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# NORTHEAST FISHERIES CENTER

## NEWSLETTER

JULY-AUGUST 1981

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



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"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.

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## MEET THE ATLANTIC ENVIRONMENTAL GROUP

by

Dr. Merton C. Ingham, Director  
Atlantic Environmental Group

### INTRODUCTION

#### History

The Atlantic Environmental Group (AEG) began in autumn 1971 as part of the National Marine Fisheries Service's (NMFS) Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) in Washington, D.C. It spent nearly 3 yr trying to do scientific work in bureaucratic surroundings, not an easy task. In summer 1974, AEG requested and was allowed to transfer to Narragansett, Rhode Island--its present site--where it could work more closely with scientists of the MARMAP Field Group, the Northeast Fisheries Center (NEFC), and the University of Rhode Island (URI).

In autumn 1976, as part of a NMFS reorganization, administrative authority for the AEG shifted from the Central Office to the NEFC, an arrangement which still exists. In summer 1978, most of the MARMAP Field Group (five people) and most of its plankton monitoring and data analysis activities transferred to the AEG, bringing AEG up to its present staffing level.

#### Structure

The AEG currently has nine permanent and eight temporary (mostly college student) employees. These 17 employees include nine oceanographers, three technicians, two computer programmers, one visual information specialist, one secretary, and one clerk-typist.

The AEG occupies five house trailers (surplus from flood relief efforts) located adjacent to the NEFC's Narragansett Laboratory, and has space in that laboratory for an instrument workshop. Both the AEG and the Narragansett Laboratory are situated in the northwestern corner of the Narragansett Research Complex--a complex which includes facilities of URI and the US Environmental Protection Agency (EPA). See Figure 1.

#### Function

The AEG supports NMFS programs by "...conducting studies in marine environmental monitoring and providing data collection and interpretation for the purpose of better understanding fishery problems. The mission includes analysis, portrayal, and interpretation of oceanographic and meteorological data, and their interrelation to fishery and environmental forecasting."

The activities described in the above mission statement principally support NMFS interests in the Northwest Atlantic and Gulf of Mexico. They depend in part upon requests for assistance, cooperation, or information from individuals and programs, but are not limited to such initiatives.

## OCEANOGRAPHIC STUDIES

### Ship-based Observations

Monitoring activities at AEG include a Ships-of-Opportunity Program (SOOP) for: (1) collecting water-column temperature data using expendable bathythermographs and plankton samples using a Hardy continuous plankton recorder and neuston nets, or (2) a larger set of hydrographic data along with a plankton sample using an undulating oceanographic recorder (Figure 2). The ships participating in SOOP are mostly merchant vessels, with some research ships and US Coast Guard cutters helping out. These data and samples are collected monthly along predetermined transect lines or in specified areas in coastal and offshore waters (Figure 3). One transect has been sampled since 1962, but more commonly the coverage extends back about 7 yr, long enough to begin describing seasonal norms and year-to-year variations or anomalies.

The undulating oceanographic recorder (UOR) noted above is a recent addition to the instruments used in our ocean monitoring activities; its deployment by AEG began this spring on the New York-to-Bermuda transect. The UOR is an automatic, instrumented, towed vehicle which can be programmed to undulate between a minimum depth of 5 m and a maximum depth between 15 and 100 m, with a choice of undulation lengths from 0.8 to 40 km. Towing speed can vary from 8 to 26 knots. It continuously collects plankton while simultaneously making discrete measurements of depth, temperature, salinity, and chlorophyll-a. Data are captured on tape cassettes and processed either at sea (for research ship operations) or ashore (for merchant vessel and US Coast Guard cutter operations) by a microprocessor-based translator, which combines the data with sensor calibration coefficients and prints out tabular and graphic portrayals as well as a computer-compatible data file. All of these data become part of our ocean monitoring and climatology data bases.

In addition to using the ocean monitoring data in our own studies, we provide portrayals and interpretations to other investigators in the national and international marine science communities. Annual reports are prepared for the International Council for the Exploration of the Sea and the Northwest Atlantic Fisheries Organization, and an annual inventory of our physical oceanographic data is published by the NOAA Environmental Data and Information Service's National Oceanographic Data Center where it is archived and available to all interested parties.

### Satellite-based Observations

Another form of oceanographic monitoring by the AEG is the detailed analysis of oceanic fronts as portrayed in infrared (IR) imagery (gray-scale photographs) and derived chart portrayals that are regularly available from the NOAA National Earth Satellite Service's (NESS) polar-orbiting and geostationary satellites. The time series of weekly IR imagery and chart portrayals for the Northwest Atlantic extends back to 1973. Systematic analysis of this information has produced detailed yearly and multiyear descriptions of: (1) variations in the position of the shelf-slope water front; and (2) characteristics of Gulf Stream warm-core rings (times, locations, and frequency of formation; rates and directions of movement; longevity; and interactions with adjacent shelf, slope, and Gulf Stream water masses).

This frontal analysis increases our understanding of how physical variability in the deep ocean may affect biological production in the shallower waters of the continental shelf and slope where the principal fisheries are concentrated. Prior to late 1973, when high-resolution infrared radiometers were deployed in NOAA satellites, such investigations were not possible because the frequency and density of conventional oceanographic observation (from ships, buoys, and occasional aircraft surveys) were insufficient.

Within the last year, the NEFC has acquired a GOES-TAP facsimile recorder and located it at AEG for timely reception of NOAA environmental satellite imagery. Linked by leased phone line to the NESS Washington Satellite Field Services Station in Camp Springs, Maryland, the recorder provides IR imagery from both the polar-orbiting and geostationary satellites, as well as visible light imagery from the geostationary satellites. Imagery is received 30 min after the data are recorded by the satellite. Although the great majority of transmissions are designed for meteorological rather than oceanographic applications, two channels are assigned to special requests regarding geographic coverage and enhancement. The recorder is a significant step toward real-time environmental monitoring. When the Northeast Area Remote Sensing System facility becomes established at the URI Bay Campus, we will be able to obtain more specialized data and data processing from NASA experimental satellites and foreign satellites with a much wider range of sensors.

#### Fisheries Support

An important by-product of our frontal analysis has been its usefulness to fishermen. For example, both commercial and recreational fishermen, who recognize that large pelagic predators such as sharks, tunas, and billfishes tend to concentrate in the vicinity of fronts, frequently request information on frontal configurations from the AEG. Furthermore, lobster and crab fishermen working on the outer continental shelf and on the continental slope have learned through unfortunate experiences that the strong currents associated with passing Gulf Stream rings can cause serious reductions in catch rates and the loss of gear resulting from submergence of surface floats and from movement of strings of pots along the bottom. Accordingly, they have developed considerable interest in frequent information on the location of rings for planning their operations. Presently, AEG partially meets the needs of both groups of fishermen by weekly mailing them modified or highlighted copies of the "Oceanographic Analysis" charts of surface thermal features produced by NESS (Figure 4) and by answering telephone inquiries for the most recent information.

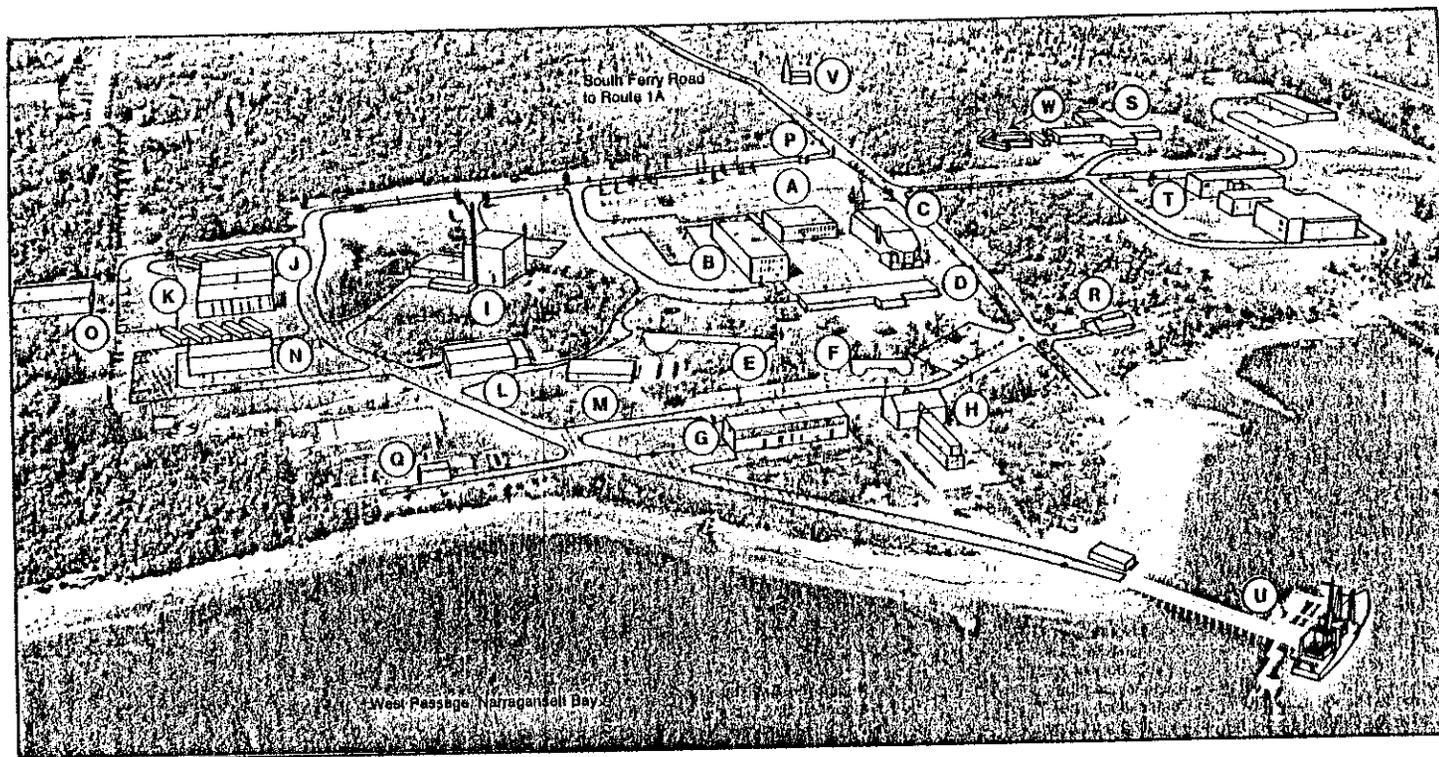
#### CLIMATOLOGICAL STUDIES

Climatological studies by the AEG have generally been part of cooperative efforts with several other NMFS scientists, usually fishery biologists. These studies have utilized time series of oceanographic and meteorological data in attempts to define the impacts of natural environmental variation on marine organisms. Past studies addressed the involvement of early water-column thermal stratification in the development of critically low oxygen concentrations in bottom water off New Jersey in summer 1976, the effect of winter wind-driven transport of Atlantic menhaden larvae south of Cape Hatteras upon year-class strength, the effect of variation in spring wind-driven transport of Atlantic mackerel larvae in the Middle Atlantic Bight upon year-class strength, the potential environmental impacts from petroleum development on the outer continental shelf in the Gulf of Mexico, and the environmental impacts of deepwater disposal of waste products in the Middle Atlantic Bight.

In the near future, similar cooperative studies will begin on conditions in the "cold cell" in the shelf water in the Middle Atlantic Bight, the effect of natural environmental variations on haddock recruitment, and the impact of entrainment of Georges Bank water around Gulf Stream warm-core rings on the survival of the larvae of various fish species.

#### PUBLICATIONS/REPORTS

Since moving to Narragansett in 1974, the staff of AEG has produced over 135 reports, ranging from data portrayals distributed to NEFC and SEFC scientists in the Data Analysis Product series, to published articles in scientific and technical journals. Since 1976 the titles of current reports have been listed in the "Northeast Fisheries Center Newsletter" ("NEFC News"). Anyone wishing a complete listing of these publications/reports can obtain a copy from Mrs. Gertrude Kavanagh, Atlantic Environmental Group, National Marine Fisheries Service, South Ferry Road, Narragansett, Rhode Island 02882-1199.



-5-

Figure 1. Building key: A = Claiborne de B. Pell Library (URI), B = Francis H. Horn Laboratory (URI), C = Norman D. Watkins Laboratory (URI), D = Charles J. Fish Laboratory (URI); E = Bunker Cram Laboratories (URI), F = Bunker Armstead Laboratories (URI), G = Research Aquarium (URI), H = Marine Environmental Research Laboratory (URI), I = Rhode Island Nuclear Science Center (URI), J = South Laboratory (URI), K = Trailer Park (URI), L = Technical Services Building (URI), M = Marine Building (URI), N = Maintenance Building (URI), O = Ocean Engineering Laboratory (URI), P = Police (URI), Q = Sewage Treatment Plant (URI), R = Helen Mosby Center (URI), S = Narragansett Laboratory (NEFC), T = Environmental Research Laboratory (EPA), U = Dock for R/V Endeavor (URI), V = South Ferry Church, and W = Atlantic Environmental Group (NEFC).

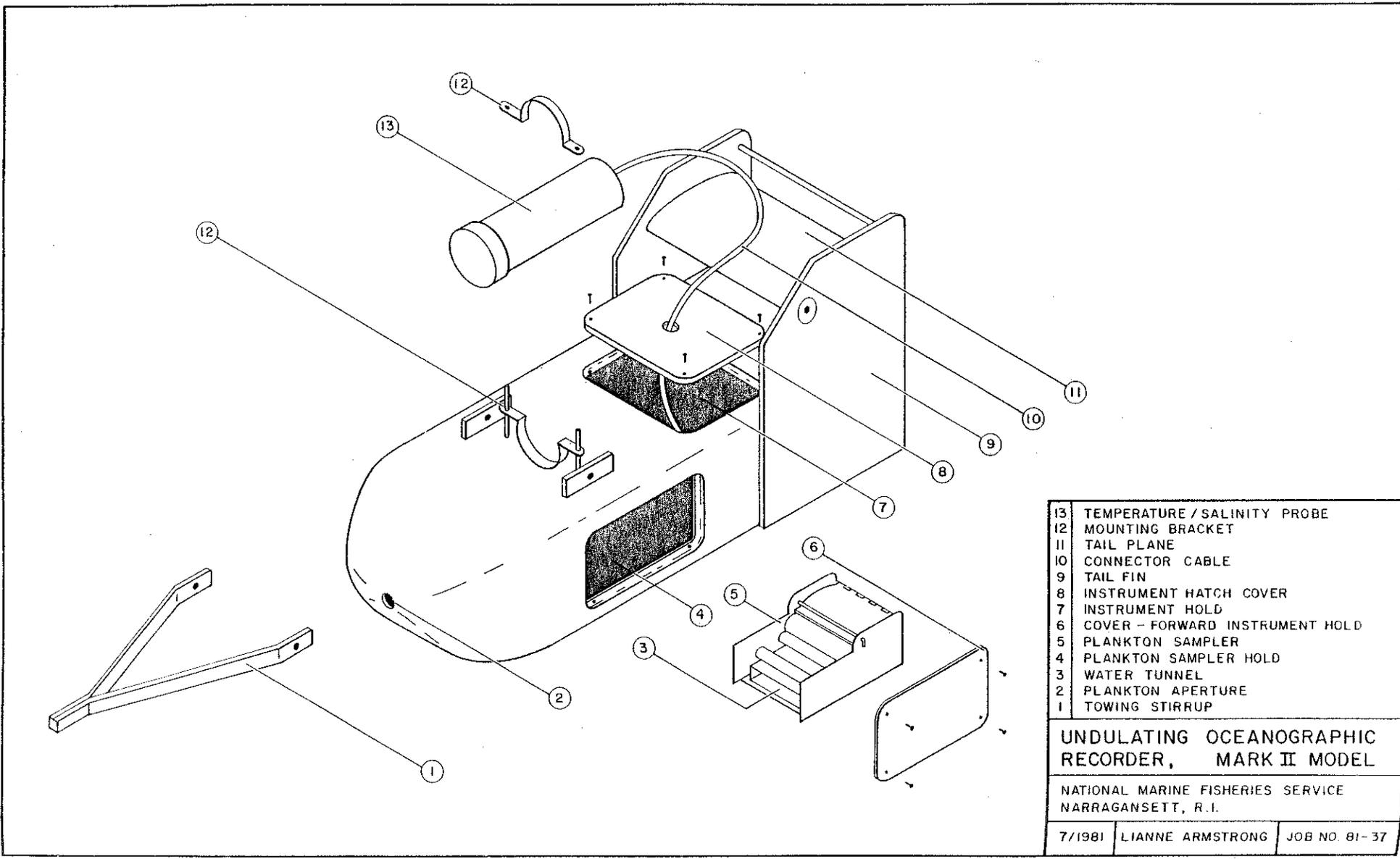


Figure 2.

