to the distribution and abundance of certain species than related directly to environmental effects of dumping activities at DWD 106. A summary report of these field studies and a final cruise report were submitted to the NOAA Office of Marine Pollution Assessment.

Sea scallop shells, supplied by Edith Gould of the Milford Laboratory, were examined to determine the possible cause of shell blisters that had formed on the lower valves. The blisters conformed to the general shape of the visceral mass (body) of the scallops. These scallops were compared to others collected on resource assessment surveys, and they appear to occur throughout the Middle Atlantic Bight. X-rays of the shells revealed numerous interlaced channels. These channels were caused by a marine annelid worm. Due to the dry, brittle nature of the worms, no positive identification has been made. Examination of the shell deposited on the blisters indicates that the scallop is capable of repairing and recovering from at least some of the damage caused by these worms.

A histologically processed American oyster section from Delaware Bay, with syncytial cells exhibiting loss of ciliation and intranuclear inclusions in the gonoduct, was plastic-embedded and sectioned for electron microscopy. Examination was completed, and, while the technique was very successful in locating the specific tissue of interest, the inclusions were found to be negative for virus.

During this reporting period, the Histological Services Unit prepared over 2000 sections of various fish and shellfish for examination by resident pathologists. They continued their work on manual preparation and developing new histochemical services.

Microbial Ecology and Parasitology Investigation

Mr. Jay Lewis participated in the first NOAA/EPA recovery-phase cruise to the Philadelphia-Camden sewage disposal site to collect (Atlantic) rock crabs and sediment samples. The cruise was designed to obtain follow-up data subsequent to the cessation of spoil disposal at the site in November 1980. Gill condition in rock crabs was recorded for 296 specimens, 171 males and 125 females. None of the animals had black gills, but 64 of them had small ulcer-like perforations of the carapace or appendages and 14 had one-to-four missing legs or claws. Although the "typical" black gill condition was not observed, three had blackened gill tips or bases and 30 had small foci of black melanization due to unknown causes. Gills from 50 animals (i.e., sewage stations, 20 specimens; acid-waste stations, 20 specimens; control stations, 10 specimens) were fixed for histological study at the Oxford Laboratory and heavy metals studies by Mr. Richard Greig at the Milford Laboratory. Hepatopancreas tissue from 15 animals collected at the sewage site were frozen for PCB analyses by Mr. Greig. Recent literature has reported that the hepatopancreas of certain crustaceans, including rock crabs, contains an enzyme which binds both copper and cadmium. Because of the binding capacity of the enzyme, the hepatopancreas from the same samples used for gill analyses also were frozen for metal analyses. We have noticed in previous collections that the hepatopancreas from different crabs presents a wide diversity in both color and texture. The organ has been noted to range in color from yellow to brown, pink, green, or black; sometimes it is firm and easily removed and at other times it is thin, watery, and removed with difficulty. Among the 50 crabs collected for pathology and metal analyses, 40 of them had a firm hepatopancreas that ranged from yellow to brown in color; in three it was brown and watery, in five it was yellow and watery, and in two it was black. When microscopic examinations and metal analyses are complete, we will determine whether or not there is an association between tissue condition and these two measurements. Also, we will compare metal concentrations obtained during this cruise with values obtained from several hundred specimens collected during the period of active sewage disposal practices. Future collections are planned to determine if metal levels in rock crabs will decrease with time and provide data which suggest that inactive disposal sites are entering a "recovery" phase.

Mr. Lewis collected sediments during the recovery-phase cruise in order to compare the spatial distribution of pathogenic and nonpathogenic *Acanthamoeba* species with data obtained while the site was active. All stations sampled for amoebae were selected on the basis of historical data [sewage bacteria MPN's (mean probable number) and previous isolations]. Cultures were prepared from sediments taken at 22 sewage stations, 8 control stations, and 1 acid-waste station. The rationale for sediment studies was based on the fact that sewage-associated bacteria are expected to die-off with the cessation of sewage dumping and that the cyst-forming amoebae will persist

for much longer periods of time. Preliminary identifications of the amoebae show that 8/22 sewage stations were positive, 0/8 control stations, and 0/1 acid-waste stations. Results from the present cruise show that 36% of the sewage stations yielded Acanthamoeba compared with an overall incidence of 20% in previous studies. The higher incidence of 36% is attributable to the fact that all stations selected for this study were chosen on the basis of previous positive results for bacteria and amoebae. Statistical analyses on the relationship between bacterial MPN's and the frequency with which the amoebae may be recovered from sediments showed an exceptionally high correlation between our expected and actual results.

Fish Pathology Investigation

The second edition of the "Catalog of Slide Accessions of the Registry of Marine Pathology" is nearing completion. Mrs. Jane Swann has completed preparation of the slide listings and cross indexes and Ms. Michele Cox of the Sandy Hook Laboratory has prepared the catalog's cover design. The catalog will be mailed on schedule in July.

Several manuscripts were prepared for ICES. A manuscript titled, "An International Registry of Marine Pathology," was revised for publication in the Rapports et Proces-verbaux des Reunions Conseil International pour l'Exploration de la Mer. The manuscript was the basis of an oral presentation made at the Special Symposium on Diseases of Commercially Important Marine Fish and Shellfish in Copenhagen, Denmark, in October 1980. A second manuscript is in preparation (Ms. Linda Despres-Patanjo is senior author) which presents the results of fish disease surveillance activities conducted on bottom trawl survey cruises in 1979 and 1980. The manuscript will be submitted to the Environmental Quality Committee for consideration for presentation at the Statutory Meeting in Woods Hole in October 1981.

Trawling was conducted in Raritan Bay and the New York Bight apex on 1, 13, 26, and 27 May, and on 1, 2, 8, and 24 June in search of ulcerated red hake. The first fishes seen with ulcers since the December 1980 collections were captured in East Reach Channel, Raritan Bay, on 27 May. At that time, 155 hake were examined and a lesion prevalence of 4% was found. On 1 and 2 June, 108 additional fish were captured at this location. The prevalence of ulcers reached 10% on certain tows. Ulcerative lesions from 13 fish were fixed for histology. The warming of Bay waters during June caused red hake to abruptly depart and no fish were captured on 24 June when water temperatures were 19°C. Fish caught in the Bay were generally smaller than those at the offshore Ambrose Tower location and ranged from 13 to 27 cm TL.

A liver hepatoma survey in flatfishes was initiated in the highly polluted Arthur Kill near the Outerbridge Crossing. After much searching for trawlable ground on this foul bottom, four winter flounder and two summer flounder were obtained on 2 June. Livers were fixed for histological examination at the Oxford Laboratory. Another sample was taken on 25 June consisting of 10 summer flounder, 11 winter flounder, and 4 hogchokers. Two of 17 summer flounders captured at this site exhibited signs of severe fin erosion.

Eustrongylides sp., a nematode which caused some problems with exportation of American eels from Chesapeake Bay in 1980, has been successfully grown to the adult stage in black-crowned night herons (Nycticorax nycticorax). The infected eels were supplied by Maryland Tidewater Administration biologists and the herons were obtained through the courtesy of the USFWS at Patuxent, Maryland. The parasite

reference collection of the USDA at Beltsville, Maryland, will be used to help identify the adult worm from the eel. The worm had caused marketing problems earlier in the century in the New York area, but the species had never been identified.

The prevalence of the nemertean parasite Pseudocarcinonemertes homari on American lobsters is being monitored in New Brunswick, Canada, and in Massachusetts. Because the worm has not been found to date in Massachusetts, but is occurring at a very high prevalence in New Brunswick, lobsters from a more northern US location were examined. With the help of biologists from the Maine Department of Marine Resources, several dozen sublegal lobsters were examined which were being held in the Boothbay Harbor Laboratory as part of a study on the effects of tagging on lobster growth. Because these were experimental animals, only external examinations were possible. No worms were found. Several larger lobsters from the Laboratory's display aquarium were also examined. Although external examination of these animals did not reveal any Pseudocarcinonemertes, several other flatworms were found. One of the older, less desirable display animals was sacrificed and several specimens of Pseudocarcinonemertes were found in the branchial chamber between the gill lamellae. Maine biologists plan to intensify their search for this worm when berried females become available in July.

Experiments were conducted on striped bass larvae reared at the Narragansett Laboratory. Four-week-old larvae hatched from eggs collected in the Nanticoke River (Maryland) were exposed to several different concentrations of copper (100, 50, and 25 ppb) for 24 hr prior to being fixed for electron microscopic observations of their visual and olfactory tissues. Exposure to the higher concentrations (100 and 50 ppb) resulted in considerable mortality (40 and 20%, respectively) while survival at 25 ppb was comparable to control values (approximately 90%). Scanning electron microscopic evaluation of a limited number of fishes revealed little change in the olfactory organ, but sloughing of epithelial cells of the cornea appeared to be enhanced in specimens from the 100-ppb group. Light and electron microscopic evaluation of sectioned material will be needed to determine whether the toxicant has affected the deeper, nonsurface structures of the sensory organs.

In addition to experiments on striped bass larvae exposed to contaminants, cytological examinations of starved larvae are also in progress. Using larvae from 4 to 21 days old, control (fed) and unfed animals reared under identical conditions are being preserved for light and electron microscopic examination.

A paper titled, "The Cytopathological Effect of Copper on the Olfactory Organs of Larval Fish (Pseudopleuronectes americanus and Melanogrammus aeglefinus)," was written and submitted to the Center Directorate for review prior to submission for presentation at the ICES Statutory Meeting to be held at Woods Hole in October 1981.

Diseases of Larval Mollusks Investigation

On 7 and 8 May, the monthly bacterial sampling cruise in Long Island Sound provided 33 isolates that are being used for pathogenicity evaluation. Preliminary biochemical tests for genus identification and an oyster larval challenge test were completed with these isolates this reporting period. With the collection of 40 new bacterial isolates on 5 June, the final in the series of Long Island sampling cruises was completed. These isolates will also be tested for routine biochemical charac-

teristics and then used to challenge oyster larvae for toxicity. During this reporting period, isolates from the April 1980 (7), June 1980 (11), September 1980 (15), February 1981 (18), March 1981 (18), April 1981 (17), and May 1981 (19) cruises were used in challenge tests. In addition, 12 biochemical tests were completed on 76 isolates obtained from cruises taken in January, February, and March 1981. Data from these cruises are being compiled for a paper to be presented at the National Shellfisheries Association meeting in August.

Throughout 2 yr of a comparative study of the natural oyster beds at New Haven, Stratford, Bridgeport, and Norwalk, Connecticut, the Stratford site has shown the greatest number of pathogens. Consequently, a new in-depth study has been initiated to characterize pathogen prevalence at this site. Historically, the Stratford shellfish bed has been a poor producer of oysters. It is, therefore, considered important to determine whether relationships exist among the bacterial flora, environmental characteristics, and the low oyster numbers.

In microbial identification studies, 10 of 40 marine bacterial isolates were selected, on the basis of low maximum growth temperature and high salinity tolerance, for use in the continuing evaluation of a modified Minitek biochemical test system. The bacteria have been included in a panel with 26 others which are now being tested for 31 biochemical reactions for comparison between the standard identification method and the Minitek method.

In our toxicological studies, recent experiments indicate that no toxins are produced by three bacterial isolates obtained from diseased oyster larval culture. Two vibrios isolated from the culture are thought to be invasive, while the third, a pseudomonad, seems to remove an essential compound from the oyster culture water. Interestingly, the last two experiments on these isolates suggest that their filtrates can enhance larval development under certain water quality conditions.

Cellular responses of oyster larvae to a pathogenic Pseudomonas sp. were examined in experiments similar to earlier work with pathogenic Vibrio sp. Larvae were reinfected daily with doses of 5-5000 Pseudomonas cells per milliliter; after 2 or 6 days, the larvae were crushed to release plastic-attaching cells, and, following formalin fixation, the cell types were counted by phase-contrast microscopy. The results, although incomplete, suggest that Pseudomonas sp. induces a cellular response in the larvae that is different in type and quantity from that induced by Vibrio sp.

In cooperative work with the shellfish industry, three isolates from Marine Bioservices were found to be pathogenic to oyster embryos, causing 100% mortality in two separate challenge experiments. This information, along with the locations where isolates were taken, was provided to the owner, Mr. John Sheldon.

At the request of International Shellfish Enterprises in Moss Landing, California, Dr. Blogoslawski assisted with a mortality problem affecting both Crassostrea gigas and Ostrea edulis set. Three isolates were brought to the Milford Laboratory and were used to challenge C. virginica larvae. At 48 hr, the larvae infected with two of the isolates survived to the straight-hinge stage. The third isolate appeared to be pathogenic. Experiments will be continued to determine whether these bacteria will interfere with the process of setting. At the request of Campford Fisheries, Dr. Blogoslawski traveled to Homer, Alaska, to conduct ozone depuration experiments. Results of this work will be reported in the next bimonthly narrative report.

In cooperative work with the State of Connecticut during May, a batch of hard clam meats was tested for coliforms. High coliform levels were found and an ozone depuration experiment was completed. Ozone reduced the coliform levels by one log, but did not totally eliminate coliforms as measured by Lauryl tryptose broth and brilliant green bile broth. No coliforms were found in another collection of hard clams taken from the same Milford clam bed in June.

Publications

- Blogoslawski, W. J.; Monasterio, P. O. Bacterial depuration of the Mexican scallop, Argopecten circularis. World Maricult. Soc. (Abstract.) (S)
- Bodammer, J. E. The cytopathological effect of copper on the olfactory organs of larval fish. Int. Assoc. Aquat. Anim. Med. (Abstract.);1981. (P)
- Bodammer, J. E. The cytopathological effect of copper on the olfactory organs of larval fish. Int. Counc. Explor. Sea, Comm. Mem. (S)
- Bodammer, J. E.; Sawyer, T. K. Aufwuchs protozoa and bacteria on gills of the rock crab, Cancer irroratus Say: a survey by light and electron microscopy. J. Protozool. 28:35-46;1981. (P)
- Brown, C. Characterization of exotoxin produced by a shellfish-pathogenic Vibrio sp. Sixth Annu. East. Fish Health Workshop. (Abstract.) (S)
- Farley, C. A. Phylogenetic relationships between viruses, marine invertebrates and neoplasia. Proc. Princess Takamatsu Int. Symp. (S)
- Johnson, P. T.; Otto, S. V. Histology of a bilateral gynandromorph of the blue crab, Callinectes sapidus Rathbun (Decapoda: Portunidae). Biol. Bull. (S)
- Johnson, P. T.; Stewart, J. E.; Arie, B. Histopathology of gaffkemia in the lobster Homarus americanus, and a comparison with histological reactions to a gram-negative species, Pseudomonas perolens. J. Invertebr. Pathol. (A)
- Khan, R. A.; Newman, M. W. Blood parasites from fish of the Gulf of Maine to Cape Hatteras areas in the Northwest Atlantic Ocean, with notes on the distribution of fish hematozoa. Can. J. Zool. (S)
- MacLean, S. A. Focal gill melanization in euphausiid shrimp. Annu. Rep. Congress, 1978 Ocean Pollut. Res. Prog. Act. (Abstract.) (S)
- O'Malley, M. L.; Lear, D. W.; Adams, W. N.; Gaines, J.; Sawyer, T. K.; Lewis, E. J. Microbial contamination of continental shelf sediments by ocean disposal of sewage sludge. J. Water Pollut. Control Fed. (A)
- Robohm, R. A.; Sparrow, D. A. Evidence for genetic selection of high antibody responders in summer flounder (Paralichthys dentatus) from polluted areas. Develop. Biol. Standard. (S)

- Robohm, R. A.; Brown, C.; Murchelano, R. A. Comparison of antibodies in marine fish from clean and polluted waters of the New York Bight. *Int. Assoc. Aquat. Anim. Med. (Abstract.)*;1981. (P)
- Sawyer, T. K. Recent progress in understanding phylogenetic relationships among rhizopod protozoa (Sarcomastigophora: Sarcodina). *J. Protozool. (Abstract.)* (A)
- Sawyer, T. K.; Bodammer, S. M. The emerging role of marine amoebae (Protozoa: Sarcodina) as indicators of healthy or impacted seabottom sediments. *Proc. Second Int. Ocean Dump. Symp.* (A)
- Sawyer, T. K.; Lewis, E. J.; Galasso, M. E.; Greig, R. A.; Ziskowski, J.; Pacheco, A. Gill condition in the rock crab, Cancer irroratus, as an indicator of ocean health. *Third Int. Ocean Disposal Dump. Symp. (Abstract.)* (S)
- Sawyer, T. K.; Lewis, E. J.; Galasso, M.; Lear, D. W.; O'Malley, M. L.; Adams, W. N.; Gaines, J. Distribution of pathogenic and nonpathogenic amoebae (Amoebida: Acanthamoebidae) in ocean sediments in an offshore sewage disposal site. *J. Water Pollut. Control Fed.* (A)

Reports

- MacLean, S. A. Focal gill melanization in euphausiids -- summarization of field studies. Report prepared for NOAA Office of Marine Pollution Assessment; 1981.
- MacLean, S. A. Cruise report of May 1980 DWD 106 cruise -- examination of planktonic crustaceans. Report prepared for NOAA Office of Marine Pollution Assessment; 1981.
- Sawyer, T. K.; Galasso, M. E.; Lewis, E. J.; Ziskowski, J. Gill fouling in rock crabs, Cancer irroratus. Northeast Monitoring Program Contract Report;1981.