Figure 2.

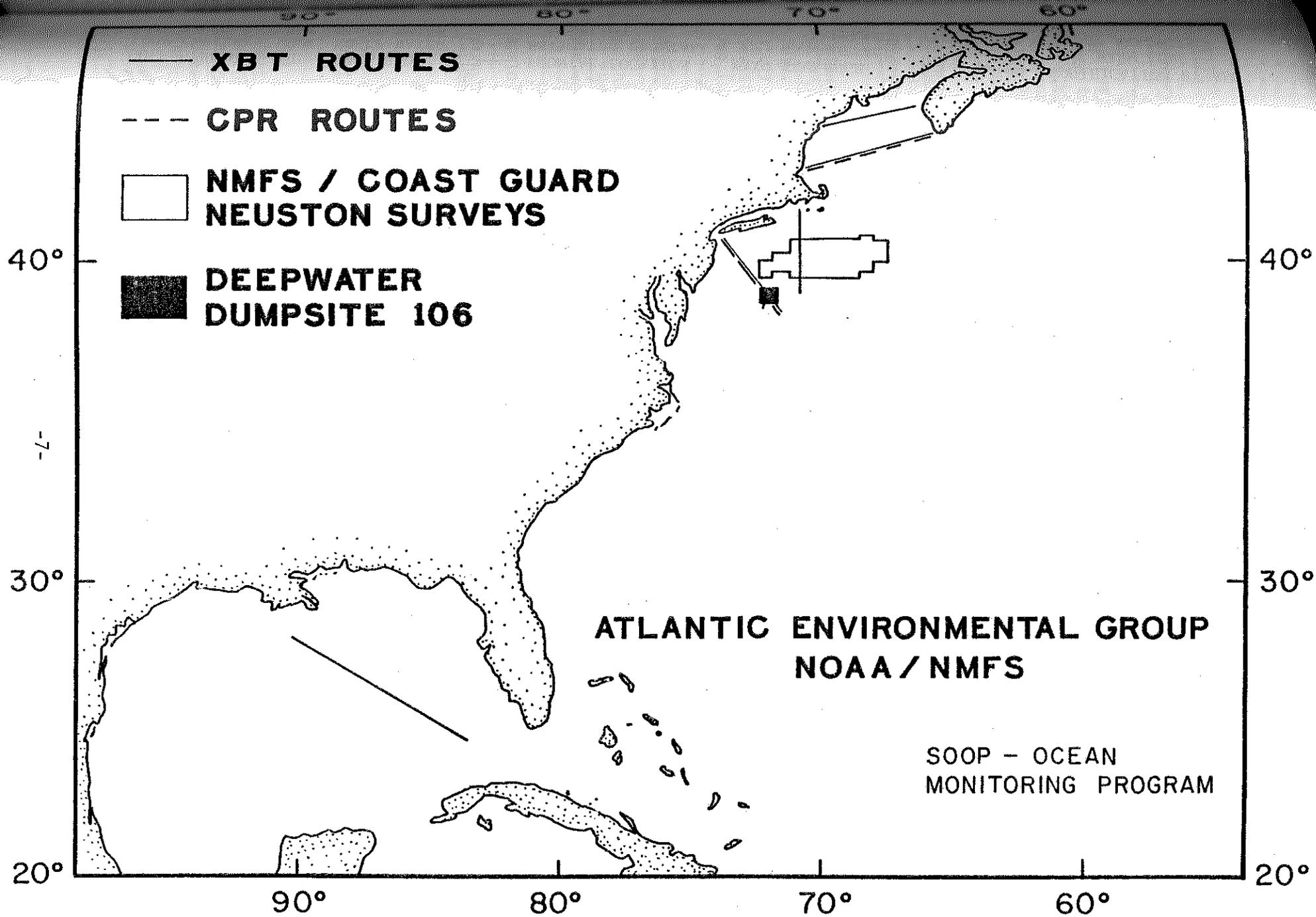


Figure 3.

OCEANOGRAPHIC ANALYSIS

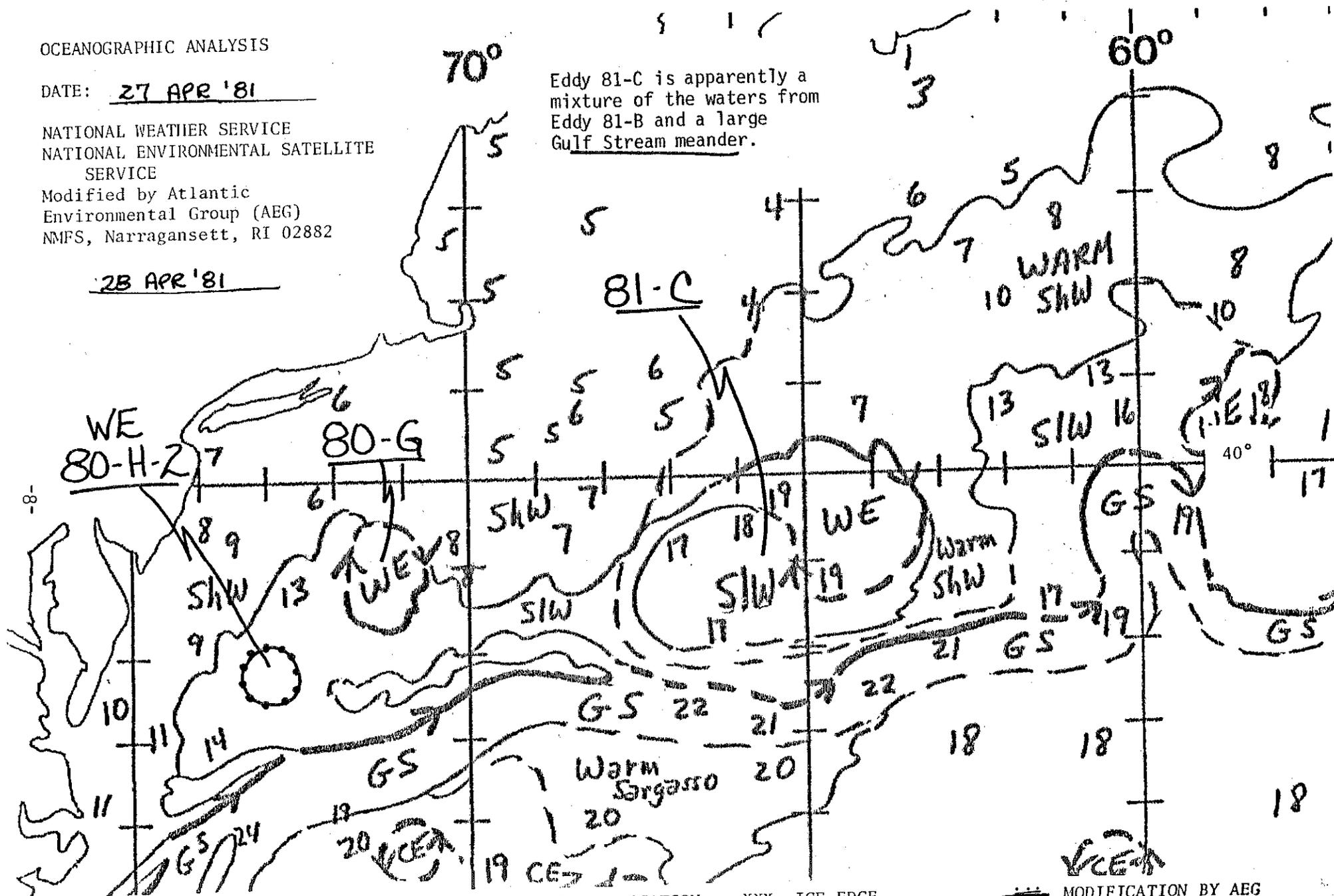
DATE: 27 APR '81

NATIONAL WEATHER SERVICE  
NATIONAL ENVIRONMENTAL SATELLITE  
SERVICE

Modified by Atlantic  
Environmental Group (AEG)  
NMFS, Narragansett, RI 02882

28 APR '81

Eddy 81-C is apparently a  
mixture of the waters from  
Eddy 81-B and a large  
Gulf Stream meander.



GS	GULF STREAM	CE	COLD EDDY	---	FRONTAL LOCATION	XXX	ICE EDGE		
LC	LOOP CURRENT	SHW	SHELF WATER	---	ESTIMATED FRONTAL LOCATION	19	SEA SURFACE TEMPERATURE (°C)		
WE	WARM EDDY	SIW	SLOPE WATER						--- MODIFICATION BY AEG OF WARM CORE EDDY ANALYSIS

Figure 4.

## CENTER DIRECTORATE

### Fishery Technology

Robert Learson, Deputy Director of the Gloucester Laboratory, was nominated by the Northeast Regional Director and two Northeast Regional Office employees to receive an incentive award for his role in coordinating an international symposium on squid utilization in Boston during 9-12 August 1981. The citation by the Regional Director reads in parts: "The success of the event is attested by the fact that 20 foreign countries were represented." and "It gives me a great deal of pleasure to recommend these individuals for this award for their efforts were well beyond the normal requirement of their jobs."

### RESOURCE ASSESSMENT DIVISION

#### Resource Surveys Investigation

The 1981 summer bottom trawl survey was completed 24 July aboard the NOAA R/V Delaware II. Darryl Christensen was Chief Scientist on the southern leg from 27 June to 2 July. Malcolm Silverman was Chief Scientist on the northern leg from 7 to 24 July. In addition to the standard finfish survey, a special shrimp diel availability study was conducted in Jeffreys Basin (Gulf of Maine) during the second leg. Other investigation personnel participating on the cruise were Liz Bevacqua, Carl Harrison, Amy Tuttle, and Susan Wigley.

Andy Thoms, Jim Crossen, and Chuck Byrne spent most of their time in July and August preparing for the ocean quahog-surf clam survey. The first leg of the survey aboard the Delaware II was successfully completed during 3-21 August with Chuck Byrne as Chief Scientist. Andy Thoms also participated on the first leg. The second leg of the survey began on 24 August with Tom Azarovitz as Chief Scientist; aboard with him were Chuck Byrne, Andy Thoms, and Jim Crossen.

The staff completed processing and placed on final tapes, the data from the spring bottom trawl survey and the June sea scallop survey.

#### Fishery Biology Investigation

##### Age and Growth

Vi Gifford completed the second aging of the second and third quarters of the 1974 commercial redfish samples. She also aged once the third quarter and twice the fourth quarter 1974 commercial redfish samples.

Kris Andrade completed aging, coding, and summarizing haddock samples from the 1981 spring bottom trawl survey (Delaware II Cruise No. DE 81-02) and sent the age sheets to the Woods Hole Laboratory's Automatic Data Processing (ADP) Unit for keypunching. She completed the age sheet for the second quarter 1981 commercial haddock samples and sent them to assessment personnel. Kris also checked Doris Jimenez's aging of pollock samples for the 1981 spring bottom trawl survey, and sent the coded age sheets to the ADP Unit for keypunching.

Melinda Grace put the second quarter 1974 commercial redfish age data on sheets, coded, and then summarized them. She also put the yellowtail flounder age data for frozen samples from the 1981 spring bottom trawl survey on sheets and then coded and summarized all of that survey's yellowtail flounder age data. She put the yellowtail flounder age data from the spring gear testing cruise (NOAA R/V Albatross IV Cruise No. AL 81-02) on sheets and summarized them. Melinda, Ruben Millor, and Jim Fletcher worked up all the F/V Francis Elizabeth (the State of Massachusetts chartered research survey vessel) frozen age samples for the 1978-81 spring bottom trawl surveys.

Wendy Sylvia continued to process various species for aging and assisted in auditing age sheets. At the end of August, Wendy entered as a freshman at the University of Massachusetts at Amherst.

Judy Penttila made selected checks of Atlantic cod samples aged by Doris Jimenez as follows: 1980 commercial samples for all four quarters, 1981 commercial samples for the first quarter, and 1981 spring bottom trawl survey samples. After checking the age sheets and summaries, she sent the commercial data to assessment personnel and the survey age sheets to the ADP Unit. Judy aged and summarized second quarter 1981 commercial yellowtail flounder samples and sent data to assessment personnel. She also sent yellowtail flounder age sheets for the 1981 spring bottom trawl survey to the ADP Unit.

### Finfish

Sherry Sass aged and summarized butterfish samples from the fall 1980 and spring 1981 bottom trawl surveys. She and David Pyoas continued to rear young-of-the-year winter flounder. They met with Bob Cully from the US Geological Survey to learn scanning electron microscope techniques for aging young fish.

David Pyoas was trained by John Ropes to process shellfish samples, particularly ocean quahogs for reproductive and aging studies. David then participated in a shellfish survey aboard the Delaware II. Upon his return, David completed the final draft of a report describing his work experiences as a cooperative education employee, and returned to South Carolina State College.

Alicia Kelly sectioned 1981 spring bottom trawl survey silver hake otolith samples and impressed 1981 spring survey summer flounder scale samples. Alicia, Mark Costa, and Leslie DeFillipis processed frozen young-of-the-year scale and otolith samples from various species. Mark and Alicia both left at the end of August to enter as college freshmen at Lincoln University (Pennsylvania) and the State University of New York at Stony Brook, respectively.

Brenda Fields completed aging more than a year's backlog of commercial and research vessel survey scale samples from summer flounder. All summer flounder aging is up-to-date through the 1981 summer bottom trawl survey for research vessel survey samples, and through the second quarter 1981 for commercial samples.

Louise Dery completed aging and preparing age-length summaries for red hake from the 1980 spring and fall bottom trawl surveys. She also completed the first phase of a US-Canada Atlantic mackerel age study, and with Alicia Kelly completed

the age-and-growth reference file with subject and author index. Louise, Sherry, and John Ropes worked out new microphotography methods for fish otoliths and made photographs of butterfly otoliths for Gordon Waring and our own documentation. Mss. Dery and Sass also worked with Neil Churchill of the Massachusetts Division of Marine Fisheries on alewife aging methods.