NATIONAL SYSTEMATICS LABORATORY

Benthic Fishes Investigation

A draft of an annotated list of commercial and potentially commercial cod-like fishes of the world was submitted to FAO, who partly supported its production. It includes information on 30 species of cods, Gadidae; 23 species of grenadiers, Macrouridae; and 11 species of deepsea cods, Moridae. A section on the live-bearing cusk, Bythitidae, was completed for the Sea Fishes of South Africa.

Pelagic Fishes Investigation

Work continued on a revision of the Spanish mackerels. A review of scombroid classification was prepared for presentation by Bruce Collette as the Presidential Address of the annual meeting of the American Society of Ichthyologists and Herpetologists. Preparation continued of a manuscript on mangrove swamp fishes of New Guinea.

Penaeoid Shrimp Investigation

Research continued on a revision of the American Pacific rock shrimps of the genus Sicyonia. Two projects on the genus Solenocera were carried forward: one the description of the females of an Hawaiian species previously known from males only; the other the description of a new species from the Indian Ocean.

Crustaceans Investigation

The book, Shrimps, Lobsters, and Crabs of the Temperate Eastern U.S., is nearly completed.

ATLANTIC ENVIRONMENTAL GROUP

Ocean Monitoring and Climatology Task

Reprinted on pages 55 and 56 are announcements of eddy conditions in the Georges Bank-Middle Atlantic Bight area which were sent to the Commander of the Atlantic Area for the US Coast Guard for publication in the June and July 1981 issues of Atlantic Notice to Fishermen.

The cooperative Ship of Opportunity Program obtained 10 XBT (expendable bathythermograph) transects and five CPR (continuous plankton recorder) transects in May and June: three XBT and two CPR transects in the Gulf of Maine, two XBT transects off Southern New England, three XBT and three CPR transects across the shelf and slope off New York, and two XBT transects across the Gulf of Mexico.

Ocean Dumping Task

The second draft of the in-house report titled, "Advection of Near-Surface Waters at the 106 Mile Dumpsite," was sent to the program office after revisions were completed.

Drifting buoy 03022, deployed north of Puerto Rico by Clearwater Consultants, was reported ashore near Merida (Yucatan), Mexico. Tracking of the buoy by Service ARGOS has ceased.

Publications

Armstrong, R. S. Transport and dispersion of potential contaminants at the Buccaneer Oil Field. EXPOCHEM '80; 1980 October; Houston, Tex. (A)

Bisagni, J. J. The movements of two satellite tracked drogued buoys deployed at the offshore 106 mile dumpsite. Coast. Ocean Pollut. Assess. News 1(2): 26; 1981. (P)

Crist, R. Wylie; Chamberlin, J. L. Bottom temperatures on the continental shelf and slope south of New England during 1979. Ann. Biol. 36. (A)

Crist, R. Wylie; Chamberlin, J. L. Bottom temperatures on the continental shelf and slope south of New England during 1980. Ann. Biol. 37. (A)

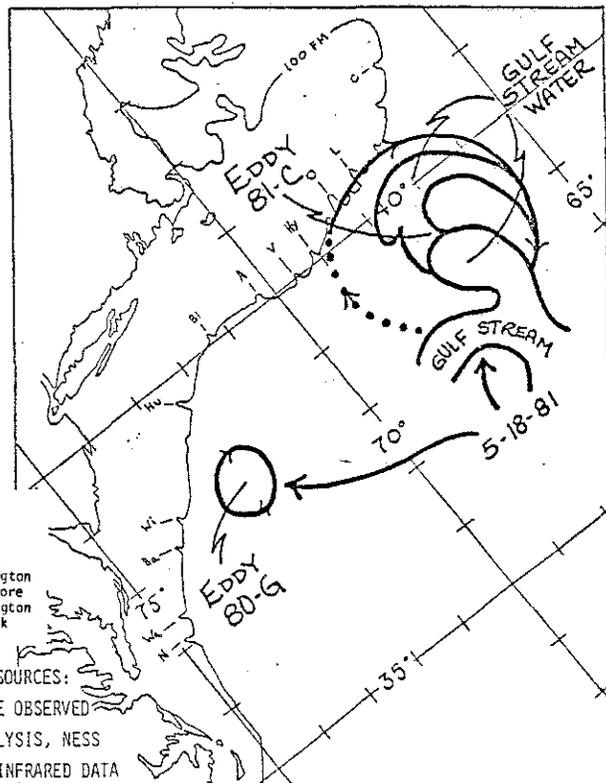
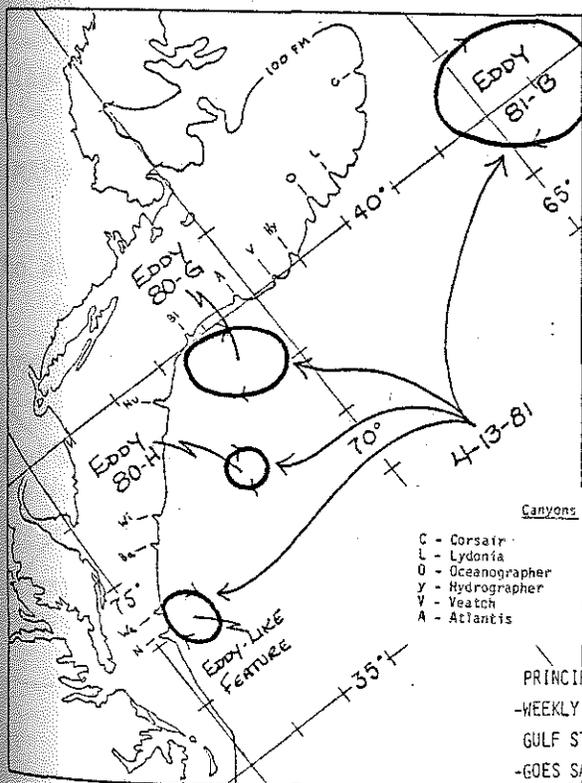
GULF STREAM EDDY LOCATIONS

The Atlantic Environmental Group of the National Marine Fisheries Service reports that two warm core Gulf Stream eddies were present off the northeast coast of the United States in mid-May.

Eddy 79-H travelled southwest and was resorbed by the Gulf Stream during early May, centered at about 37.0°N, 73.0°W, east of Norfolk Canyon. Eddy 80-G moved southwest about 180 km (97 nm) to a center position at about 38.3°N, 72.4°W, east of Baltimore Canyon. Eddy 81-C formed about April 24 by merging of Eddy 81-B with a Gulf Stream meander to the west of it. It extended about 200 nm E-W and 105 nm N-S when first clearly seen on April 28, centered at about 39.0°N, 65.4°W. Eddy 81-G apparently does not have as well organized a pattern of clockwise circulation as is typical of warm core rings. Its western boundary position is consequently uncertain. Gulf Stream water penetrating northward into the ring at 75.0°W in mid-May suggests a ring center position at about 39.3°N, 66.7°W, yet on May 15-16, trap fishermen found a surface current above 2 knots toward the NE, west of Oceanographer Canyon.

During the next 30 days Eddy 80-G may move southwest and become resorbed by the Gulf Stream east of Norfolk Canyon. If Eddy 81-C is not resorbed by the Gulf Stream it may move west to a center position south of Hydrographer Canyon.

Fishermen are requested to report unusual conditions or catches occurring in the vicinity of these eddies to the Director, Atlantic Environmental Group, National Marine Fisheries Service, RR7, South Ferry Road, Narragansett, Rhode Island 02882, by mail. Updates on eddy positions and general information on Gulf Stream eddies may be obtained by calling the Atlantic Environmental Group (401-789-9326).



- Canyons**
- C - Corsair
 - L - Lydonia
 - O - Oceanographer
 - y - Hydrographer
 - V - Veatch
 - A - Atlantis
 - B1 - Block
 - Hu - Hudson
 - Wi - Wilmington
 - Ba - Baltimore
 - Wa - Washington
 - N - Norfolk

PRINCIPAL DATA SOURCES:
 -WEEKLY SATELLITE OBSERVED
 GULF STREAM ANALYSIS, NESS
 -GOES SATELLITE INFRARED DATA

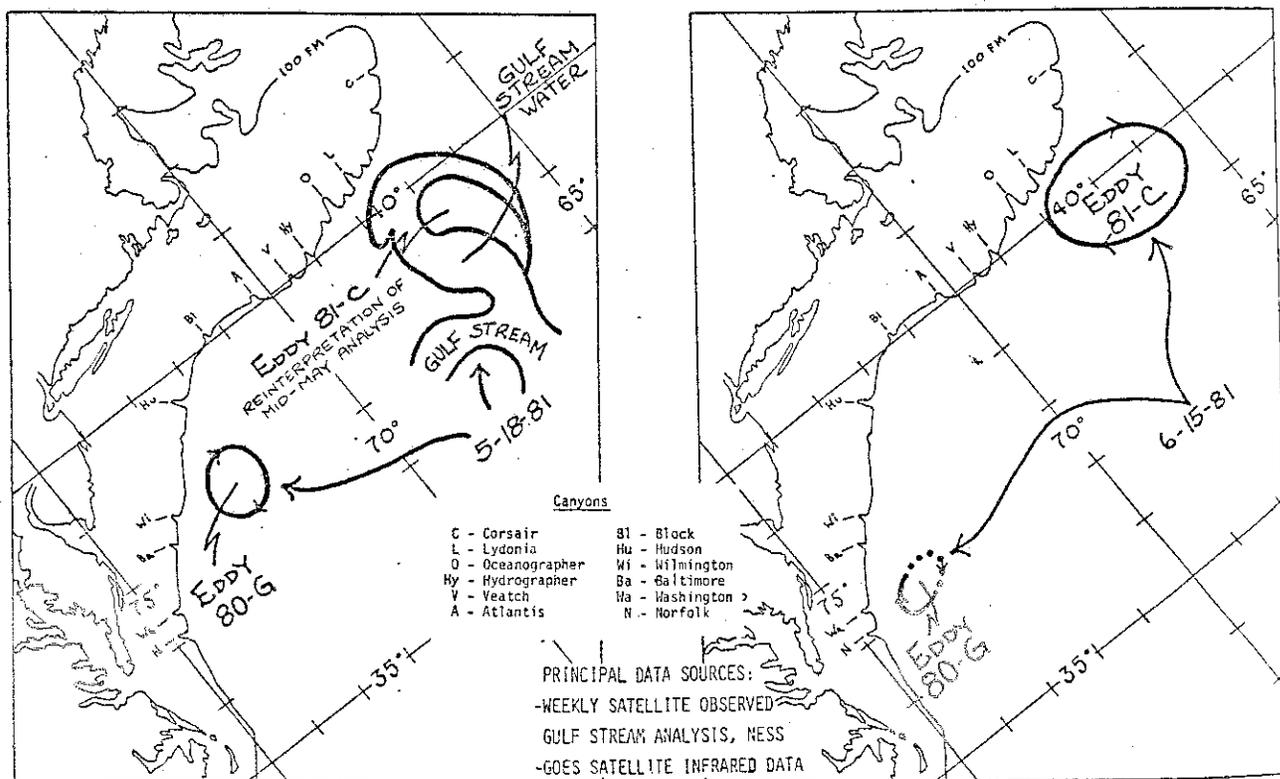
GULF STREAM EDDY LOCATIONS

The Atlantic Environmental Group of the National Marine Fisheries Service reports that two warm core Gulf Stream eddies were present off the northeast coast of the United States in mid-June.

Eddy 80-G travelled southwest about 150 km (80 nm) and is being resorbed by the Gulf Stream near 37.3°N, 73.5°W. Eddy 81-C decreased in surface diameter during late May and separated from the Gulf Stream in early June. The center position of the eddy is near 39.8°N, 66.7°W, 55 km (30nm) north of the mid-May center position.

During the next 30 days Eddy 80-G will be completely resorbed by the Gulf Stream and Eddy 81-C may move west to a center position south of Hydrographer Canyon.

Fishermen are requested to report unusual conditions or catches occurring in the vicinity of these eddies to the Director, Atlantic Environmental Group, National Marine Fisheries Service, RR7, South Ferry Road, Narragansett, Rhode Island 02882, by mail. Updates on eddy positions and general information of Gulf Stream eddies may be obtained by calling the Atlantic Environmental Group (401-789-9326).



Fitzgerald, J. L.; Chamberlin, J. L. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1979. Ann. Biol. 36. (A)

Fitzgerald, J. L.; Chamberlin, J. L. Anticyclonic warm core Gulf Stream rings off the northeastern United States during 1980. Ann. Biol. 37. (A)

Hilland, J. E. Variation in the shelf water front position in 1979 from Georges Bank to Cape Romain. Ann. Biol. 36. (A)

Hilland, J. E. Variation in the shelf water front position in 1980 from Georges Bank to Cape Romain. Ann. Biol. 37. (A)

Hughes, M. M.; Cook, S. K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1979. Ann. Biol. 36. (A)

Hughes, M. M.; Cook, S. K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1980. Ann. Biol. 37. (A)

Ingham, M.C. Water masses and dumping at the 106-mile site. Coast. Ocean Pollut. Assess. News 1(2);1981. (P)

Ingham, M. C.; McLain, D. R. Sea-surface temperatures in the northwestern Atlantic in 1980. Ann. Biol. 37. (A)

McLain, D. R.; Ingham, M. C. Sea-surface temperatures in the northwestern Atlantic in 1979. Ann. Biol. 36. (A)

TRAVEL, MEETINGS, AND PRESENTATIONS

Resource Assessment Division

On 4 May, Fred Serchuk attended a Surf Clam/Ocean Quahog Fishery Management Plan Review Team meeting in Gloucester, Massachusetts.

On 6 May, Emory Anderson attended the Mid-Atlantic Fishery Management Council's (MAFMC) S&S Committee meeting in Philadelphia.

On 8 May, Emory Anderson attended a bluefin tuna meeting in Washington, DC, to discuss problems preparatory to USA-Japan bluefin tuna meetings at the end of May.

During 8-11 May, Mike Sissenwine and Ann Lange attended a fisheries ecology meeting at WHOI.

On 11 May, Mike Sissenwine and Brad Brown met with staff of the NEFC, NERO, and NEFMC to discuss the three-tier commercial fisheries statistics collection system in Woods Hole.

On 11 May, Brad Brown attended a meeting of the MAFMC's Groundfish Oversight Committee in Riverhead, New York, to discuss potential industry-state cooperative surveys of yellowtail flounder.

During 11-14 May, Steve Clark and Ambrose Jearld attended the NAFO workshop on shrimp aging methods in Quebec, Canada.

On 13 May, Emory Anderson presented a talk to the biology class from Morgan High School in Clinton, Connecticut, on the NEFC assessment efforts in Woods Hole.

On 13 and 14 May, Brad Brown attended a "mini" Center Board of Directors meeting in Narragansett, Rhode Island.

On 17 May, Andrew Thoms and Carl Harrison attended a WHOI seminar on problems with Loran C bearings.

During 19-23 May, Ambrose Jearld attended the Ethology and Behavioral Ecology of Fishes Conference in Normal, Illinois.

On 21 May, Brad Brown attended a court hearing in Norfolk, Virginia, on fishing violations.

On 21 May, Fred Serchuk attended a public hearing in New Bedford on the NEFMC Draft Sea Scallop Fishery Management Plan.

On 21 May, John Boreman, Mike Sissenwine, Fred Serchuk, Steven Clark, Emory Anderson, Vaughn Anthony, and other Resource Assessment Division staff met in Woods Hole with staff of the NEFMC to discuss improvement of interactions between NEFC and NEFMC.

On 22 May, Vaughn Anthony, Gordon Waring, and Mike Fogarty attended a (US Department of Commerce) Secretarial hearing on the Atlantic Herring Fishery Management Plan (FMP) and the status of the herring resource, held in Saugus, Massachusetts. Vaughn presented the results of the latest assessment.

On 26 May, Fred Serchuk presented an overview of resource assessment activities at a quality control workshop for fish dealers held at M. F. Foley Company in New Bedford.

On 27 May, Brad Brown, Steve Clark, Fred Serchuk, and Emory Anderson attended a program review of survey and assessment activities in Woods Hole.

On 28 May, Anne Lange presented a paper at a NFMTF meeting in Warwick, Rhode Island. Richard Hennemuth, Mike Sissenwine, Brad Brown, Steve Murawski, and Ralph Mayo also participated.

On 28 and 29 May, Eva Montiero, Elizabeth Bevacqua, Andrew Thoms, John Nicholas and Henry Jensen attended the XBT Workshop sponsored by the Sippican Corporation in Fairhaven, Massachusetts.

On 3 June, Fred Serchuk met in Woods Hole with NERO personnel to discuss data requirements for the updated Sea Scallop FMP.

During 3-13 June, Emory Anderson and Vaughn Anthony attended the NAFO Scientific Council meeting and the meeting of the Ad Hoc Working Group on Squid, held at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Fred Serchuk attended the NAFO meeting during 8-13 June, and Joan Palmer attended during 16-18 June.

On 4 June, Steve Clark attended the Northern Shrimp Technical Committee meeting in Portsmouth, New Hampshire.

On 9 June, Gordon Waring and Mike Fogarty met with the Atlantic Herring Fishery Management Plan Development Team concerning Amendment Number 4 to the Atlantic Herring FMP.

On 10 June, Susan Wigley and Amy Tuttle attended the WHOI Introductory Sigma 7 course in Woods Hole.

On 15 June, Steve Clark attended a NEFMC Groundfish Advisory Committee meeting in Danvers, Massachusetts.

On 17 June, Steve Clark presented a talk on fishery biology and stock assessments to industry representatives in New Bedford.