### Shellfish

John Ropes spent a considerable amount of time instructing other investigators in the techniques of preparing bivalve shells for observation of microgrowth features, completing preparations for the upcoming surf clam-ocean quahog cruises, and preparing marked ocean quahog specimens for future observation of age-growth lines.

Mary Hancock of the National Park Service completed sectioning about 200 shell specimens of hard clams (Mercenaria mercenaria). These were from archeological sites at the Cape Cod National Seashore.

Dr. Diane J. Brousseau of Fairfield (Connecticut) University, requested permission to thin-section shells of the ribbed mussel [Gukensia (Modiolus) demissa] for study of population age-growth line features. This species has been the subject of several recent studies of shell microgrowth analyses.

During 17-21 August, investigators (Jamie Young, Thomas MacLean, and Ross Chandler) of the Canadian Department of Fisheries and Oceans in Halifax, Nova Scotia, were at Woods Hole Laboratory to receive instruction in our methods of processing shells of ocean quahogs. They brought shells collected during Delaware II Cruise No. DE 80-06 off the Canadian coast as well as special inshore samples to process. About 75 shell specimens were sectioned, preparatory to embedding in epoxy resin for hand grinding and polishing the cut edges, etching, and producing acetate peels for microscopic examination. It was generally agreed that the grinding step was most labor intensive, due partly to embedding the shells in metal molds coated with paraffin. The uneven paraffin surface often produced an uneven surface and layer of epoxy that had to be removed to expose the cut edge. Nevertheless, more shells were processed than had been initially planned.

J. Ropes was on the surf clam-ocean quahog survey (Delaware II Cruise No. DE 81-05) from 24 August to 11 September.

Maurice Crawford aged surf clam samples received from the University of Maryland Eastern Shore and continued to train Sherry Sass to age surf clams. Maurice worked with Vi Gifford on aging sea scallops. He also entered previous surf clam age data into a computer file and trained Sherry Sass to handle the data on the computer.

### Fishery Assessment Investigation and Senior Assessment Scientists

Brad Brown devoted a great deal of time to fiscal year 1982 budget problems and development of current-year operating plans. Brad also helped review programs and prepare material for a special issue of the "Northeast Fisheries Center Newsletter" dealing with key issues within the NEFC, as well as drafted a section on fishery resources for a Georges Bank monograph. Emory Anderson prepared fiscal year 1982 current-year operating plans for the Northwest Atlantic Multispecies Fishery Analysis Task.

Mike Sissenwine prepared a proposal for the three-tier system of fisheries statistics collection and a proposal for analysis of the no-regulation alternative for the Northeast Fishery Management Task Force.

Fred Serchuk drafted a Resource Assessment Division position statement on the merits of joining the Northwest Atlantic Fisheries Organization (NAFO). Fred is also working on sea scallop data from the 1963-81 bottom trawl surveys. Fred, Paul Wood, and Bob Rak have derived a shell height-meat weight regression and are analyzing shell height-gonad weight relationships for sea scallops.

Emory Anderson drafted status-of-the-stocks reports for Atlantic mackerel, bluefish, and butterfish. Ralph Mayo drafted status-of-the-stocks reports for redfish, scup, and river herring (alewives and blueback herring).

Emory Anderson completed the 1981 Atlantic mackerel assessment. Steve Clark updated the total-finish-and-squid biomass assessment. Steve and Ralph Mayo completed the pollock assessment. Steve and Loretta O'Brien updated assessments on white hake, witch flounder, cusk, and Atlantic wolffish. Rhett Lewis is finishing the black sea bass assessment. Steve Murawski, Fred Serchuk, and Bob Rak are updating the surf clam and ocean quahog assessments. Eileen Klopfer has assisted in data preparation for butterfish, dogfish, and silver hake assessments.

Gordon Waring and Eileen Klopfer analyzed Atlantic herring tagging data from the 1976-78 International Herring Tagging Program for an upcoming NAFO meeting. Anne Lange and Fred Nichy are conducting a squid growth study in the aquarium. Mike Sissenwine developed a method of estimating "M" and "q" from the Uston equation and research vessel survey data.

Emma Henderson has completed a proposal for revising bottom trawl survey analysis computer software. The revisions allow replaying the 18 analytical programs that have accumulated since the survey started with a single program. The new program will contain a new age analysis module and provide some additional information and more flexibility in use. Emma will continue cooperating with the Woods Hole Laboratory ADP Unit on development and documentation of the computer program. Emma consulted with the Fishery Biology Investigation on nonlinear curve-fitting procedures for von Bertalanffy curves. Margaret McBride compiled data on foreign and industrial yellowtail flounder discards as a step in improving virtual population analysis. Steve Murawski has implemented Rivard's APL program for Thompson-Bell yield-per-recruit analysis on the ADP-net. Anne Lange has debugged and documented an interactive version of NORMSEP on the Sigma 7.

Emory Anderson and Anne Lange drafted an NEFC review of the squid-mackerel-butterfish fishery management plan (FMP) merger amendment, and Emory reviewed a PL 88-309 Lake Michigan lake trout study proposal for the Northeast Regional Office (NERO). John Boreman reviewed a manuscript for the US Fish and Wildlife Service (USFWS) and one for the Canadian Journal of Fisheries and Aquatic Science. Steve Clark reviewed completion reports on northern shrimp research contracts with the States of New Hampshire and Maine. Fred Serchuk reviewed a manuscript on "Environmental Biology of Fishes" and the "Federal Aid Annual Project Completion Report" for NERO.

Gordon Waring went on a sea sampling trip for spiny dogfish on 9 July aboard the F/V Acme II from Gloucester, Massachusetts. Vaughn Anthony went sea sampling on 18 July on the lobster boat Sara C out of Sebasco, Maine. Pat Chew was a member of the scientific crew on the August surf clam-ocean quahog survey cruise. Harold Foster and Detra Green served on the summer bottom trawl survey in July.

In the area of providing technical information, Emory Anderson provided optimum yield/maximum sustainable yield information for hakes, squids, Atlantic mackerel, butterfish, and dogfishes in NAFO Subarea 6 to Mark Silverman of Associated Enterprise Development, Inc., in Baltimore. Emory discussed status of bluefish resource with Beth Amaral of the Massachusetts Division of Marine Fisheries. Vaughn Anthony provided species distribution plots to Norm Olson of Eastern Marine Builders and Supply in Maryland. Vaughn provided portions of the International Council for the Exploration of the Sea's (ICES) Advisory Committee on Fisheries Management report concerning Atlantic herring as per request of Maine sardine industry members. Anne Lange met in Providence, Rhode Island, on 22 July with Spanish technical representatives interested in joint ventures. Anne sent squid biology documents and discussed squid population dynamics with Hector Letz of the National Fisheries Institute of Montevideo, Uruguay. Fred Serchuk provided Ben Jones of the NAWFC with sea scallop sampling and data summary procedures at NEFC. (An intensive commercial sea scallop fishery has developed off Oregon.) Fred provided information on orange/red sea scallop meats and their nutritional value to F. J. O'Hara and Sons, Inc.

#### Publications

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- Henderson, E.; Marchesseault, G. D. A biological prediction model developed in support of an operations research approach to the management of the New England groundfish fishery. Haley, K. N. ed. Applied operations research in fishing. New York: Plenum Pub. Co.;1981. (P)
- Mayo, R.; Lange, A.M.T.; Murawski, S. A.; Sissenwine, M. P.; Brown, B. E. A procedure for estimating rates of escapement and discard based on research vessel bottom trawl survey catches. Int. Counc. Explor. Sea, Comm. Mem. 1981/G:62. (P)
- Murawski, S.; Lange, A.M.T.; Sissenwine, M. P.; Mayo, R. K. Definition and analysis of otter trawl fisheries off the Northeast Coast of the United States based on multispecies similarity of landings. Int. Counc. Explor. Sea, Comm. Mem. 1981/G:63. (P)
- Sissenwine, M. P. An overview of some methods of fish stock assessment. Fisheries. (In press.) (A)

#### Reports

- Boreman, J.; Green, D. Striped bass: an indexed bibliography. Woods Hole Lab. Ref. Doc. No. 81-24;1981.

Fogarty, M. Review and assessment of the summer flounder (Paralichthys dentatus) fishery. Woods Hole Lab. Ref. Doc. No. 81-25;1981.

Lange, A. Stock status and estimates of potential yields of squid (Loligo pealei and Illex illecebrosus) populations off the northeastern U.S.A. Woods Hole Lab. Ref. Doc. No. 81-29;1981.

Waring, G.; Anderson, E. D. Status of the northwestern Atlantic butterfish stock, August 1981. Woods Hole Lab. Ref. Doc. No. 81-27;1981.

#### MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

During February through August 1981, MURT personnel accomplished the following tasks.

#### Georges Bank-Submarine Canyon Monitoring Regarding Oil/Natural Gas Exploration and Production

Preparations were completed in May for the July cruise, including underwater camera calibrations and coordination with the submersible operations crew of the Harbor Branch Foundation.

Two weeks of manned submersible diving at two site-specific monitoring stations on Georges Bank, two in Lydonia Canyon, two in Oceanographer Canyon, and one in Veatch Canyon were accomplished. Twenty-one dives were made, totaling 54 hr of "bottom time" or 108 man-hours (two scientists per dive). The following objectives were fulfilled:

1. The four Ocean Pulse Program (OPP) stations (No's. 2, 3, 5, and 6) established in August 1980 were revisited.
2. Three additional OPP stations were "set up" in Oceanographer and Veatch Canyons.
3. Approximately 1500, 35-mm color pictures (forward and aft camera systems) were taken at each station to define substrate type and associated megabenthic fauna, with special emphasis on American lobster, crabs, sea scallop, hakes, cusk, conger eel, squids, four-spot flounder, witch flounder, shrimps, ocean pout, and anemones. All photographs are quantitatively calibrated for analyses of species densities. Each photograph encompassed 6 m<sup>2</sup> of ocean floor or a total coverage of approximately 9000 m<sup>2</sup> per monitoring station.
4. Extensive observations and videotaping were accomplished in support of defining behavior and ecology of the megabenthic fauna. Special emphasis was given to defining shelter types and occupants.
5. Twenty-four replicate substrate samples were collected in-situ on Georges Bank (Station 3) and in Lydonia Canyon (Station 5) to: (1) define infauna; (2) collect tissue samples from one or two dominant species (infauna) for tissue-load determinations of contaminants; and (3) provide

a calibration for the conventional, surface-lowered sediment samples (Smith-McIntyre grab) at two stations characterized by different substrates.

6. Additional documentation of tilefish ecology, habitat, behavior, etc., was obtained.
7. Samples of tilefish, American lobster, Jonah crab, and sea scallops were collected for tissue-bound contaminant determinations at each monitoring station where they occurred. Sediment samples were also collected for contaminant analysis.
8. Extensive photographs, observations, and specimen collections were accomplished to define the distribution, abundance, ecology, and relative importance of the mud anemone and the mud anemone "forests" as animal shelters and as a very distinctive ecosystem of the ocean floor.
9. Over 1200 photographs and observations were made of the upper axis of Oceanographer Canyon with emphasis on its possible function as a conduit for bottom currents and the dispersal of bottom-oriented contaminants. Sediment samples were collected from various substrate types and geological formations (sand dunes, waves, etc.) along the canyon axis. Also, observations were made on the behavior of megabenthic fauna to strong (3 knots) and variable bottom currents.

All exposed film has been developed and some 10 000 individual frames are being analysed for species diversity, abundance, habitat type, community structure, behavior, etc. Geological observations and sediment samples are being analyzed by the US Geological Survey. Contaminant loads in the fish and crustacean samples and substrate samples are being analyzed by an analytical firm in Boston.

#### Jeffreys Ledge and Block Island Monitoring for the Northeast Monitoring Program

The MURT dive team conducted two cruises in May and June to: (1) revisit the Northeast Monitoring Program station on Jeffreys Ledge, and (2) establish a new station off Block Island. The NEFC's R/V Gloria Michelle proved to be an excellent platform for supporting the diving operations. The following tasks were accomplished at these monitoring stations:

##### Jeffreys Ledge

1. 30-m, site-specific transects were quantitatively photographed for both horizontal and vertical surfaces (substrates).
2. Twelve new site-specific 0.25-m<sup>2</sup> quadrats were established on horizontal and vertical surfaces.
3. Fouling panels of varied substrates were set up to measure, upon quarterly sampling, recruitment into the communities. Early results suggest Ptilota (dominant alga) recruitment to be due to immigration rather than sexual reproduction.

4. Samples of "key indicator species" (the red alga Ptilota, the starfish Asterias, and the ascidian Ascidia) were collected for determination of tissue-bound levels of pollutants (heavy metals, hydrocarbons, and polychlorinated biphenyls).

The data from this cruise will allow a completion of the baseline description of the site. Future efforts will monitor the site, utilizing our quantitative photographic methods.

#### Block Island

In an effort to better understand the impact of man's activity on the inshore coastal environment and its ocean floor biota, the MURT divers conducted an extensive survey of the waters around Block Island, off the mouth of Long Island Sound. This is an area considered to be "impacted" or "potentially impacted" because of the proximity to large population centers and the large amount of shipping through the area. The following tasks were completed:

1. Established one site-specific monitoring station off the southeast corner of Block Island.
2. Photographically documented (via 0.25-m<sup>2</sup> quadrats) the epibenthic fauna (attached and mobile) of the hard (bedrock and boulder) substrates.
3. Made detailed collections (air-lift sampling) of epibenthic fauna for comparison with photographic documentation.
4. Collected samples of two "key indicator species" (the sea anemone Metridium and the starfish Asterias) for determination of tissue-bound pollutants.
5. Conducted general photographic survey of station surroundings for a complete geological-biological description of monitoring site.

#### Assistance to the Southeast Fisheries Center's Manned Submersible Program

Assistance to the SEFC was rendered over the past 6 mo with regard to: (1) defining objectives and preparing proposals for two submersible programs to be conducted on Middle Ground off west-central Florida, (2) coordinating the science and operations through the Harbor Branch Foundation, and (3) arranging for outside NOAA financial support for equipment purchase. Both cruises were successfully completed this summer, representing a "good start" for the SEFC in their manned submersible-fishery assessment studies.

#### Deep Sea Camera Received

A 20 000-ft capacity Benthos 35-mm Deep Sea Camera System was purchased with assistance from the NOAA Manned Undersea Science and Technology Office to give MURT the capability to document quantitatively the megabenthic fauna at the Northeast Monitoring Program's Georges Bank and submarine canyon stations during the "cold rough weather" time of the year; all monitoring activity to date has been conducted with manned submersibles at site-specific locations during mid-late summer. We hope

to use this camera system at other Northeast Monitoring Program stations to define better the surficial geology and related fauna at sites where, to date, no such documentation has been obtained.

### Manuscripts

MURT scientists are continuing the preparation of the following manuscripts:

1. "Biology and Geology of Veatch Submarine Canyon"
2. "Biology and Geology of the Heads of the Georges Bank Submarine Canyons -- Corsair, Lydonia, Gilbert, Oceanographer, Hydrographer, and Veatch"
3. "Pre-drilling Baselines of the Megabenthic Fauna and Their Habitats of Georges Bank and the Georges Bank Submarine Canyons"
4. "Trace Metal and Hydrocarbon Levels of Selected Marine Species from Inshore and Offshore Monitoring Sites (Georges Bank, Submarine Canyons, Jeffreys Ledge, and Block Island)"
5. "Distribution, Abundance, and Related Ecology of Mud Anemone, Cerianthus sp., Forests of the New England Continental Shelf and Submarine Canyons"
6. "Descriptive and Functional Ecology of the Macrobenthos of Horizontal and Vertical Substrates at a Pristine, Offshore, Rocky Pinnacle in the Gulf of Maine"

### Publications

Able, K.; Grimes, C.; Cooper, R.; Uzmann, J. Habitat construction by tilefish, Lopholatilus chamaeleonticeps, at Hudson Submarine Canyon in the Mid-Atlantic Bight. Mar. Biol. (A)

Cooper, R.; Uzmann, J. Georges Bank and submarine canyon living resources and habitat baselines in proposed drilling areas. Contribution to Annual NEMP report on the health of the northeast coastal waters of the United States, 1980. NOAA Tech. Mem. NMFS-F/NEC-10;1981. (P)

Meyer, T.; Cooper, R.; Pecci, K. Underwater observations on the performance and the environmental effects of a hydraulic dredge in a high clam density area off southwestern Long Island, New York. Mar. Fish. Rev. (A)

Pecci, K.; Hulbert, A. Descriptive and functional ecology of the macrobenthos of Jeffreys Ledge (Pigeon Hill), Gulf of Maine. Contribution to Annual NEMP report on the health of the northeast coastal waters of the United States, 1980. NOAA Tech. Mem. NMFS-F/NEC-10;1981. (P)

## MARINE ECOSYSTEMS DIVISION

### Ichthyoplankton Investigation

A number of 61-cm bongo samples were collected in three of the four MARMAP subareas in July by piggybacking on the summer bottom trawl survey. Our geographic coverage did not include the Gulf of Maine. Some additional samples were collected on Georges Bank during an Ocean Pulse Program survey. Cooperation by other vessel users in assisting us with field work over the past 4 mo has been outstanding.

In the lab much of our efforts in July went into the completion of contributions for the fall ICES meeting in Woods Hole (see list of publications). Other staff members continued work in progress. Myron Silverman is completing charts and tables on the distribution and abundance of silver hake, bluefish, Atlantic mackerel, and yellowtail flounder larvae collected between 1977 and 1980. Mike Fahay is putting the finishing touches on his guide to the identification of fish larvae spawned in the western North Atlantic, and John Sibunka, when not at sea, continues to work on an assessment of the spawning biomass of bluefish, using data on distribution and abundance of eggs as determined from our broadscale MARMAP surveys.

Ichthyoplankton samples were collected during August from Cape Hatteras to Nantucket Shoals on the annual summer surf clam-ocean quahog survey. Arrangements were made to have additional 61-cm bongo tows taken on Georges Bank during an Ocean Pulse cruise that began in late August. The combined sampling efforts will provide us with late summer samples from three of the four MARMAP I analytical subareas, but we will again miss the Gulf of Maine, an area we have not surveyed since spring. Our next plankton survey begins in late September, when we will participate in the autumn bottom trawl survey.

Autumn and winter MARMAP ichthyoplankton surveys of coastal waters between Cape Hatteras and Cape Sable during 1980-81 reveal that for the fifth consecutive year, production of Atlantic herring larvae was poor on Georges Bank. We caught no herring larvae on the Bank during three surveys, an indication that spawning activity in that part of the survey area continued in the ominous pattern of decline observed during the late 1970's. Most of the young herring occurred around the northern perimeter of the Gulf of Maine with numerically and geographically smaller concentrations in and around Massachusetts Bay.

For the past 25 yr, NEFC biologists have been conducting ichthyoplankton surveys off the New England coast on a regular basis. To our knowledge, the autumn of 1980 marks the first spawning season within the above time frame that Atlantic herring larvae were not caught on Georges Bank, the center of spawning activity during the 1960's and early 1970's.

### Larval Fish Dynamics Investigation

#### Experimental Studies

During July, analysis of samples collected as part of the NOAA-USFWS study of the effects of existing contaminant burdens on the viability of the early life stages of striped bass was continued. Swim speed/stamina testing was completed for all groups of lab-reared larvae except the Brookneal group. Brookneal larvae will be

reared to an age of 78 days and tested for swim speed/stamina. Preparations are being made for an upcoming trip to the Chesapeake Bay region for collection and stamina/swim-speed testing of young-of-the-year striped bass from the Potomac, Nanticoke, and Choptank Rivers. We are constructing a mobile unit to carry the swim speed/stamina testing apparatus which will allow for quick onsite setup. Preliminary analysis of nucleotide levels in larval fish was begun; however, we are having some problems separating an unidentified peak from the AMP (adenosine monophosphate) peak using high-performance liquid chromatography. Preliminary estimates of the adenylate energy charge of lab-reared larvae range from 0.7 to 0.8.

A weeklong field trip to the Chesapeake Bay region was successfully completed. Thirty-six striped bass juveniles from the Potomac River and 32 from the Nanticoke River were collected with a beach seine, tested for swimming stamina, and frozen for biochemical analysis. Fish from the Potomac were generally larger and appeared to have greater swimming stamina than fish from the Nanticoke River. Despite considerable effort, no striped bass fry were caught in the Choptank River. Preparations are being made for similar work on the Hudson River.

One hundred thirteen samples of larval and juvenile sand lance were analyzed for standard length, dry length, dry weight, RNA, DNA, and protein. The sand lance were collected at 14 stations on the spring MARMAP survey (Albatross IV Cruise No. AL 81-01). Most samples consisted of individual fish between 0.17 and 50 mg in dry weight and from 5 to 42 mm in standard length. The RNA-DNA ratio values observed were uniformly high (range of 4.2-9.8; mean of  $6.60 \pm 1.18$ ). One hundred three samples of larval and juvenile Atlantic cod collected at five stations on the larval dynamics process-oriented survey (Albatross IV Cruise No. AL 81-03) were analyzed for dry weight, standard length, RNA, DNA, and protein. Most of the samples consisted of individual cod between 0.49 and 14 mg dry weight and from 5 to 17 mm standard length. The RNA-DNA ratio values were uniformly high (range of 3.3-10.3; mean of  $6.46 \pm 1.38$ ). One hundred twenty-five samples of haddock larvae ranging in size from 0.15 to 3.5 mg in dry weight and from 2.5 to 10 mm in standard length were also analyzed. These larvae were collected on another larval dynamics process-oriented cruise (Albatross IV Cruise No. AL 81-05). With very few exceptions, all haddock larvae analyzed had very high RNA-DNA ratio values (range of 2.8-17.0; mean of  $7.65 \pm 3.57$ ). These haddock larvae had some of the highest RNA-DNA ratio values observed to date. The high RNA-DNA ratio values of these cod, haddock, and sand lance are indicative of good condition and rapid growth. The high RNA-DNA ratio values of the cod larvae were not unexpected since they appeared upon visual examination to be very robust and in excellent condition. Their guts were packed with Calanus finmarchicus. Based on lab studies of the relationship between RNA-DNA ratio and growth rate in cod larvae, the dry weight of these field caught cod larvae was estimated to be increasing at the rate of 14% per day. Although no comparable lab data exist for sand lance or haddock, those species would be expected to be growing at about the same rate.

### Population Processes

Roz Cohen, George Bolz, and Greg Lough devoted July to the preparation of ICES documents which represent major summaries and analyses of the ICNAF (International Commission for the Northwest Atlantic Fisheries) larval Atlantic herring survey data base. Roz Cohen reported on larval herring food habits over three spawning seasons

(1974-76) in the Georges Bank-Nantucket Shoals area. A shift in the dominant copepod prey of larval herring was noted in 1976, as well as an increase in their feeding incidence and condition during that season. George Bolz examined the ichthyoplankton from 30 ICNAF surveys during 1971-77, and delineated three discrete faunal zones in the Georges Bank region by numerical classification techniques which were clearly related to water-mass types.

Final revisions were made in August on the 1981 ICES documents by Roz Cohen and Greg Lough, and by George Bolz and Greg Lough. Greg and George are making revisions on the larval herring growth manuscript returned from Fishery Bulletin. Roz is completing some additional analyses on the larval herring food habits data base and is in the final stages of putting together a data report on the 0.333-mm-mesh-captured zooplankton from 1974-77 ICNAF surveys, with the help of computer programming and processing by John Hauser and Nancy Lyons. Dave Potter and Randy Goodlett completed lab processing of a selected number of larval herring guts from a vertical series of MOCNESS samples (multiple opening-closing net and environmental sensing system) collected on a West German R/V Anton Dohrn survey (Cruise No. 77-03). Peter Donnelly, Philip LeBlanc, and Randy Goodlett continued sorting and identifying ichthyoplankton and zooplankton from the Albatross IV Cruise No. AL 81-05 MOCNESS hauls.

#### Fishery Oceanography Investigation

During July, Ron Schlitz and David Mountain met with investigators from Woods Hole Oceanographic Institution, US Geological Survey, University of New Hampshire, and EG&G, Inc., to discuss combining their respective data sets from Georges Bank to allow a more complete analysis. Ron and David also met with investigators of the warm-core ring study to discuss preliminary modeling results by Glenn Flierl of the Massachusetts Institute of Technology and Joe Wroblewski of Dalhousie University. Joe is modeling the entrainment of larvae from the shelf by a ring which is of primary interest to NEFC.

The month of August saw the preparations for the upcoming warm-core ring study accelerate. Meetings were held for coordinating the work on our own cruise and also for coordinating our work with National Science Foundation ship operations. The new O<sub>2</sub>-sensor was installed in the CTD, and intercalibration with the CTD's to be used on the other vessels was performed. Coordination of our work with the visiting Soviet R/V Stvor was also accomplished. The Stvor, with Chief Scientist Anatoliy Bendik, will make up to three hydrographic and biological surveys of the region between the shelf/slope front and the Gulf Stream from Georges Bank to Cape Hatteras.

In other areas, Dan Patanjo worked with the Woods Hole Laboratory ADP Unit to get four MARMAP hydrographic data sets on computer-compatible tape and 10 more sets ready for key entry. Chris Nadeau continued analysis of hydrographic data from the April larval dynamics cruise as well as working up the Ship-of-Opportunity Program expendable bathythermograph (XBT) transects. David Mountain, with help from Jim King and Karen Lennon, completed analysis of the 1970-decade hydrography along the north-east US coast for presentation at a NAFO symposium in September.

## Ecosystem Dynamics Investigation

As part of the NEFC's policy to reduce the number of task development plans, the Benthic Dynamics Investigation was consolidated with Ecosystem Dynamics Investigation, and henceforth the two activities will be conducted as one investigation. The focus of the personnel from the former benthic group will continue to be on the linkages between fish and the benthos via studies on the fish food habits and macrobenthic invertebrates. In addition to Roger Theroux and Ray Bowman, other full-time permanent employees include Tom Morris and Charles Wheeler, who will be involved with experimental fish feeding studies in the aquarium, with larval stages of American lobster in coastal waters, and with aspects of marine food webs.

Six ICES documents were completed in July and occupied most of the time for Ed Cohen, Mike Pennington, Marv Grosslein, and Tom Morris. The titles are listed in the "Publications" section. Roger Theroux prepared the French text of the abstracts.

Wendell Hahm made simulation runs on silver hake predation on other fishes with the computer model GEORGE, and worked on two manuscripts, one on flow analysis and one documenting GEORGE for users. John Hauser wrote a computer program to add displacement volumes to the ICNAF zooplankton data base and began debugging it. Also, John Hauser and Nancy Lyon worked on program documentation for data listing and plot routines for the ecosystem files.

Roger Theroux continued work on the northern (macrobenthic) biomass report and made revisions to the benthos section of the chapter on the Elsevier series, Continental Shelf Ecosystems; and he began reviewing the manuscript by Don Maurer on benthos versus oil on Georges Bank. Roger also consulted with Jon Gibson regarding remodeling the Woods Hole darkroom.

A summary of feeding and distribution data on swordfish prey was prepared by Ray Bowman for the Food and Drug Administration. On 7 and 8 July, he accompanied Charles Stillwell to the US District Court in Boston, where Chuck testified as an expert witness on the feeding of swordfish.

Marv Grosslein completed proofing and editing galleys of the text and references for the monograph on fishes for the New York Bight Atlas series.

Mike Pennington reanalyzed data on incidence of nematode parasites in Atlantic herring from a manuscript by Boyar and Brennan, which shows an infestation level off western Nova Scotia twice that of Georges Bank. This analysis was a first step toward evaluation of the potential use of parasite data for estimating herring stock mixing in the Gulf of Maine area; the manuscript and Mike's results will be presented at the NAFO meeting in September. Mike also worked with Greg Lough on revision of the larval Atlantic herring growth manuscript, and reviewed a paper for the Fishery Bulletin. Wendell Hahm completed a draft of the user manual for the simulation model GEORGE, and made additional test runs with the model and flow analysis methods by using silver hake data. Ed Cohen completed final editing of several ICES papers and continued refining estimates of prey size and consumption of fish predators for use in our modeling work. Ed Cohen and Ron Schlitz sent around for internal review their manuscript on the nitrogen budget for the Gulf of Maine and Georges Bank; the paper is to be submitted for publication in the Journal of Biological Oceanography.

John Hauser completed checkout of the computer program for adding displacement volumes to the plankton data base and updated Roz Cohen's zooplankton file. John began writing a program for cluster analysis of the zooplankton data on the Sigma 7 and also began familiarizing himself with the model GEORGE. Both John Hauser and Nancy Lyon produced data listings and plots of predator/prey weight data and predator length frequencies for the modeling. Nancy Lyon completed documentation on several computer routines for generating listings and plots of plankton and food habits data, and assisted a number of biologists in the Division with data retrievals and summaries. Nancy completed her summer appointment on 25 August to begin graduate school at Florida State University.

Roger Theroux continued work on the New England Region biomass report with first-draft typescripts for sections on "Materials and Methods," "Description of the Region," "Faunal Composition," and "Total Macrobenthos" completed; and he completed a review of Don Maurer's draft of "Review of Benthic Invertebrates of Georges Bank in Relation to Gas and Oil Exploration with Emphasis on Management Implications." Roger also spent a fair amount of time preparing plans and purchase orders for updating and improving the Woods Hole Laboratory's darkroom. Also, he prepared several sections for the "Photographic Methods and Techniques" portion of the NEFC audiovisual quality control guidebook. John Malone continued the arduous task of updating, via Sigma 7 EDIT, the Georges Bank motile invertebrates data base. Computer shutdowns are still plaguing this task.

Summer employees (Rene Eppi, Judith Scanlon, and Wendy Stephenson) completed examination of fourspot flounder stomach and intestine contents. Preliminary results indicate fourspot feed mainly during the daytime (as did winter and yellowtail flounders). Catchability data examined thus far show all three species are principally caught at night. Ray Bowman completed the paper on causes of variation in fish feeding studies. Ray also completed an examination of the data from several cruises to determine the catchability of flounders. William Michaels continued work on 1979 stomach content data. Bill also began a reorganization of the filing system for feeding information.