On 18 June, John Boreman attended a briefing of staff of the House Committee on Merchant Marine and Fisheries on striped bass research activities.

On 18 and 19 June, Brad Brown attended a joint meeting in Narragansett, Rhode Island, of EPA and NOAA personnel on ocean dumping. Brad presented a review of the data bases and research conducted by the Resource Assessment Division and NEFC.

On 18 June, Fred Serchuk attended a NEFMC Sea Scallop Oversight Committee meeting in Saugus, Massachusetts.

On 23 June, Ralph Mayo, Ambrose Jearld, David Pyoas, Sherry Sass, Wendy Sylvia, Alicia Kelly, Doris Jimenez, Malcolm Silverman, and Donald Flescher attended the American Fisheries Society's Workshop on Care and Handling of Fish, held at the New England Aquarium in Boston.

On 25 June, Brad Brown conferred with representatives of the General Accounting Office.

On 25 June, Emory Anderson discussed the beneficial effects of extended jurisdiction on the Atlantic mackerel stock with Bob Siegel of the NMFS Central Office.

On 26 June, Steve Clark and Fred Serchuk individually met in Woods Hole with Jay Lanzillo of the Chatham Fishery Cooperative to discuss the recent spring-bottom-trawl-survey-indicated distributions of haddock, and hook selectivity studies on groundfish species.

On 27 June, Brad Brown, Vaughn Anthony, Mike Sissenwine, Gordon Waring, and H. C. Boyar met with Jack Suomala of the Charles Stark Draper Laboratories, Inc., to discuss Atlantic herring research and the potential for hydroacoustically locating concentrations of pre-spawning herring on Georges Bank.

On 29 June, Fred Serchuk attended a NERO staff meeting in Gloucester, Massachusetts.

On 30 June and 1 July, Fred Serchuk attended a meeting of the NEFMC in Danvers, Massachusetts.

Marine Ecosystems Division

Wendell Hahn met with Dr. Ira Sohn from the New York University Institute for Economic Analysis to discuss a bionomic paper currently in preparation.

Marvin Grosslein attended a number of Editorial Subcommittee meetings of the Georges Bank Study Committee.

William Michaels presented his data on "The Vertical Distribution and Biology of the Chaetognath Sagitta elegans on Northeast Georges Bank" to his Ecology of Oceanic Zooplankton class.

Roger Theroux met with Ken Sherman and Marv Grosslein on the development of the benthos section for a chapter of a book on Ecosystems on Continental Shelves. He also met with Alex Proctor of Promotional Planning Service concerning preparation of graphic materials for the chapter.

Art Allen presented a talk to a biology class from Morgan High School in Clinton, Connecticut, about the aims and uses of physical oceanography. The class was touring the Woods Hole Laboratory.

On 1 May, Carolyn Griswold attended a session of the New England Estuarine Research Society's Annual Meeting at Galilee, Rhode Island.

On 4 May, Julien Goulet visited Bob Payne of the EPA to discuss future applications on the PDP11 computer.

On 5 May, Ken Sherman visited Wally Smith at the Sandy Hook Laboratory to discuss divisional activities.

On 7 and 14 May, Julien Goulet visited Joe Berry of Yale University to work on an Oceans '81 Conference paper.

On 8 May, Lou Bivins of NOAA's Office of Ocean Technology and Engineering Services (OTES) met at Narragansett with Ken Sherman to be briefed on the image scanner.

On 11 May, Ken Sherman met with the Narragansett Laboratory Safety Committee to discuss recommendations of the Regional Safety Committee.

On 12 May, Ken Sherman visited Lou Bivins in Washington, DC, to discuss automated plankton analysis.

On 13 and 14 May, an Executive Meeting was held at the Narragansett Laboratory.

On 15 May, Julien Goulet met with Bob Payne and Jerry Ogilby of EPA to discuss the structure of the MARMAP Ecosystem Data Base.

On 15 May, Carolyn Griswold attended a meeting of the Mid-Atlantic Biological Task Force in the Department of Interior's Main Building in Washington, DC.

On 17 May, Carolyn Griswold met with Dr. Malcolm Spaulding and Eric Anderson of the URI Ocean Engineering Department to discuss their work on an oil spill trajectory model for Georges Bank. This work is a part of a large contract to URI from the Bureau of Land Management.

On 19 May, Ed Cohen delivered a lecture on oceanic plankton to members of the University of Pennsylvania-Cornell University Aquavet Program.

On 20 May, Ed Cohen attended a modeling activities meeting (chaired by George Ridgway) and a joint research meeting at Brookhaven National Laboratory (BNL).

On 20 May, Roger Theroux delivered his annual lecture on benthic ecology to the Aquavet Program.

On 20 and 21 May, Ed Cohen, Jack Green, Marvin Grosslein, Ken Sherman, and Mike Sissenwine met with BNL's John Walsh and his staff to review 1980-81 activities and future plans. Among the subjects discussed were: NEFC-BNL cooperation in the Shelf Energy Program, BNL research on this MESSEX Program, and plans for intercalibration experiments for primary productivity measurements.

On 21 May, Gene Heyerdahl of the Center Directorate and Julien Goulet met with Bob Payne of EPA and Len Bass of URI to discuss use of the PDP11 computer.

During 25-29 May, Steven Ramp and Ron Schlitz presented a poster paper, "Eulerian Current Measurements in Four Warm Core Rings Near the Shelf Break South of Cape Cod," at the American Geophysical Union's Spring Meeting in Baltimore, Maryland. The paper illustrated the passage of four warm-core rings along the shelf edge south of Nantucket as indicated by the flux-line current measurements and by satellite imagery. David Mountain also attended the meeting which included many interesting papers on shelf and coastal circulation.

On 27 May, Ken Sherman went to Woods Hole to discuss marine ecosystem studies with WHOI Director John Steele.

On 27 May, Julien Goulet attended a meeting with Marine Ecosystems Division personnel and URI Graduate School of Oceanography personnel concerning Georges Bank modeling.

On 28 May, Wally Smith, Ken Sherman, and Mike Pennington met at Narragansett with URI staff to discuss progress on cooperative research.

On 29 May, Ken Sherman was in Washington, DC, regarding briefing for Tommy Austin on MARMAP.

On 2 June, Grayson Wood, Jack Green, and Donna Busch met with Creighton Wirich and Terry Whitledge to exchange information about chlorophyll sensors and data recording systems.

On 2 June, Roger Theroux conferred with two biologists from the State University of New York at Stony Brook seeking specimens of fourspine and ninespine sticklebacks for study -- unfortunately, our collection contained too few for their needs.

On 3 June, a meeting of Standing Committees on Recruitment Processes and Ecosystem Productivity was held at Narragansett. It was attended by most of the people in the Marine Ecosystems Division.

On 3 June, Dave Potter met in Woods Hole with principals of Solar Design Associates to discuss the status of the Woods Hole Laboratory solar system proposal.

On 4 June, Carolyn Griswold, Tom Halavik, Wes Pratt, and Jerry Prezioso serviced AEG's temperature and pressure recorder on the Breton Reef Tower.

On 5 June, Julien Goulet visited Joseph Berry of Yale University to work on a manuscript for Oceans '81 Conference.

On 5 June, Jim Hall of Solar Design Associates met with Peggy Lamoureux, Ray Maurer, Jack Green, Donna Busch, and Bob Marak to review the status of the solar system proposal for the Narragansett Laboratory.

On 5 June, Ken Sherman met with George Ridgway and Don Bourne to discuss the recruitment processes studies of the Marine Ecosystems Division.

On 4 and 5 June, Donna Busch, Jack Green, and Grayson Wood met with Cleaver Symonds of Somerset, United Kingdom, and Tad Sipsky of Toronto, Canada, representatives of Fathom, Inc., to discuss chlorophyll sensors and instrument needs related to monitoring and small-scale studies by the NEFC.

During 8-11 June, Marv Grosslein, Ken Sherman, and Geoff Laurence participated in the Fishery Ecology Workshop held at WHOI. Geoff made a presentation on larval fish and the environment, Ken made a MARMAP presentation, and Marv described food habits studies.

On 9 and 10 June, Julien Goulet attended a Northeast Regional Fisheries Information System Technical Advisory Group Meeting in Woods Hole.

On 9 June, Dave Potter met with Solar Design Associates and the Program Director from NASA Marshall Space Flight Center for a 30% design review of the Woods Hole Laboratory solar system proposal.

On 11 June, Julien Goulet visited John Sailor of the New England River Basin Commission to work on a manuscript for the Oceans '81 Conference.

On 11 June, Carolyn Griswold spoke to two classes at the North Kingstown (Rhode Island) Junior High School about fish and fisheries in the Northeast with some emphasis on the species found locally. Donald Flescher of the Woods Hole Laboratory kindly donated slides and some of his fish models for the presentation.