#### Plankton Ecology Investigation

Donna Busch and John E. O'Reilly completed and submitted an ICES paper (see list of publications). They also submitted an abstract titled, "The Annual Cycle of Phytoplankton Primary Production (Netplankton, Nannoplankton), and Release of D.O.M. for the Northwestern Atlantic Shelf (Middle Atlantic Bight, Georges Bank, and Gulf of Maine)," to Dr. J. J. Zijlstra, convenor of an ICES Symposium on Biological Productivity of Continental Shelves in the Temperate Zone of the North Atlantic.

Donna reviewed several ICES papers, the Marine Ecosystem Division's monthly report, and an ecosystem modeling proposal for the Narragansett Laboratory Director. She also prepared and sent the fourth shipment of phytoplankton samples to Gdynia, Poland, for cooperative studies between NEFC and the Polish Sea Fisheries Institute.

During July and August, Carolyn Griswold conducted a bibliographic search and literature review on gelatinous zooplankton species. She participated in Leg II of the surf clam-ocean quahog survey on the Delaware II from 14 to 21 August, and collected plankton samples for volumizing comparisons.

Jack Green was involved in the selection and purchase of equipment to improve the performance of the plankton pumping system. Preliminary analysis of the Nantucket Shoals samples was begun in preparation with the Bigelow Laboratory of Ocean Science, Brookhaven National Laboratory, URI, and the University of New Hampshire for fall participation in the Nantucket Shoals experiment.

### Image Analysis

Jerry Prezioso continued processing Antarctic krill samples using the Image Analysis System. Counts and measurements for each major group are being stored on magnetic tape for statistical analysis by the URI computer. Length-frequency information will be summarized for each group and the entire sample. Biomass estimates based on dry-weight conversion factors presently being calculated will be made for both adult and juvenile krill.

The B&L image system has moved to new quarters in the plankton lab at the Narragansett Laboratory.

Ray Maurer, Jack Green, and Jerry Prezioso participated in a research coordination meeting for the Stvor on 26 August. This work will focus on hydrography and distribution of euphausiids and saury along the slope/shelf front.

### Biostatistics

Julien Goulet spent a large fraction of time working with EPA on the implementation of ADP capability for the Narragansett Laboratory on the PDP11/70.

A marine ecosystem cartographic research project was developed with Professor Joe Berry of Yale University. This project will run about 6 mo and will involve spatial, temporal, and statistical analysis of about nine key ecosystem variables from 2 yr of MARMAP surveys.

Tom Plichta attended an Office of Personnel Management training course in Boston titled, "Systems Analysis and Design."

All of the 1977-80 station data, experiment/gear data, zooplankton volume data, zooplankton count data, and total ichthyoplankton count data have been extracted from the MARMAP Information System's master files and are now in unit-record sequential format on tape. This data will be input into the MARMAP Ecosystem Data Base which will be implemented on the EPA's PDP11/70. Lorrie Sullivan, Bob Sand, Paula Caito, and Steve Eldridge had dedicated their summer to this project.

### Apex Predators Investigation

In July we received information on 23 recaptures. All were blue sharks except one dusky which was free for 20 mo. It remained near Bermuda and was recaptured within 25 mi of the tagging location.

Short-term recaptures predominated the blue shark returns with 14 of the 21 sharks recaptured after less than 30 days. Some of these individuals were retagged and released and for the first time in our study we have recaptured one of these retagged fish. The fish was originally tagged last July and recaptured and re-tagged 55 days later in September. A typical short-term recapture, or so we thought. After 288 additional days at liberty it was recaptured and retagged for the second time and is still free.

In August, we received information on 19 tag returns including 8 from blue sharks, 5 from sandbar sharks, 3 from dusky sharks, 2 from tiger sharks, and 1 from a mako shark. Three of the eight blue shark recaptures were at liberty for more than 1 yr. All of these had either remained or returned to the continental shelf off the Southern New England coast, except one which was recaptured 203 mi southwest of Bermuda by a Taiwanese longliner. A sandbar at liberty for 1818 days (5 yr) traveled from off Fire Island, New York, to Fort Pierce, Florida, a distance of 860 mi. Two other sandbars traveled over 1970 mi from off Long Island to Mexico in 751 and 738 days, respectively. A dusky shark released off Nantucket Island, Massachusetts, was also recaptured off Mexico (2015 mi) after 5 yr. These three Atlantic-to-Gulf recaptures are important additions to our recapture data base. The remaining sandbar recaptures (two) showed movements within the Mid-Atlantic Bight. One of the dusky sharks at liberty for 3 yr showed movement between the Jones Inlet area and Cape Ann, Massachusetts. We are attempting to verify this recapture which is the first to show movement of this species into the Gulf of Maine. The remaining dusky at liberty for 1.5 yr moved from off the North Carolina coast to the coast of Cuba. One of the tiger sharks tagged off New Jersey was recaptured within 50 mi of the tagging site after 400 days at liberty. The other tiger shark, free for only 68 days, traveled 650 mi across the Gulf of Mexico from the west coast of Florida to Galveston, Texas.

Three tournaments were attended by project personnel during July and three others were monitored for us by Scott Emery of the State University of New York at Stonybrook. Our two major sampling tournaments at Montauk, New York, resulted in the landing of 55 makos, 11 tigers, 29 blue sharks, 4 white marlin, and 1 scalloped hammerhead. During these tournaments, participating anglers tagged approximately 100 sharks for our program. Jack Casey, Wes Pratt, Chuck Stillwell, Alan Lintala, Nancy Kohler, and Pat Hadfield collected catch-per-effort data, reproductive tissues, age and growth samples, and food habits information.

Three shark tournaments were attended by project personnel in August: two on the south shore of Long Island, New York, and one at Hyannis, Massachusetts. A total of 51 sharks and 46 teleosts were landed and made available to us for examination. Lengths and weights were taken on all fish; biological samples were also obtained along with food habits information.

Jose Cort, a tuna specialist from Spain, joined us for several weeks of cooperative work on bluefin tuna. His study deals with the occurrence of gill and nasal parasites as indicators of the relationships between the eastern and western Atlantic population of bluefin. Jack Casey has arranged for him to sample bluefin tuna at Point Judith, Rhode Island, and Montauk, New York.

Chuck Stillwell sailed aboard the commercial longliner Darana R. to collect food habits data from sharks and swordfish. Longline fishing operations were conducted along the edge of the continental shelf from east of Oregon Inlet, North

Carolina, to Wilmington Canyon. Squid was the predominant food observed in the stomachs and consisted primarily of Illex illecebrosus. Beaks from the family Gonatidae were also identified in a few stomachs.

Nancy Kohler finished coding food habits data for three species of sharks, the bigeye thresher, porbeagle, and dusky shark. Coding of the swordfish data was begun.

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- Langton, R. Diet overlap of some Northwest Atlantic fishes. Int. Counc. Explor. Sea, Comm. Mem. 1981/G:50. (P)
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## RESOURCE UTILIZATION DIVISION

### Gloucester Laboratory Review

The Gloucester Laboratory was reviewed by a panel of 20 people representing a large segment of the Laboratory's constituency. Members of the panel represented the NEFC, NERO, NMFS Office of Utilization and Development, American consumers, fisheries development foundations, seafood industry organizations, seafood consultants, seafood processors, NOAA Office of Sea Grant, universities, Food and Drug Administration, and US Department of Agriculture.

### Harvesting and Sampling Gear Development Investigation

#### Research Vessel Activity

Our R/V Gloria Michelle was used for experimental demonstration fishing for squid using light attraction and jigging equipment. The ship was deployed after dark to the Scantum area of Ipswich Bay. The fishing locations were varied and the best fishing experienced was at about 62 fathoms at a catch rate of 1000 lb/hr. The squid that was caught was landed and frozen at Gloucester for industry evaluation. The jigging equipment consisted of two hand-operated units with 30 jigs each and a double-reel automatic rig. The experiment was repeated 8 days later with a similar catch rate and a total catch of about two tons of squid for each trip.

The vessel is now being outfitted for a cruise scheduled for September and October for the acoustic biomass estimation of offshore Northwest Atlantic herring. A gallows frame has been designed and the plans will be sent to a contractor for construction. A new winch and net reel have been obtained.

#### Engineering Assistance to Other Center Programs

The new shellfish assessment dredge which was contracted and built in Florida was delivered to Woods Hole. The Golden Ship Repair, Inc., of Portland, Maine, did the redesign and rebuilding of the fixed ramp assembly and delivered it to Woods Hole as scheduled. Two of their representatives accompanied the ramp and remained during its installation on the Delaware II. Dan Baker also went to Woods Hole for the week to supervise the installation and to be there in case of any technical design problems. The installation went very well and everyone was pleased with the new design and felt

that handling and future assembly and disassembly would be much more efficient and accomplished much more easily and quickly than was previously possible.

Vern Nulk completed the July sampling trip on the M/V Marine Evangeline for AEG, and Kate Wiggin and Pat Donahue completed the August trip.

A meeting was held with W. J. Hall and C. Elliott, representatives of Solar Design Associates, to review the Gloucester Laboratory solar project and resolve technical problems with regard to interfacing new solar installations with existing systems.

#### Facilities and Safety

Freezer Room No. 5 at the Gloucester Laboratory has been repiped and is undergoing performance tests. Freezer No. 6 renovation is progressing with new insulation being installed at this time.

#### Manuscripts

Ms. G-497, "Recovery of Waste Energy in a New England Fishing Vessel," was submitted to Fish Boat for publication.

#### Program Changes

This will be the last bimonthly report from the Engineering Unit as it now exists. Al Blott, Vern Nulk, Jack Moakley, and John Kenney will soon be moving to Rhode Island to take up their new duties at URI. They have all had to spend considerable time planning and getting ready to move.

The rest of the people in the Unit will remain in Gloucester and will carry on with engineering activities related to processing and preservation.

Tom Connors will also assume some new duties that have to do with the operation of the marine products irradiator, radiology, and health physics.

#### Processing and Preservation Investigation

##### Nutrition

The unsaponifiable lipid fraction of selected bivalves was sent to the Massachusetts Institute of Technology (MIT) for mass spectral analyses. Our lab has been able to separate 10 different sterols from these, but MIT is experiencing some difficulty with the samples because they cannot achieve our resolution with their capillary columns.

The lipid research has led to the start of two manuscripts, each concerning lipid methodology. The research done on shellfish is so minimal compared to finfish, and the shellfish are so different, that a great deal of finfish research must be retailored to accommodate the shellfish. We are doing much more thin-layer chromatography as a cleanup step.

Determining cholesterol content in squid has proved to be a headache. Two distinct lots of squid had widely divergent amounts of cholesterol. Many more batches will need to be analyzed.

We resurrected 60-mm surf clams from rafts in Cape Cod Bay and brought them to the lab for organoleptic and proximate analyses.

Kate Wiggin is experiencing difficulty with agarose gel isoelectric focusing of denatured protein. She will be concentrating on extraction solutions.

Heather MacFarlane will be leaving to attend her freshman year at the University of New Hampshire.

### Blue Crab

Organoleptic testing continued on commercially picked crab meat that was pasteurized in different types of plastic pouches and held at 34°F. Using a method of pasteurizing (185°F for 5 min) whereby a total of 30 lb of air pressure (absolute) was used in the retort vessel during come-up, pasteurization, and quick come-down (i.e., vessel was cooled in ice water), not one pouch burst. These pouches were then placed in refrigerated storage and taste-tested monthly against canned, commercially pasteurized meats of the same age.

To date, meats pasteurized in nylon-6 pouches and held for 9 mo at 34°F are as acceptable as the commercial controls. In fact, in eight out of nine tests, the appearance of the pouched meats was superior to the canned sample because there was no discoloration of the meats.

In two other experiments, commercially picked meats were pasteurized in Mylar (O<sub>2</sub> impermeable) and in polyethylene (O<sub>2</sub> permeable) pouches and are now being tested against commercially pasteurized canned meats. After 3 mo of refrigerated storage, the meats from the pasteurized pouches are as acceptable as the commercial controls.

### Assured Quality of Frozen Fish Fillets

A fourth trip was made to the supermarket chain in the Albany, New York, area selling the "U.S. Grade A" frozen fish. Frozen samples were brought back to the lab for examination. Also, the temperature of the fish in the frozen food cases in the supermarkets was measured. The surface temperatures of the frozen fish packages varied from -2.5°C (27°F) to -13°C (8.5°F). These temperatures are too high to maintain the Grade A quality during storage in the supermarkets. The taste tests confirmed that the quality of the frozen fish samples was lower than it should have been. This situation was outlined in an informal report submitted to the fish processor. The processor discussed the findings with the fish buyer from the supermarket chain. With mutual agreement, the low quality fish is to be removed from the supermarkets and replaced with higher quality Grade A fish.

The study to determine the storage stability of "U.S. Grade A" haddock in the new Vendo freezer (a new concept in frozen food display cases) was begun. After 2 mo in the freezer, the haddock was graded as good by the Gloucester Laboratory panelists and as Grade A quality by the US Department of Commerce (USDC) inspector. This study will continue for 1 yr or until the haddock quality falls below Grade A.

The taste-test results from the 0°F and -20°F frozen storage study showed that after 2 mo of storage, all samples (Atlantic cod, haddock, pollock, winter flounder, and ocean perch) were graded as good to very good. All of these samples were graded by a USDC inspector and all received a "U.S. Grade A" score. Hunter L (color) and Instron (texture) measurements were also taken to complete the experiment.

### Manuscripts

"The Sterol and Fatty Acid Content of Three Northwest Atlantic Crabs," by J. Krzynowek, K. Wiggin, and P. Donahue, will be submitted to the Journal of Food Science within the next 2 mo.

"The Utilization of Yearling Surf Clams - A Second Look," by J. Krzynowek and K. Wiggin, will be submitted to the Shellfisheries Journal within the next 2 mo.

"Fatty Acid and Sterol Composition of Three Varieties of Surf Clams (*Spisula solidissima*)," by J. Krzynowek, K. Wiggin, and P. Donahue, will be submitted to the Journal of Food Science within the next 2 mo.

### Product Quality, Safety, and Standards Investigation

#### Product Quality

The Association of Official Analytical Chemists (AOAC) collaborative study of a method for fish species identification by agarose gel isoelectric focusing was completed, and the results were submitted to the AOAC. Fourteen collaborators identified a total of 276 samples with 84% accuracy. Slight differences in the protein patterns were judged to be the cause of the misidentifications which were largely attributed to only five of the fourteen collaborators. The other nine collaborators averaged above 90% correct. Since the overall average was below 90%, Ron Lundstrom (an AOAC Associate Referee) recommended to the AOAC that the method not be adopted as an "Official Method" and that another collaborative study be conducted after modification to the method.

Tests were conducted on either air-packed or vacuum-packed belly flaps or fillets of dogfish after 30 wk of storage at 0°F. Organoleptic tests indicated that the quality had become marginal. Vacuum-packed samples were only slightly better in quality compared to air-packed samples. Samples taken from headed-gutted fish held 11 days on ice prior to freezing were inferior in quality compared to samples from three-day-iced fish.

Work is continuing on the study with the USFWS to resolve the assertion by some consumers that American shad taken from different rivers during their annual spring spawning run have acquired different tastes characteristic of the area where caught (i.e., Connecticut River, Delaware River, York River, Hudson River, and Delaware Bay). Triangle tests are being conducted on frozen, freshly-caught shad to determine if significant flavor differences exist. To date, 28 tests have been conducted. These initial results indicate that there is a significant flavor difference between the Connecticut River versus the Delaware River samples; however, no firm conclusions will be drawn until all tests are completed.

### Manuscripts

"Fish Species Identification by Agarose Gel Isoelectric Focusing: Collaborative Study," by R. C. Lundstrom, was submitted to the Journal of the AOAC.

### Product Safety

Copies of the final report on a survey of polychlorinated biphenyls (PCB's) in selected finfish species from US coastal waters was submitted to Harry Seagran, Program Manager of the National Microconstituent Task, and Betty Hackley of the NMFS Central Office.

A final report on the analysis of polynuclear aromatic hydrocarbons (PAH's) in muscles of finfish and shellfish collected on the Gulf and Atlantic Survey-I was submitted to Mr. Reid, Project Coordinator for ERL's Marine Ecosystem Analysis Program. A copy of this report was sent to Dr. Pearce at the Sandy Hook Laboratory.

A draft for a manuscript on the determination of PAH's in the New York Bight was submitted by Mr. Humason for review.

The mass spectrum on the following PAH's was obtained on a Hewlett-Packard 5992B GC-MS: Acenaphthylene; Benzo-a-Pyrene; Benzo-e-Pyrene; Naphthalene; Pyrene; Chrysene; 1, 12 - Benzo Pyrene; Phenanthrene; Anthracene; Acenaphthene; Fluorene; 1, 2, 3, 4 - Dibenzanthracene; 1, 2, 5, 6 - Dibenzanthracene; 9 - Phenylanthracene; 1 - Methylanthracene; 2 - Methylanthracene; 9 - Methylanthracene; and Perylene.

A user library for PAH's is being provided in the Gloucester Laboratory. This data base will be used to compare one spectrum of an unknown to another in this base.

Our workup of liver samples for PCB's in striped bass is nearing completion. These samples were collected from San Joaquin River off Antioch, California; the Sacramento River off Clarksbury, California; and Coos River, Oregon. Some of the extracts have been analyzed by gas-liquid chromatography utilizing an electron-capture detector. A final report will be forwarded to Dr. Whipple of the NMFS Tiburon Laboratory as soon as the remaining extracts have been analyzed.

### Product Standards and Specifications

Drafts of "Proposed U.S. General Standards for Grades of Fresh or Frozen Fish Steaks" and "Proposed U.S. General Standards for Grades of Shrimp" are being reviewed by the NMFS Central Office. They will be published as "Notices of Proposed Rule-makings" in the Federal Register. An initial draft of "Inspector's Instructions for Grading Fresh or Frozen Fish Steaks" is being reviewed by the USDC Inspection Service.

Comments were received on an initial draft of a "Proposed U.S. Standards for Grades of Frozen Fish Portions and Fish Sticks" from the USDC Inspection Service and others. These comments are being resolved.

Work is continuing on comments received on several Codex Alimentarius "Proposed Draft Standards" and "Codes of Practice." We are preparing appropriate draft U.S. comments on these documents.

Questionnaires for both producers and food service operators have been prepared for a market research and analysis report on fresh and frozen fish fillets.

A market research and analysis report on canned salmon is being prepared for the Quality Assurance Branch of the US Department of Agriculture.

### Technical Assistance

Information and technical assistance were provided in the following areas: training for fish processors; agarose gel isoelectric focusing method for fish species identification; electrophoresis; differentiation of dehydrated fish and mussel tissue; red snapper; halibut; handling dogfish; scallop gear; design of our modified La Pine heading and gutting machine and the products that can be made from minced fish (four inquiries); squid utilization; storage of live lobsters; thaw drip as a defect in published "U.S. Standards for Grades of Cod and Haddock Fillets"; label designation for a new (imported) canned product made from pilchard; names of New England firms which make fish portions and fish sticks; scientific and common names of fishes; procurement of scallops "in-the-shell"; mechanical separation of fish flesh from bones; the English equivalent of "raie blanc" (in French) as a species name; freeze-thaw stability of extruded products, especially shrimp; parasites; publications of the Gloucester Laboratory; military purchase of Pacific Coast fish; fish entrees in the Federal Stock Catalog; and purchasing seafood.

### DIVISION OF ENVIRONMENTAL ASSESSMENT

#### Biological Oceanography of Stressed Ecosystems Investigation

The Total Plankton Respiration Subtask completed and submitted a paper titled "Total Plankton Respiration in the Chesapeake Bay Plume" to be included in the NASA/NMFS Chesapeake Bay Plume Studies: Superflux 1980 Symposium Proceedings. Work is continuing on the "Chesapeake Bay Plume Studies (Superflux 1980): Shipboard Results" for the NOAA Technical Memorandum NMFS-F/NEC series, and also on the "Nantucket Shoals Experiment: Total Plankton Respiration" report.

Algal assay glassware was coated with Proril-28, a compound which increases chemical resistivity. This was done because the consistent growth limitation due to iron deficiency encountered in previous assays might be, in part, the result of iron adsorption on the culture-tube walls. Following this, 11 Northeast Monitoring Program (NEMP)/Ocean Pulse Program (OPP) samples were assayed, with cell counts made at 4, 8, and 12 days of incubation. Iron deficiency was again the most important limiter of growth of the assay diatom Thalassiosira pseudonana. Nitrogen was the next scarcest nutrient, but phosphorus supply was equally critical in five of the samples. In a single sample, vitamin B<sub>12</sub> deficiency equaled iron scarcity in importance. There was temporary growth limitation (evident at day 4, but not by day 8) associated with B<sub>12</sub> in two samples and with silicate in one sample.

Cell counts made early in the incubation period (day 4) can reveal when the concentration of a nutrient is not seriously growth limiting, but sufficiently deficient to lower the growth rate of the phytoplankton. Such information aids our understanding of the chemical water quality controlling phytoplankton growth in shelf waters. However, the temporary limitation is found only infrequently and with just two nutrients, vitamin B<sub>12</sub> and silicate. Dropping the initial count is, therefore, being considered in the interest of speeding the assays.

One hundred twelve samples from Albatross IV Cruise No. AL 81-07 during 7-27 July 1981 have been concentrated and stored in vials to settle before being evaluated for phytoplankton community structure by Mrs. Myra Cohn and Dr. Harold Marshall, the latter of Old Dominion University in Norfolk, Virginia.

Samples for phytoplankton population enumeration are currently being procured on an OPP survey on Albatross IV Cruise No. AL 81-10, which began on 26 August.

Two manuscripts have been sent to Jon Gibson, Coordinator of the NOAA Technical Memorandum NMFS-F/NEC series, for publication. They are "Phytoplankton Community Structure in Northeastern Coastal Waters of the United States. I. October 1978," and "Phytoplankton Community Structure in the Northeastern Coastal Waters of the United States. II. November 1978," coauthored by Dr. H. G. Marshall and Mrs. Myra S. Cohn.

Myra Cohn attended a meeting of the Interagency Committee on Phytoplankton Blooms on 26 August at Edison, New Jersey, where she gave a talk on the presence of phytoplankton species in areas of high chlorophyll-a concentrations. Present at the meeting were representatives of the Nassau County and Suffolk County (New York) Departments of Health, Ocean County (New Jersey) Department of Health; Food and Drug Administration Area 2 (New York) Shellfish Control; New Jersey Department of Environmental Protection, Bureau of Shellfish Control; NOAA Office of Marine Pollution Assessment; Interstate Sanitation Commission; New Jersey Department of Environmental Protection, Water Resources Division; Gateway National Recreation Area; Monmouth County (New Jersey) Health Department; EPA; and NMFS.

The final articles for the NASA/NMFS Chesapeake Bay Plume Studies: Superflux 1980 Symposium Proceedings, edited by J. W. Campbell and J. P. Thomas, have been received. The volume, to be released in about 2-3 mo, will be about 500 pages in length.

Jim Thomas attended a Northeast Area Remote Sensing System (NEARSS) meeting at the University of Massachusetts on 9 July. In addition to discussions concerning the implementation of NEARSS, a decision was made to produce vegetation maps of the wetlands between Cape Hatteras and Canada by 31 December as the initial thrust of the Coastal Habitat Assessment Research and Monitoring Program (CHARM). This will be done using LANDSAT imagery supplemented where needed by aircraft observations.

Jim Thomas attended a CHARM meeting on 22 July at the University of Delaware where planning and scheduling for accomplishing the wetlands vegetative mapping occurred.

On 31 July, Jim Thomas and Craig Robertson attended a Nantucket Shoals Experiment meeting at Old Dominion University in Norfolk, Virginia, to review data from the Nantucket Shoals Experiment of May 1981.

Craig N. Robertson attended a 1-day workshop/training session on 18 August at the University of Delaware as part of the CHARM Mensuration and Assessment of Coastal Habitats (MACH) wetlands assessment program. Training was given to standardize aircraft observations and groundtruth sampling which will be an important part of Phase I of the program. In addition, criteria were established for picking calibration sites. Actual sampling should begin September-October 1981.

The paper, "Chesapeake Bay Plume Studies (Superflux) Relative to the Biology of the Contiguous Shelf, Fishery Research and Monitoring," by J. P. Thomas, was sent to the Oceans '81 Conference for inclusion in the proceedings of a symposium to be held 16-18 September 1981 in Boston.

### Environmental Chemistry Investigation

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 tissues collected during the NEMP survey in August 1980 for contaminants in the New York Bight were keypunched and proofed. The ADP Unit at Sandy Hook is working with Bob Reid, Jay O'Reilly, and Vincent Zdanowicz to develop a data file for all of the data from this single survey (benthic species, trace metals, organic carbon and nitrogen, coprostanol, PCB's, PAH's, etc.).

Vince Zdanowicz, Tony Ruiz, and Frank Steimle provided materials to Tom Azarovitz and Steve Murawski of the Resource Assessment Division for sampling approximately 600 surf clams and ocean quahogs during the August survey of the shelf between Georges Bank and Chesapeake Bay aboard the Delaware II. These analyses, when complete, will provide a spatially reliable baseline for contaminant burdens in these two resource species, as well as permit a comparison of present levels of metals with a comprehensive baseline established for these two species in 1974 by Wenzloff, Greig, Merrill, and Ropes.

Vincent Zdanowicz also participated in the July OPP survey on Albatross IV Cruise No. AL 81-07. One hundred thirty-three sediment cores for trace metal analysis were collected at 30 stations. Approximately 290 samples of invertebrate and fish tissue were collected at 12 stations. Principal species sampled were winter flounder, sea scallop, windowpane, (Atlantic) rock crab, and American lobster. During the NEMP survey in August (Albatross IV Cruise No. AL 81-09), extensive collections of seabed cores were made in the New York Bight to assess the distribution of seabed contaminants (trace metals, coprostanol, PCB's, and PAH's), particularly in and adjacent to the sludge disposal site in the apex and in the Hudson shelf valley and canyon.

Approximately 5000 analyses of seawater nutrients (nitrate, nitrite, phosphate, silicate, and ammonium) were made in July and August, completing analysis for nutrients collected during four 1981 surveys.

Al Matte participated on the August New York Bight water-column monitoring survey on Albatross IV Cruise No. AL 81-08 for the purpose of intercalibrating our methods for nutrient analysis with the methods used by Dr. T. Whitledge and colleagues at the Brookhaven National Laboratory (BNL). Samples were collected throughout the water column at 33 stations. The BNL personnel analyzed nutrient concentrations on shipboard shortly after seawater collection, using an autoanalyzer. Aliquots were also frozen and analyzed at the Sandy Hook Laboratory and at BNL to evaluate the extent of alteration due to sample storage and the analytical agreement between the two laboratories. A report describing the results of this intercalibration exercise is being prepared.

Concentrations of chlorophyll-a and phaeophytin-a were measured in netphytoplankton (>20  $\mu\text{m}$ ) and in nannophytoplankton (<20  $\mu\text{m}$ ) throughout the water column at 65 stations sampled during the OPP survey on Albatross IV Cruise No. AL 81-07.

Euphotic integral rates of  $^{14}\text{C}$ -primary production (by netphytoplankton, nanophytoplankton, and released dissolved organic matter) were measured at 28 stations. Mr. Andrew Draxler of this Investigation served as Chief Scientist.

Considerable time has been spent by members of this Investigation for final proofing of all chlorophyll and primary productivity data collected over the past 2 yr. These data along with information on sampling location and date are being computerized with hydrographic and nutrient data so that we can easily computer-generate contour maps of data collected during MARMAP and OPP surveys.

Members of this Investigation finished final drafts of three papers to be presented at the ICES meeting in Woods Hole in October: "Preliminary Estimates of the Annual Phytoplankton Primary Production for the Northwestern Atlantic Shelf (Middle Atlantic Bight, Georges Bank, Gulf of Maine)," by J. O'Reilly and D. Busch (for the Biological Oceanography Committee as Memorandum 1981/L:16); "The Relationship Between Surface and Average Water Column Concentrations of Chlorophyll-a in the Northwestern Atlantic Shelf," by J. O'Reilly, C. Evans-Zetlin, and J. Thomas (for the Biological Oceanography Committee as Memorandum 1981/L:17); and "Effects of Sewage Sludge Dumping on the Consumption of Oxygen in the Water Column at the New York Bight Apex Disposal Site During an Experiment on Acoustical Tracking of a Sludge Dump, 11-16 July 1976," by J. Thomas and J. O'Reilly (for the Marine Environmental Quality Committee as Memorandum 1981/E:32).

#### Coastal Ecosystems Investigation

##### Benthic Community Structure

We carried out much of the planning and sampling for the second annual New York Bight benthic contaminants survey, conducted aboard Albatross IV from 10 to 19 August. Christa Facciola and Clifton Banks (volunteers) and Bob Reid, Dave Radosh, and Steve Fromm participated on the cruise. Samples were collected for analysis of sediment grain sizes; concentrations of carbon, nitrogen, heavy metals, PCB's, PAH's, and radionuclides; benthic macrofauna; and levels of metals and organic contaminants in winter, windowpane, and fourspot flounder, silver and red hake, Cancer spp. crabs, and American lobsters. Bob Reid, Ann Frame, and Steve Fromm worked on proofing the benthic macrofauna data set and preparing a report on the summer 1980 survey of the Bight. Bob also helped complete the overall 1980 NEMP report, which is now available.

Dave Radosh collected the summer 1981 NEMP regionwide benthic macrofauna samples aboard the Albatross IV in July. Dave and Clyde MacKenzie continued their several in-situ projects concerning the biology and ecology of the surf clam as possibly influenced by contaminants. Trays with sediments from a gradient of less-to-more contaminated environments were set out to determine any effects on clam spatfall. Burrowing rates in clean, oil-contaminated, and sewage-sludge-area sediment trays were observed in the field.

We discussed our NEMP benthic work with John Scott and Don Miller of the EPA's Narragansett Laboratory. We answered an EPA New York Office request to estimate current benthic impacts of sewage sludge dumping at the New York Bight dumpsite, and to predict rate and extent of recovery if dumping there ceased. Information on Long Island Sound benthos was provided to the Connecticut Department of Environmental Protection.

Ann Frame and Steve Fromm collected capitellid polychaetes for Dr. Judy Grassle at WHOI. Ann also identified amphipods from the NEMP collection for Phyllis Johnson of the Oxford Laboratory.