On 12 June, Roger Theroux and Wes Pratt participated in an NEFC workshop concerned with "Audiovisual Quality Control," chaired by Michelle Cox of the Sandy Hook Laboratory. Objective of the meeting was to compile a guidebook of procedures for visual communication standards. In the next 2 mo, Roger and Wes will be preparing guidelines for various photographic applications.

On 16 June, Roger Theroux, Robert Edwards, and Richard Cooper met to discuss the use of currently existing sediment data and a longer-term strategy for pinpointing Atlantic herring spawning sites.

During 17-20 June, Carolyn Griswold accepted an invitation to attend a conference on the "Future of Gas and Oil from the Sea" held at the University of Delaware.

On 18 and 19 June, Ken Sherman made a presentation on marine ecosystems studies to the EPA's Narragansett staff.

On 19 June, Roger Theroux met with Ruth Turner to discuss the bivalve distribution manuscript she is reviewing and other collaborative efforts.

On 19 June, Tom Plichta attended a workshop in Boston presented by RIMS/MPG on a BASIC-PLUS code generator.

During 21-24 June, Bernard Skud and Carolyn Griswold attended a conference on the "U.S. Fishing Industry and Regulatory Reform" at URI.

On 23 June, Lorrie Sullivan attended a Southern New England Chapter meeting of the American Fisheries Society at the New England Aquarium. She was responsible for registrations.

On 23 June, Ken Sherman met with Martin Belsky of the NOAA Office of Planning and with Roland Smith, Acting Director of the NMFS Office of Conservation and Management.

On 24 June, Dave Potter met with Solar Design Associates to orient their structural engineers with the Woods Hole Laboratory.

On 25 June, Ken Sherman, along with Perry Jeffries and Alex Poularikas of URI, made presentations to the OTES Directorate in Rockville, Maryland, on the status of development of the High Speed Plankton Sorting System.

Resource Utilization Division

Perry Lane attended a monthly and an annual business meeting of the New England Fisheries Steering Committee.

Joe Mendelsohn attended the "New Product Opportunities for the Seafood Industry" seminar held at the King's Grant Motel in Danvers, Massachusetts. The use of a rotating retort for sterilizing food was explained in terms of producing a much higher quality product using much less energy. A wide variety of on-line and experimental food products were displayed, accompanied by discussion on how the new technique could be applied to fishery products.

John Ryan and Joe Carver participated in a meeting of the Armed Forces Product Evaluation Committee at the US Army's Natick (Massachusetts) Laboratories on 13 May.

Fred King participated in a meeting of the New England Fisheries Institute on 4 June in Milton, Massachusetts.

Fred King participated in a meeting of the Center Incentive Awards Committee on 17 and 18 June.

Vern Nulk attended an Audiovisual Quality Control Workshop at the Woods Hole Laboratory.

Division of Environmental Assessment

Russ Terranova and Bob Reid attended the Spring Meeting of the New England Estuarine Research Society in Galilee, Rhode Island, during 30 April-2 May.

A. Calabrese, M. Dawson, and F. Thurberg attended the New England Estuarine Research Society meeting at Galilee on 1 May.

On Thursday, 7 May, Mr. Ron Rossi of the New Jersey Department of Environmental Protection visited Dr. Pearce to discuss environmental monitoring activities being conducted by the NEFC. Mr. Rossi is interested in how monitoring activities ongoing within the State of New Jersey can be combined with OPP and NEMP data.

On Monday, 18 May, Dr. Pearce and Mr. Millington Lockwood of NOAA's National Ocean Survey visited with Dr. Robert Pierce of the US Army Corps of Engineers' (COE) New York Division. The purpose of the meeting was to meet with COE personnel in relation to the continued development of NEMP, especially to provide information necessary to COE activities in the Middle Atlantic Bight. Possible emphasis was given to the topic of how our monitoring activities might be used to get data in relation to ocean disposal of dredged materials.

Allen Bejda attended the Third Biennial Conference on the Ethology and Behavioral Ecology of Fishes at Normal, Illinois, from 19 to 22 May. The Conference was sponsored by the Department of Biological Sciences of Illinois State University.

On 26 May, Bill Phoel and Steve Spina presented their seabed oxygen consumption and nutrient regeneration data from the Knorr cruise to the New York Bight in March, at a BNL meeting.

Dr. Pearce and Dr. James Thomas participated in a NMFS Habitat Protection Workshop at the Central Office on Thursday, 28 May. The Workshop was principally concerned with the use of remote sensing and measuring variables of interest to NMFS. Following the workshop, Dr. Fred Vukovich of Research Triangle Park gave a seminar to the NMFS Central Office staff. His seminar was, again, concerned with the use of remote sensing techniques in fisheries research.

During 8-10 June, Dr. Pearce participated in an EPA-sponsored review of the Mussel Watch Program. Investigators from the WHOI, the University of California, and other facilities presented the results of their activities during the past 3 yr.

The EPA invited a number of outside Mussel Watch reviewers, as well as personnel from several federal agencies to participate in the review.

F. Thurberg and E. Gould attended a "Mussel Watch" program review in Providence, Rhode Island, on 9 June.

E. Gould attended an Audiovisual Quality Control Workshop on 12 June in Woods Hole, as tertium quid.

F. Thurberg and C. Brown hosted the Center IYABA Meeting at the Milford Laboratory on 16 June.

On 17 and 18 June, Dr. Pearce, along with other NEFC personnel, participated in an EPA/NEFC workshop on ocean dumping. Presentations were given by principal NEFC investigators, as well as personnel from the EPA's Narragansett Laboratory. Based on the presentations and subsequent discussions, the working groups developed position statements in regard to a number of activities as they relate to ocean dumping.

M. Dawson attended the Center Awards Committee meeting in Woods Hole on 17 and 18 June.

Dr. William Steiner presented a paper (coauthored with B. L. Olla) titled, "Activity Patterns and Shelter Usage in Juvenile Red Hake (Urophycis chuss) Associated with Sea Scallops," at the Annual Meeting of the Animal Behavior Society at the University of Tennessee in Knoxville on 22 June.

Bill Phoel met with Dr. Howard Feder of the University of Alaska at Fairbanks, to discuss how the benthic ecology of the southeast Bering Sea shelf relates to seabed oxygen consumption (carbon utilization) and nutrient regeneration.

Al Matte attended an XBT workshop sponsored by the Sippican Corporation in Marian, Massachusetts.

Aquaculture Division

A. Longwell attended the ICES Genetics Working Group meeting in Copenhagen, Denmark, during 12-14 May.

S. Stiles attended the Joint Meeting of the Genetics Society of America and the Genetics Society of Canada in Raleigh, North Carolina, during 15-17 June. The joint meeting provided an especially large diversity of subtopics within the field of genetics, including molecular genetics, population genetics, mutagenesis, recombination and repair, cytogenetics, developmental genetics, evolution, gene action, quantitative genetics and breeding, and ecological genetics.

Pathobiology Division

Dr. Rosenfield met with Dr. Sulkin of the Horn Point Environmental Laboratories (HPEL) on 6 May to discuss future plans for cooperative research; during 11-13 May, he visited the NMFS Galveston Laboratory to discuss shrimp aquaculture programs; on 20 May, he visited the NMFS Central Office to discuss potential utilization and development projects to be conducted by the HPEL as part of the Cooperative Agreement

between the Oxford Laboratory and the HPEL; on 26 May, Dr. Rosenfield and Dr. Sindermann visited Drs. Colwell, Taylor, and Sulkin at the HPEL to discuss building and operating plans for the future Institute of Environmental and Coastal Studies; on 8 June, Dr. Rosenfield participated in a Citizens Advisory Board meeting of Maryland Sea Grant; on 18 and 19 June, he coordinated an in-depth Oxford Laboratory Pathobiology Division program review (Division staff, including those from the Milford and Sandy Hook Laboratories, as well as contractees and cooperative state investigators made presentations. Several visitors, including those from the NMFS Central Office, Maryland Department of Natural Resources, universities, and other NEFC laboratories, attended the review); on 24 June, Dr. Rosenfield joined the senior staff of the Oxford Laboratory in holding a joint meeting with HPEL staff at Horn Point to discuss ongoing research and possible areas for future cooperative research in Chesapeake Bay and Chincoteague Bay; on 25 June, he attended a data base workshop sponsored by the University of Maryland's Sea Grant Office and NMFS at the University of Maryland; and on 30 June, Dr. Rosenfield and Dr. Murchelano visited the new facilities of the Chesapeake Bay Institute in Shady Side, Maryland, to discuss possible future interactions and research activities.

Dr. Murchelano attended a meeting of the Center Promotion Review Board at the Woods Hole Laboratory on 1 May; on 4 May, he chaired a session on Environmental Pathology at the annual meeting of the International Association for Aquatic Animal Medicine (IAAAM) at Mystic, Connecticut; on 1 June, he presented a lecture and conducted a lab session on "Diseases of Marine Fishes" for the Aquavet Program at the Marine Biological Laboratory in Woods Hole; on 24 June, he attended a research planning meeting at Horn Point in behalf of the Oxford Laboratory/HPEL Cooperative Agreement; and on 30 June, he participated in a research planning meeting with Drs. Taylor and Powell at the Chesapeake Bay Institute of Johns Hopkins University in Shady Side, Maryland.

Dr. Bodammer conferred with Dick Greig regarding contaminant experiments with larval fish on 1 May at the Milford Laboratory; during 4-6 May, he conducted contaminant experiments with larval fish at the Narragansett Laboratory; and during 6-8 May, he attended the IAAAM meeting at Mystic, Connecticut. He presented a paper at the IAAAM meeting on "The Cytopathological Effect of Copper on the Olfactory Organs of Larval Fish."

Dr. Brown of the Milford Laboratory met with Mr. Donald Gilpatric of Acadian Aquacultural Enterprises on 3 May to discuss problems associated with oyster culturing; on 9 and 10 June, she attended a Kontes-sponsored, thin-layer chromatography workshop held in King of Prussia, Pennsylvania; on 16 June she attended an IYABA meeting at the Milford Laboratory; and on 18 June, Drs. Brown and Robohm, Mr. Rose, and Ms. Petti participated in the Program Review at the Oxford Laboratory.

On 21 May, Dr. Blogoslawski chaired the Pan American Committee meeting of the International Ozone Association in Washington, DC.

Dr. Sawyer attended a conference on "Protistan Evolution" and presented a paper on "Mitosis and Cyst Formation in Sarcodina Amoebae" on 2 and 3 June at Port Deposit, Maryland.

Mr. Kern attended the Center Incentive Awards Committee meeting on 17 and 18 June.

Mr. Farley attended a 1-day session of the Tissue Culture Association meeting in Washington, DC, on 10 June; he also attended a 2-day meeting at the Virginia Institute of Marine Science on the status of haplosporidian disease in the mid-Atlantic region on 11 and 12 June.

Mr. Newman visited the Woods Hole Laboratory to discuss diseases of clupeid fishes and lobsters and to attend the Audiovisual Quality Control Workshop on 12 June.

National Systematics Laboratory

D. Cohen traveled to the Northwest and Alaska Fisheries Center (NAFAC) in Seattle to discuss possible transfer to that Center, and to the California Academy of Sciences (CAS) in San Francisco to investigate holdings of Bering Sea Fishes.

B. Collette visited the Southwest Fisheries Center's Tiburon Laboratory to discuss possible transfer, and the CAS to investigate holdings of Indo-Pacific clupeoid fishes.

Both Cohen and Collette attended the annual meeting of the American Society of Ichthyologists and Herpetologists where Collette presided and presented a lecture on scombrid classification as the Presidential Address to the Society. Cohen served on the Board of Governors and delivered a paper on fishes from the Galapagos Rift thermal vent area.

Atlantic Environmental Group

On 30 April and 1 May, Mert Ingham attended a meeting of the Center Personnel Management Advisory Committee at Woods Hole.

Janet Hess and Amy Friedlander participated in a cruise aboard the Albatross IV during 4-16 May.

Mert Ingham attended a "Climate Users Conference" sponsored by the NOAA Climate Analysis Center which was held at Gettysburg, Pennsylvania, during 11-14 May.

Sandra Lundin attended E. Heyerdahl's meeting of ADP personnel which was held in Woods Hole on 9 and 10 June.

On 11 and 12 June, Lianne Armstrong, graphic arts specialist, participated in an Audiovisual Quality Control Workshop held at Woods Hole.

On 16 June, Reed Armstrong attended an IYABA meeting which was held at the Milford Laboratory.

Jayne Fitzgerald traveled to Washington, DC, on 29 June to visit the National Earth Satellite Service installation and check the satellite imagery files. She returned to Narragansett on 6 July.

SEMINARS

Resource Assessment Division

On 24 June, Emory Anderson chaired a seminar in Woods Hole given by Ransome Myers, a Ph.D. candidate at Dalhousie University in Halifax, Nova Scotia, on long-term genetic changes in fish life history parameters as influenced by exploitation. Many Resource Assessment Division personnel attended this seminar.

Marine Ecosystems Division

On 4 May, Margaret Brown, Director of Training for the Massachusetts Department of Social Services, gave a 3-hr workshop on stress at the Narragansett Laboratory.

On 7 May, George Heimerdinger was at the Narragansett Laboratory to demonstrate the Apple computer connection to the National Oceanographic Data Center's data base.

Division of Environmental Assessment

On Friday, 29 May, Dr. Lars Edler of Lund (Sweden) University gave a seminar at the Sandy Hook Laboratory titled "A Recent Bloom of Ceratium Off the Swedish Coast." Dr. Edler talked about the Ceratium bloom and its possible relationship to marine pollution. He noted that there had been instances of low dissolved oxygen (DO) and avoidance of such low DO areas off the coast of Sweden by commercially important fish.

Pathobiology Division

Dr. Richard Neve of the University of Alaska's Institute of Marine Science, visited the Oxford Laboratory on 22 June and presented a seminar on aquaculture in Alaska.

VISITORS

Resource Assessment Division

On 23 June, Emory Anderson discussed NEFC assessments and data bases with Francis LaLoe, a visiting French scientist from ORTSOM (Office de la Recherche Scientifique et Technique de Outre-Mer), working in Dakar, Senegal. Emma Henderson provided information on sampling of mixed fisheries.

Marine Ecosystems Division

On 13 May, Ray Maurer presented a review of NEFC programs and a tour of the Narragansett Laboratory to Mr. Deryck Michael, Permanent Secretary of the Antigua Ministry of Agriculture, Lands, and Fisheries.

On 22 June, the NOAA Administrator, John Byrne, visited with Ken Sherman, Dick Hennemuth, and Brad Brown at the Narragansett Laboratory.

Resource Utilization Division

Reverend Tom Morrison of Gloucestershire, England, visited the Gloucester Laboratory and the Port of Gloucester.

Barbara Ecklemeyer and John Laundon from Abbot's Seafood Company, Connecticut, visited the Gloucester Laboratory to discuss retorting of chowder products.

Division of Environmental Assessment

On Wednesday, 6 May, Dr. Morris Baslow of Cornell University visited the Sandy Hook Laboratory to discuss data available for the Lower Hudson River and the Raritan Bay estuary. Dr. Baslow is involved with contract studies on fisheries in the Hudson River and how certain environmental impacts may affect estuarine and anadromous fishing.

On Monday, 11 May, Ms. Geraldine Kelpin of the State University of New York at Stony Brook visited the Sandy Hook Laboratory to obtain information concerned with environmental monitoring activities ongoing within the NEFC. Ms. Kelpin is preparing a report on ongoing monitoring efforts within the Northeast Region. Her efforts have developed out of at least two NOAA-supported workshops in the Northeast.

On Friday, 12 June, Dr. Russell Synnot of Melbourne, Australia, visited the Sandy Hook Laboratory to discuss ongoing research and monitoring programs. Dr. Synnot is in charge of a research program which is concerned with monitoring activities in Port Phillip Bay, adjacent to Melbourne.

Aquaculture Division

Visitors to our operations at the Milford Laboratory were: Lance Stewart and Peter Auster of the University of Connecticut at Noank; Roger Fabreau and Matthew Gaily of Juniper Point Sea Farm in Branford, Connecticut; George Matthiessen of Cotuit Oyster Company in Fishers Island, New York; and John Volk of Long Island Oyster Farms in New Haven, Connecticut.

Pathobiology Division

On 4 June, Ms. Barbara Hayden of the New Zealand Department of Fisheries and Shellfisheries visited the Milford Laboratory and discussed molluscan disease problems and ozone depuration with Drs. Blogoslawski, Robohm, and Brown.

Visitors to the Oxford Laboratory during the May-June period were Dr. Carl Shuster of the US Department of Energy in Washington, DC; Dr. R. Newell of the Center for Environmental & Estuarine Studies in Cambridge, Maryland; Ms. Barbara Hayden of the New Zealand Fisheries Research Division in Wellington; Dr. Dan Hunt of the US Food and Drug Administration in Washington, DC; an ecology class from Frostburg (Maryland) State College; Mr. George Deibel of Havre de Grace, Maryland; Mr. and Mrs. Ben Uchitelle of St. Louis, Missouri; Mr. Ben Drucker of the NMFS Central Office; Dr. Carl Sindermann of the Sandy Hook Laboratory; Mr. Jim Meehan of the NMFS Central Office; Dr. Richard Neve of the University of Alaska in Fairbanks; Ms. Ann Hamberger of the US Air Force in Wichita Falls, Texas; and Mr. Richard Greig of the Milford Laboratory.