### Benthic Energetics

Jan Ward has designed formats so that benthic invertebrate life history information which we are presently compiling may be computer filed for rapid retrieval and updating. This file is being developed to allow us to characterize rapidly the functional attributes of dominant species from OPP or other benthic collections to assist in assessing causes or significance of apparent changes in community structure. She also helped design formats to list the species collected in each sample or station in descending order by number of individuals per species or biomass to detect automatically the dominant species at a station. These programs will decrease time spent in organizing data for analysis and interpretation. She continues to review literature and compile life history data on species defined as dominant (by number of individuals or biomass) at OPP monitoring sites. Dot Jeffress, with assistance from Bruce Baker, has completed the major portion of determining the biomasses of benthic organisms at an array of stations around the New York Bight apex dumpsite. She has only to fill in some small gaps and enter the data into the ADP system before we will be able to begin to examine apparent impacts of dumping on the standing stocks and productivity of benthic invertebrates.

Russ Terranova completed a calorimetric analysis of ocean quahogs from a range of size classes to determine if there is a significant difference in caloric content based on size of individuals. Analysis of preliminary data indicates there may be a difference, a possible inverse relationship with size. However, further analysis is needed. Russ also ran some additional shark liver samples for Chuck Stillwell and continues to work on seasonal variation samples for our basic benthic species series. Bruce Baker, our summer aid, worked on analyzing the salinity samples from our spring and summer OPP surveys and coded an early benthic survey off southwestern Long Island for ADP filing. The inclusion of this data set in our ADP files will assist us in computer searches for species occurrence and distribution, data required to augment our life history compilations.

When Frank Steimle had time off from his Ocean Pulse Coordinator duties, he addressed reviewer comments for his manuscript on a survey of the benthic invertebrates of Block Island Sound and is beginning to organize data for a contribution to the NEMP annual report.

### Ocean Pulse Coordination

This summer, we completed planning and organizing the July OPP monitoring survey aboard the Albatross IV. With Andy Draxler's assistance as Chief Scientist, this cruise was very successful in its accomplishments. Besides our routine work, 12 additional stations were occupied to supply samples of sediments and benthic organisms to EPA for analysis of radioactivity levels adjacent to a dumpsite off Boston. Samples of epibenthic organisms were also collected for petroleum hydrocarbon analysis on Georges Bank to back up a concurrent effort by the Bureau of Land Management. We also planned and organized the early fall OPP monitoring survey that departed on 26 August aboard the Albatross IV.

During late July and early August, a drastic decline in dissolved oxygen (DO) levels along the northern New Jersey coast occurred. During this period we worked in cooperation with the EPA's Edison (New Jersey) Laboratory to monitor the situation, by adding special DO monitoring stations to OPP surveys and by reporting daily DO results. A cool-weather break in mid-August appears to have prevented the situation from developing into a major problem. We will continue to make a special effort to monitor the area until the fall water-column overturn occurs.

This summer, we also developed, with generous cooperation from the Resource Surveys Investigation, an extensive collection survey of ocean quahogs and surf clams between Chesapeake Bay and Georges Bank. This survey will collect both species of clams for heavy metal and petroleum hydrocarbon analysis at a large number of locations. This survey will augment our OPP monitoring by providing shellfish for analysis we are normally unable to collect in sufficient number in our routine surveys and will partially be a repeat, for comparison, of a 1974 survey.

#### Behavior of Marine Fishes and Invertebrates Investigation

Results of field studies conducted last summer on the effects of oiled sediment on predator-prey interactions between blue crabs and hard clams indicated that the crabs consumed more clams from oiled sediment than from clean. It appeared that this was related to changes in burying behavior of the clams. To investigate these findings further, lab studies were conducted to measure the effects of oiled sediment on burying behavior and vertical distribution of the clams in the absence of a predator. Preliminary results indicated that clams which were placed on the surface of oiled sediment buried at significantly slower rates than those placed on clean sediment. After a 96-hr exposure, clams in the oiled sediment were buried at shallower depths than the controls. When the clams were removed from the oiled sediment and then placed on clean sediment, normal burying behavior was resumed.

#### Environmental Statistics Investigation

We studied the geographical classification of the ocean water to achieve a reasonable precision in statistical estimation of various effects. The computed correlation matrix used the measurements of four physical variables: temperature, salinity, density, and transmissivity for each station, and then made comparisons with those of other stations. Using factor analysis and numerical classification, data resulting from the New York Bight studies of NEMP have been analyzed. The resultant similarity index matrix was subject to cluster analysis for detecting patterns. Preliminary results indicate the distribution of hydrographically similar stations is a reflection of the bottom topographic regime of the Hudson Canyon, the direction of the prevailing current and influx of river flows.

Technical consulting activities for various investigations carried out included data handling, format correction, data manipulation, software creation, and statistical analyses. A manuscript on the effects of a 30-mo exposure of juvenile blue mussels to copper and silver is in progress. An environmental data monitoring manuscript for NEMP is also in progress.

## Physiological Effects of Pollutant Stress Investigation

### Physioecology

Surf clams exposure to silver in a diluter system continues. All bay scallops, however, both controls and experimental, have died.

An experiment exposing surf clams and bay scallops to copper at 1, 5, and 10  $\mu\text{g}/\ell$  in a diluter system has been terminated because of high mortality in both experimentals and controls.

Studies exposing blue mussels to either copper or silver in a diluter system have been concluded after 2 yr of exposure. Mussels exposed to silver were removed and respiration measurements, shell length, and meat weights were noted. Survival of the mussels exposed to copper was so poor that the above measurements could not be made.

Juvenile mussels exposed to silver at 0, 5, 25, and 50  $\mu\text{g}/\ell$  for 6 mo were measured. Growth was significantly different from controls at 25 and 50  $\mu\text{g}/\ell$ , with no growth at 50  $\mu\text{g}/\ell$ .

Adult blue mussels were collected and set up in a diluter system. Twenty-seven mussels were placed in each aquarium and will be exposed to ambient water only. Ten animals will be removed at biweekly intervals to monitor copper uptake from our natural seawater.

Considerable time was spent on the translation of English abstracts into French for papers being presented at the ICES meeting in Woods Hole this fall.

The remainder of the reporting period was spent in refabricating diluters.

### Physiology

We have completed two additional sets of blue mussel samples taken from Narragansett Bay as part of a cooperative study with the EPA's Narragansett Laboratory. Gill-tissue respiration measurements were made on 40 animals from both June and July collections, and hemolymph ions and osmolality were measured for each mussel. This study will continue on a monthly sampling basis into the fall months; the August collection has just been completed.

Lab analysis continues on fish and scallop samples collected during the spring NEMP/OPP cruise and additional samples added by personnel participating in the July NEMP/OPP cruise. Sixty-seven winter flounder, 15 yellowtail flounder, 140 sea scallops, and 22 windowpane were sampled during the July cruise. We are now preparing for the late summer NEMP/OPP cruise (Albatross IV Cruise No. AL 81-10) and will participate in both legs of that exercise.

Sampling continues at three stations in Long Island Sound. Blood samples were taken from 20 windowpane at each station in June, July, and again in August. Lab measurements have been completed on these samples for June and July.

We are now preparing for a new set of studies with striped bass in the swimming speed respirometers. We will be studying effects of pollution in the New York Bight/Hudson River area on various aspects of bass locomotion.

Recent reports in the literature have noted changes in the gill epithelium of finfish in response to environmental stress. Among the alterations reported were changes in mucus cells. We have been studying flounder gills with a scanning electron microscope and have made special note of mucus cells in gills of fish taken from OPP stations in Long Island Sound and from fish exposed to metals in the lab. Since the production of a protective mucus layer is one of the first lines of defense against a pollutant or irritant, this is an appropriate area to explore as a monitoring technique for environmental stress. Preliminary analysis of the gills collected thus far indicate increased mucus production and increased numbers of mucus cells in metal-exposed fish and in fish from the most polluted Long Island Sound station. These studies will continue.

### Biochemistry

Biochemical work continues to focus on the sea scallop. Analyses were completed on phasic adductor muscle samples from scallops collected during the NEMP/OPP survey on NOAA R/V Kelez Cruise No. KE 81-04/05, and work is under way on kidneys from the same animals. For scallops experimentally exposed to 10 ppb of Ag for 60, 78, or 90 days (final takedown on 30 June), we've similarly finished testing adductor muscle and have started on kidney.

Adductor muscles from the June sampling of an offshore New Jersey scallop population, a continuing seasonal effort, were also analyzed, as were those from another two stations sampled during Delaware II Cruise No. DE 80-07 last October.

In an ongoing cooperative study with EPA personnel, blue mussels set out along a pollutant gradient in Narragansett Bay were sampled in July and August. Gill and posterior adductor muscle tissues were excised, packaged, and frozen at -80°C to await testing. Warming of Bay waters earlier than normal this summer threatens our plans to continue sampling through November, because of the early and fairly sudden heat stress.

Biochemistry did not take samples during the July NEMP/OPP cruise because we had just participated in the annual sea scallop survey immediately prior (Albatross IV Cruise No. AL 81-06). The assessment-oriented surveys are an invaluable source of scallop samples, and have successfully filled holes in our OPP data, in addition to alerting us to the "Gulf of Maine deepwater" and the "Mud Patch" populations. Biochemistry personnel are currently participating in the late summer NEMP/OPP survey on Albatross IV Cruise No. AL 81-10.

From the desk, a completed manuscript "Field Stress in the Sea Scallop, Placopecten magellanicus" (for the Marine Environmental Quality Committee as Memorandum 1981/E:7) was submitted to ICES for its annual statutory meeting this fall. The biochemical testing schedule, with options and windows for flexibility, was mapped out through May 1982.

## Anaerobic Bacteriology/Metabolism

Lab activities during this reporting period were largely directed at characterizing bacterial isolates obtained from samples collected on this year's spring NEMP/OPP cruise. Clostridium perfringens counts were made for all sediments; there was little variation in the plate counts for this sampling period compared to previous ones, perhaps because of temperature differences. Vibrio counts were low, a normal occurrence at low environmental temperatures (5°C). V. parahaemolyticus, usually detected in summer and early fall samples, were not detected. Surprisingly, of the 16 isolates characterized, five were presumptive V. cholerae. Other characterized isolates belong to the genera Pseudomonas and Serratia. As has been the case previously, over half of the bacterial isolates tested could not be identified with our present methodology.

Other field activities included the monthly sampling of our Long Island Sound OPP stations and participation in the second annual New York Bight benthic monitoring cruise. On this cruise, sediments were collected from 58 stations. Top and bottom waters were sampled at 11 stations, and animals (sea scallops, American lobsters, and Cancer spp. crabs) were taken from seven of them. The sediments were analyzed for fecal coliforms, the waters for C. perfringens and the Vibrio group, and animals for both total coliforms, fecal coliforms, and a selected group of pathogens commonly associated with coliform bacteria.

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## AQUACULTURE DIVISION

### Aspects of Nutritional Requirements of Mollusks Investigation

#### Experimental Feeding of American Oysters

Experimental feeding studies were conducted with young American oyster (Crassostrea virginica) spat to corroborate previous studies in which a cryptomonad flagellate (previously described) was used as a food supply. In the previous studies, concentrations of  $2.0 \times 10^6$  cells were available to each spat per day, and in the present study three concentrations of food are being compared:  $1.8 \times 10^6$ ,  $3.6 \times 10^6$ , and  $7.2 \times 10^6$ . In the earlier study it was noted that a lag of about 4-5 wk occurred before significant increases in sizes of spat were observed. Oysters in the present experiment have been held in the experimental condition for over 3 wk; hence, enough time has not elapsed for results to be available.

During the past several months we have made five different attempts to rear American oyster larvae from the fertilized egg. Although development is always good and the onset of larval growth proceeds normally, in every trial we have encountered serious mortalities between days 8 and 10 of the rearing process. In the most recent work, we separated the fertilized eggs into three batches and reared each one under different experimental conditions in an effort to shed light on the factors that could be provoking these mortalities. One batch of larvae was incubated at  $26^\circ\text{C}$  in buckets containing 10 liters of seawater that had been filtered, exposed to ultraviolet irradiation, and treated with activated charcoal; another batch of larvae was reared in the same water as the latter group, but these larvae were incubated in basins of 80 liters of water at room temperature; the third batch of larvae was incubated in a continuously flowing seawater system in which the seawater had been filtered and ultraviolet irradiated. In each of the above experimental containers, the results were similar in that larvae began to appear unhealthy about the sixth day, thereafter demonstrating heavy mortalities until 100% mortality was reached about the 10th day. Because the pattern of mortality is so similar in each experimental trial, we are looking for fundamental problems in the culture system. One hypothesis is that some adhesive bacteria are being introduced to the culture system through the fertilized egg suspension and the bacterial population takes about 10 days to increase to the point where it causes heavy mortalities.

## Algae Culture

During the period covered by this report, 3164 liters of algae used as larval foods, and 2742 liters of algae used for juvenile molluscan food, were harvested from the semicontinuous algal mass-culture system. These algal foods were distributed to the various Milford Laboratory Investigations as follows: Spawning and Rearing of Mollusks, 2309 liters; Aquacultural Genetics, 2352 liters; Physiological Effects of Pollutant Stress, 258 liters; and Diseases of Larval Mollusks, 9 liters. All strains of the algal culture collection were subcultured on schedule. Starter cultures were forwarded to Mr. Chan Siu Ming of the Kowloon Workers Benevolent Society Hatchery in Hong Kong.

## Aquacultural Genetics Investigation

### Oyster Genetics and Breeding

Effort this period was expanded mostly in simply culturing and setting larvae from crosses made the prior month. Juveniles growing in outdoor tanks and lantern nets had to be cleaned of fouling organisms and silt.

S. Stiles prepared a paper updating progress on directed breeding of Long Island Sound oysters, to be presented to the Mariculture Committee at the statutory meeting of ICES to be held in Woods Hole in October. A. Longwell worked on the draft of the report of the ICES Genetics Working Group. This report discusses some aspects of the selective breeding of oysters and salmonids, and for the first time puts together a summary of aquaculture genetic studies ongoing in most ICES member countries.

### Cytogenetic Studies of Environmental Contamination

Progress in applying the micronucleus test to fish was outlined in our quarterly report to the Ocean Pulse Program. Roughly 800 fish and a million erythrocytes have been examined in the course of this work. Micronuclear incidences are higher in the immature circulating blood forms found in larval and egg stages of teleosts than in the mature circulating blood of adults. Methodology perfected for applying the test to immature erythrocytes of the kidney reveals incidences there also to be higher than in circulating blood. Field data show a gradation of micronuclear incidences in Long Island Sound over three presumed dirty-to-clean stations with the clean area having an incidence essentially identical to that of open ocean areas. Ranked according to species background, micronuclear incidences ranged from low to high accordingly: windowpane in open ocean areas; Fundulus; silver hake in open ocean areas; windowpane in Long Island Sound; and Atlantic cod. In cod, a few fish with piscine erythrocytic necrosis infections may be the cause of elevated micronuclear levels. Some mammalian viruses and even vaccines are known to increase chromosome mutation in other vertebrate systems.

Once fully analyzed statistically, these data will be prepared for publication and the course of future field studies decided. In the meantime, additional experimental research is being planned using the micronucleus test on blood-forming tissue of the kidney.

Other efforts are underway to adapt the sperm mutation test to teleosts with monitoring as well as experimental applications in mind.

A. Longwell prepared a background paper on cytogenetic perspectives on petroleum pollution for the National Academy of Science's update of its 1975 report on "Petroleum in the Marine Environment."