National Systematics Laboratory

Visitors included Dr. James Tyler of the National Science Foundation who worked intermittently on plectognath fishes; Mr. Ken Sulak of the Virginia Institute of Marine Science who discussed Atlantic deepsea fishes; Mr. Gregg Small of the NWAFC in Seattle who took scale samples from Merluccius; and Mr. Nigel Merrett of the National Institute of Oceanography in the United Kingdom who studied grenadiers.

UNIVERSITY AFFAIRS

Resource Assessment Division

Donald Flescher met with Karsten Hartel and Caty Kessler of the Museum of Comparative Zoology at Harvard University. Don presented specimens of five species of fish to the Museum collection. He also had an identification confirmed of a queen crab (Chionectes opilio) caught in the Gulf of Maine bottom trawl survey.

Through correspondence with Eugenia Bölke of the Department of Zoology of the Philadelphia Academy of Natural Sciences, Donald Flescher had the identification of a reticulate moray (Muraena retifera) confirmed. Don has also sent saltwater fish photographs to the American Fisheries Society's fish photo collection.

On 21 May, Emory Anderson provided information on management of the silver hake fishery, particularly the foreign fishery, to Andrea Neuman of Rutgers University.

On 26 May, Fred Serchuk served as a Ph.D. committee member at the preliminary comprehensive oral examination of Steve Murawski, a Ph.D. candidate at the University of Massachusetts at Amherst.

On 12 June, Gordon Waring and Emma Henderson provided information on butterfish and summer flounder to Sheldon Pratt of the University of Rhode Island's Graduate School of Oceanography.

On 17 June, Fred Serchuk discussed American plaice assessment research with Loretta Sullivan, an M.Sc. candidate at the URI Graduate School of Oceanography.

Steve Clark organized and coordinated the summer 1981 participation of Resource Assessment Division personnel in the Shoals Marine Laboratory Summer Program sponsored by Cornell University and the University of New Hampshire.

John Boreman reviewed a striped bass life history model for M. B. Bain of the University of Massachusetts.

Many personnel from various academic institutions participated as scientific members aboard research vessel surveys. Ann Foster (University of Idaho), Medaris Banks (Hampton Institute), Thomas Durawa [Edgartown (Massachusetts) High School], Douglas Burn (Manomet Bird Observatory), and Karen Marti (URI) participated in the first leg of the 1981 sea scallop survey on the Albatross IV. Karen Marti instructed NMFS scientists on measuring sea scallops using an electronic measuring device (AIM) developed at URI. Future design and programming modifications of the measuring device are anticipated based on the field experience gained on the scallop survey. Mary Ann Etter (Canadian Marine and Fisheries Service in Halifax, Canada), Medaris Banks (Hampton Institute), Linda Davis [Lincoln-Sudbury (Massachusetts) Regional High School], Susan Fitch (Manomet Bird Observatory), and Margaret Carreiro (Boston University) participated in the second leg of the 1981 sea scallop survey.

Research samples collected during the spring 1981 bottom trawl survey for academic and research institutions outside NMFS included the following: yellowtail flounder specimens for Sharon McCafferty (State University of New York at Stony Brook), shipworms with wood for Carl Berg (Harvard University), liparids and hookear sculpins for Ken Able (Rutgers University), sea scallops for Mary Porter (Marine Biological Laboratory at Woods Hole), myctophids for James Craddock (WHOI), and berried lobsters for John Hughes (Massachusetts Division of Marine Fisheries).

Resource Utilization Division

Al Blott and Vern Nulk traveled to URI to discuss the NEFC-URI Cooperative Fisheries Engineering Research Unit with the URI Marine Advisory Service, Department of Fisheries and Marine Technology, and Graduate School of Oceanography personnel.

Dr. Sam Gillespie of Texas A&M University in College Station sought information on products from the various species of clams and their processing techniques.

Dr. Art Clifton of the Massachusetts Institute of Technology received help in using our Yanagiya meat/bone separator to separate cartilage in skate.

Pathobiology Division

On 1 June, Dr. Blogoslawski attended the successful master's degree defense of Mrs. Phyllis Hoikala at Quinnipiac College. Her thesis was titled, "Characterization of a Marine Vibrio, Pathogenic to Oyster (Crassostrea virginica) Larvae." A future publication on this work is planned.

Sixty mouse bioassays were completed for Dr. Julius Kuck of Fairfield University's Department of Chemistry, on samples of paralytic shellfish poison (PSP)-contaminated extracts. Drs. Kuck and Blogoslawski are trying to find a rapid means of chemical separation of PSP from shellfish and, possibly, a chemical detection test which might more accurately reflect bioassay results.

National Systematics Laboratory

Collette was reappointed Adjunct Professor of Biology at Northeastern University.

PERSONNEL

Resource Assessment Division

Summer students for the Resource Surveys Investigation this year are Susan Wigley (Bates College) working in the Survey Unit, Amy Tuttle (Smith College) and Carl Harrison (Lincoln University) working in the Technical Standardization Unit, and Jeffrey Knox (Worcester Polytechnical College) working in the Electronics Unit. Jeffrey is working with James Crossen in preparing the submersible pump, controllers, and covered electrical cable for the summer 1981 surf clam-ocean quahog survey.

Frank Almeida, Rhett Lewis, and Margaret McBride returned to the Woods Hole Laboratory from Oregon State University.

Marine Ecosystems Division

Two Narragansett Laboratory employees, Helen Cottrell and Larry Lindgren, left at the end of May for other employment opportunities.

Dan Patanjo attended a second short course on FORTRAN programming. He recommends the course to others wishing to learn basic FORTRAN principles.

On 15 May, Alice DeNofa attended a training session at the Marriott Hotel in Providence, Rhode Island, on "The Role of the Secretary as a Manager."

On 21 May, Roger Theroux participated in the Second Annual Bones Invitational Open Golf Tournament. Other participants included (Bob) Bones Livingstone, Pat Twohig, Ron (Dutch) Schultz, Ron Smolowitz, Fred Nichy, and H. C. (Half-Cup) Boyar. Scientific accomplishments: during the course of 18 holes, "Bones" managed to collect approximately 50 lb of geological specimens in his golf bag!

Cindy Fahay resigned effective 29 May to pursue a new career in the private sector. For the past decade she has been a productive member of the Ichthyoplankton Investigation. All of us will miss her.

Resource Utilization Division

Wilma Hill retired in June. Wilma was with the Gloucester Laboratory since 1963.

Pathobiology Division

Mr. Richard Vacca of the Milford Laboratory, a cooperative education employee from Roger Williams College, completed his 4-mo appointment on 15 May.

Mr. Chris Fleurer, a student from Gallaudet College in Washington, DC, joined the Oxford Laboratory staff on 15 June to assist in work on vertebral anomalies of sand lance.

EEO ACTIVITIES

Resource Assessment Division

On 9 May, Louise Dery attended a Woods Hole Laboratory Federal Women's Program (FWP) meeting.

On 14 May, Mike Sissenwine attended the NEFC EEO Committee meeting in Narragansett.

A Woods Hole Laboratory EEO Committee meeting was held on 15 May.

On 19 May, the Woods Hole Laboratory FWP sponsored a seminar on Personal Financial Planning. Anne Lange, John Boreman, Steve Clark, Mark Costa, Louise Dery, Linda Despres-Patanjo, Sherry Sass, and Ruben Miller attended.

Steve Clark prepared the draft affirmative action plan for the Woods Hole Laboratory's EEO Committee for FY 1982 and reviewed the plan at the June meeting.

On 3 June, Brad Brown and Roger St. Hilaire (Woods Hole Laboratory Administrative Officer), met with Leroy Gonsalves of the local Comprehensive Employment and Training Act (CETA) office and discussed potential NEFC involvement in the CETA training program.

On 8 June, Louise Dery spoke on her role as EEO Counselor during a Woods Hole Laboratory sexual harassment workshop.

On 11 June, Brad Brown and Ambrose Jearld attended a meeting of the Massachusetts Pre-engineering Program and met with the director, Dr. John Slaughter, concerning recruitment of minorities in science.

On 16 June, the Woods Hole Laboratory FWP sponsored a seminar and workshop on sexual harassment. Many Resource Assessment Division staff attended.

Marine Ecosystems Division

On 5 May, Ray Bowman attended the Woods Hole Laboratory's monthly EEO meeting.

On 8 June, Greg Lough, Dave Potter, George Bolz, Roz Cohen, Peter Donnelly, and Phil LeBlanc attended a FWP seminar at the Woods Hole Laboratory on "Sexual Harassment."

Resource Utilization Division

Al Blott is a new member of the Gloucester Laboratory EEO Committee and has attended his first meeting.

Division of Environmental Assessment

A. Calabrese participated in the Center EEO meeting at the Narragansett Laboratory on 14 May.

Pathobiology Division

Mrs. Wheatley and Mrs. Hines attended the Center EEO meeting at the Narragansett Laboratory on 14 and 15 May.

PUBLIC AFFAIRS

No report.