### Spawning and Rearing of Mollusks Investigation

The use of 3-mm-mesh pearl nets with bottom areas of  $0.1 \text{ m}^2$  was explored as a method to grow hatchery-raised bay scallops (Argopecten irradians) to a seed size (25 mm) suitable for final grow-out in lantern nets. In addition, the effectiveness of the pearl nets was compared with our raceway system. Scallops initially 9.7 mm in shell height were stocked in the pearl nets at densities of 250, 2500, 5000, 7500, and 10 000/ $\text{m}^2$  and the nets deployed in Long Island Sound at a depth of 6 m. In the first month, shell height increased about 7 mm in the pearl nets and 11 mm in the raceway system. There was a significant inverse relationship between shell height and pearl net densities above 2500/ $\text{m}^2$ . At termination after 68 days, pearl net scallops ranged in mean height from 30.9 mm at the lowest density to 20.1 mm at the highest density. Raceway scallops had a mean height of 36.6 mm at termination. Much of the difference between raceway growth and growth in the pearl nets can be attributed to temperature and phytoplankton differences between the two experimental sites. The very acceptable growth of small bay scallops in pearl nets at moderate to high densities may make this a cost-effective alternative to raceway culture.

Juvenile softshell clams (Mya arenaria), hard clams (Mercenaria mercenaria), and surf clams (Spisula solidissima) were reared in the pumped raceway this summer. From May to August, Mya grew from 19 to 31 mm, Mercenaria grew from 12 to 20 mm, and Spisula grew from 18 to 37 mm. The clams were maintained at low densities to ensure adequate nutrition. A species-specific capacity for growth is evident, with Spisula exhibiting the greatest growth followed by Mya and Mercenaria.

Monitoring the physical, chemical, and nutritional conditions of seawater in the pumped raceway system has provided insight into its function in the grow-out of bivalves. Biweekly monitoring was performed for temperature, oxygen, ammonia, nitrate, nitrite, chlorophyll-a, and algal species composition. These data were compared with growth data of the surf clams held in individual tanks at different densities. Growth correlates well with many of the measured parameters. This monitoring study pinpointed the location of fouling organisms in the piping system and revealed reductions as high as 90% in the level of suspended phytoplankton. Dissolved oxygen content of seawater filtered by the fouling organisms was also reduced. Knowledge of those conditions which foster rapid growth will aid in making decisions about managing the system.

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## PATHOBIOLOGY DIVISION

### Fish Pathology Investigation

To verify newspaper accounts of the presence of red hake in the "Mudhole" of the Hudson shelf valley, a trip was scheduled on 5 August on board the head boat Dauntless from Point Pleasant, New Jersey. About 400 hake, some with ulcerative lesions, were caught. Subsequent trawling with the Sandy Hook Laboratory's R/V Kyma in 180-ft depths on 27 August yielded 152 red hake; 2.6% had ulcers. Fish ranged in size from 18 to 44 cm; however, ulcers were found only on larger fish measuring from 34 to 40 cm. Bottom temperature was 13°C. It was difficult to trawl at the "Mudhole" because of net fouling with worms, worm tubes, and organic matter which reduced the catch efficiency of the nets.

On 23 July and 20 August, flatfishes were sampled from the Arthur Kill for the hepatoma study. Thirty winter flounder were processed for histologic examination. The size of the fish ranged from 12 to 21 cm. Bottom temperatures were about 23°C. Most of the fish had no food in their guts and exhibited external signs of emaciation. Most livers were "off-color" from the normal creamy or chalky white coloration seen on fish from control areas (Great Bay, New Jersey).

Over 5400 sand lance collected from 118 stations have been examined to date. All data on vertebral anomalies have been entered into the computer and are retrievable by cruise number, station number, latitude and longitude, or depth. The number of fish examined to date represents a 75% increase in sample size since the beginning of the calendar year. Collection of sand lance will continue and analysis of the data will begin shortly. Multiple regression analysis for relationships between the percentage occurrence of several types of anomalies and depth and location of collection will be made.

A manuscript on "The Cytopathological Effect of Copper on the Olfactory Organs of Larval Fish (Pseudopleuronectes americanus and Melanogrammus aeglefinus)" was completed and submitted to ICES for presentation at the 1981 Statutory Meeting. The manuscript was accepted and will be presented in October at Woods Hole.

Scanning electron microscope preparations of striped bass larvae 4 to 21 days old are being examined for the development of the eyes (i.e., the cornea), olfactory organs, and neuromasts of the lateral-line system. The results obtained from these and other studies on the structure of sensory organ systems from normal larvae at different development stages will be used to evaluate changes observed in starved specimens and those exposed to toxicants (i.e., copper).

### Microbial Ecology and Parasitology Investigation

Black gill condition in rock crabs (Cancer irroratus) was monitored in specimens collected from the New York Bight apex and the Philadelphia-Camden ocean disposal site. Since data collected from the New York site during the past 2 yr have shown that only small numbers of crabs are recoverable by trawling at our historical stations, the sampling regime now includes an area due south from the sewage site. The area known as the "Mudhole" appears to serve as a deep trough that progressively is becoming affected by the seaward flow of discharged wastes. Water depths at the "Mudhole" stations range from 130 to 180 ft, in contrast to depths of 60-80 ft at

the historical shoreward stations. The deeper stations also harbor crabs that appear to molt during mid-to-late summer in contrast to the wintertime molt of near-shore populations. Comparative data from the first two collections at the "Mudhole" are summarized below:

Date	Males	Females	Total	Clean	Discolored	<50% black	>50% black
May 1981 (a)	52	14	66	40	5	21	0
Aug 1981 (b)	46	17	63	60	3	0	0

(a) One female in papershell condition, all others in intermolt phase; 60% with clean gills.

(b) Five females and six males in molting stage (17%); 95% with clean gills.

The two collections showed that molting activity was associated with a high incidence of clean gills and that such an incidence varies seasonally with different *C. irroratus* populations. Also, it was of interest to note that intermolt crabs collected in May were larger than those collected during molting activity in August (see table below).

Location	Date	Size range (mean) in cm	
		Males	Females
Mudhole	May 1981	5-13 (9.1)	5-8 (6.4)
Mudhole	August 1981	3-12 (6.6)	3-8 (5.6)
Ambrose Light	August 1981	4-7 (5.1)	3-6 (4.5)

During intermolt, males averaged 2.5 cm larger than they did during molt, females only 0.6 cm. Such size differences suggest the large crabs probably moved further offshore by mid-to-late summer and were replaced by smaller crabs that had moved seaward subsequent to their final molt as juveniles. This suggestion is plausible as seen from data collected near Ambrose Light and the dumpsite during the August 1981 cruise where the average size for males was 5.1 cm and for females, 4.5.

Monitoring data for 1981, which included our first attempts to observe black gill disease further seaward, showed that the condition was remarkably high (32%) at the "Mudhole" during the intermolt phase of growth in May, but had essentially disappeared during molting activity in August. It was of interest to note, however, that all affected crabs showed less than 50% blackening of their gills; seriously blackened gills (>50%) have not been observed this year. Records of the incidence of ulcers or perforations of the carapace or appendages in crabs from the above collections also provided a means by which molting activity could be followed. Intermolt crabs from the May collection showed a 33% incidence of ulceration (22/66), while molting crabs showed only a 3% incidence (2/63).

Unreported observations made on the digestive gland (hepatopancreas) of *C. irroratus* collected during the past 8 yr include data on differences in color and

texture of this organ. Color ranges from orange, yellow, brown, green, pink, to black, and texture ranges from firm to watery. Histologically, the organ ranges from condensed to highly vacuolated and thin, depending upon the molting cycle and its influence on nutrient reserves. Such differences have now been implemented into the design of our monitoring activities. Hepatopancreas color and texture were recorded during our two most recent monitoring cruises--one in the Philadelphia dump-site (now inactive), and one in the "Mudhole," in the New York Bight apex. A firm orange-yellow gland, typical of intermolt crabs, was found in 93% of the animals from the Philadelphia site and in 60% of those from the "Mudhole." The difference in incidence of firm yellow was partly due to the fact that only 1% of the Philadelphia specimens were undergoing a molt while 15% of those from the "Mudhole" were in the molting cycle. Watery glands were found in soft crabs and in those in the early papershell stage. Additionally, watery glands from the intermolt Philadelphia crabs were found only in females in which 6/7 were berried or sponge crabs. Our very preliminary observations, which will be investigated further, indicate that the watery hepatopancreas occurs naturally in sponged females, and in molting crabs that are advanced peelers (pre-molt), soft crabs, or early papershells (postmolt). Jet-black glands were observed in three crabs from the Philadelphia site; two were firm and one was watery. Black hepatopancreas, and other degrees of discoloration, will be included with black gill monitoring activities, including limited histological studies on atypical tissues.

#### Diseases of Larval Mollusks Investigation

New systems are being developed for identifying microbial molluscan pathogens. Thus, two approaches were used in developing bridging reagents between commercially available, labeled antisera and antibacterial antibodies produced in fish. In one approach, rabbit antifish globulin antibody was produced by injecting fish antibodies which had been purified by affinity chromatography, directly into a rabbit. In the second approach, the antibody was produced by first injecting washed rabbit blood cells into a fish to produce fish antirabbit cell serum, then adsorbing the fish antibody onto fresh rabbit cells, and reinjecting the cells back into the rabbit. If current examination of the titers and specificities of these rabbit antisera proves satisfactory, they will be used with specific antibacterial fish antibodies and commercial reagents to identify pathogenic bacteria of mollusks.

Toxic filtrate of a Vibrio sp. has been concentrated and the material can now be separated by gel electrophoresis, the toxic fraction eluted, the three bands comprising the fraction separated on Sephadex columns, and each band demonstrated singly by gel electrophoresis. This means that molecular weight determinations are possible using either Sephadex column or gel electrophoresis. A determination as to which band(s) is toxic also should be possible.

Preliminary experiments indicate that four bacterial strains isolated from hard clam (Mercenaria mercenaria) larvae and culture water are pathogenic to oyster larvae. Tentative identification suggests that two are pseudomonads, one is a vibrio, and the other is a flavobacter. This is only the second time in 14 yr of bacterial identification studies that a bacterium belonging to the genus Flavobacterium was found to be pathogenic to oyster larvae. Further experiments and characterizations are in progress and still others are being planned. Another culture of hard clam larvae died and a study will be conducted of the bacterial strains isolated from it.

Additional studies showed three bacterial strains isolated from lab-reared oyster larvae to produce metabolites which can be toxic to developing oyster larvae. The toxic metabolite(s) produced by one of the strains, a pseudomonad, is heat stable; it can withstand 65°C for 30 min, while those produced by the other strains, two vibrios, are heat labile. The toxin produced by the pseudomonad is not found in the filtrate; it is released when the bacterial cells lyse. The characterization of the toxic metabolites will begin at the close of this spawning season. Bacterial isolates have been obtained from two other moribund cultures of oyster larvae. These microbes will be characterized and a determination will be made as to whether the same pathogens are present. Since the three isolates appear to be sensitive to ultraviolet (UV) light, prefiltration and UV treatment of spawning and rearing water were recommended to the Aspects of Nutritional Requirements of Mollusks Investigation where the problem originated.

Nineteen standard biochemical reactions were run on each of 34 bacterial isolates as part of a continuing attempt to analyze the effectiveness of a modified, miniaturized, biochemical identification system for differentiation of marine bacteria. Twenty-four of the isolates were organisms associated with fish lesions. Most of these had been stored in a lyophilized state after being used in an earlier study. After 6 yr of storage, 67% of the isolates were still viable.

In cooperative work with International Shellfish Enterprises in Moss Landing, California, three suspect pathogens (collected on 15 June) were used to challenge American oyster (*Crassostrea virginica*) embryos. One isolate killed all embryos in 48 hr, while the other two prevented larvae from setting, even after 4 wk of growth to the 150- $\mu$ m size. These results were reported to the hatchery manager and appropriate measures were taken and sanitation protocols changed, which reduced the ongoing disease problem.

In other cooperative work with the Connecticut State Aquaculture Division, coliform tests were run on hard clam samples on 15 and 24 July. The clams, taken off Bayview Beach, Milford, showed positive coliforms at all dilutions tested. Of the three sets of samples taken on 24 July, the group closest to the shore had the highest counts and those furthest away had the lowest counts.

Three sampling cruises to the Stratford, Connecticut, natural shellfish bed were completed on 29 June, 8 July, and 19 August. Bacterial samples and plankton tows were taken in all four quadrants approximately 0.2 mi from Navigation Aid #20. On 8 July and 19 August, the stations were extended another 0.2 mi, or 0.4 mi from the navigation aid, which is the sampling center.

Five sets of Stratford isolates (approximately 150) will be challenged against oyster embryos in pathogenicity tests. These isolates will be identified via selected biochemical tests in attempts to determine the prevalence and exact location of pathogenic vibrios isolated during the 2-yr Long Island Sound sampling cruises.

Three additional oyster larval challenges were completed on 79 Long Island Sound isolates taken from February to June 1981 to terminate the Long Island Sound bacterial survey.

## Comparative Invertebrate Pathology Investigation

Samples of blue mussels (Mytilus edulis) were received from Maine, Massachusetts, Delaware, and Virginia for coastal monitoring of the molluscan histopathology project.

Data from oyster samples collected from Maine to Virginia were assembled and compared for gross and microscopic pathologic differences regarding watery condition, mantle recession, green color, inflammation, haplosporidan infections, Nematopsis infections, Bucephalus infections, and presence of mutagens in the tissues. The data were incorporated in map form for interpretation. Interesting relationships were found between watery condition, inflammation, green color, and degraded areas in West Bay, Maine; Raritan Bay, New Jersey; Delaware Bay, Delaware; and James River, Virginia. Additional slides of oysters and mussels from most of these areas were prepared and stained for the presence of copper and mucin and will be examined in the near future. A paper on virus phylogeny and molluscan neoplasia was completed and is now in press. Data on microcell disease has been assembled and a paper on the microcell disease complex is being prepared.

During the reporting period, over 2000 specimens of fish and shellfish were received by the histology lab. Over 1000 histological sections of various tissues from these specimens were prepared for histopathological examination by the Division staff.

Paraffin embedded tissue of the European oyster (Ostrea edulis) from Greece was provided by Dr. Paul van Banning of The Netherlands. These oysters were examined to compare a coccidian parasite, Perkinsus sp., with other members of this genus that affect the American oyster (Crassostrea virginica). Special stains were used to study the characteristics of the parasite. It appears that the parasite in the European oysters most closely resembles the Perkinsus sp. we described in American oysters from Hawaii.

Samples of ocean quahogs (Arctica islandica) and surf clams (Spisula solidissima) from a Resource Assessment Division survey on Delaware II Cruise No. DE 81-05 have just been received. These are now being processed and the data will be included in our NEMP/OPP studies. A manuscript, "A Parasite and Disease Survey of Korean Oysters," has been completed and is to be submitted for review.

In other OPP activities, benthic amphipods collected on Kelez Cruise No. KE 81-04/05 have been examined histologically. A possible Baculovirus infected the hepatopancreatic nuclei of 2/39 and 1/1, respectively, Rhepoxynius episotmus collected at two stations. The nuclei were much enlarged and similar to Baculovirus-infected nuclei in the blue crab (Callinectes sapidus). Another possible nuclear viral infection occurred in one specimen of Photis dentata. In this animal, most of the epithelial nuclei were much enlarged and abnormal in staining properties. Various protistan parasites found during previous surveys were also present in amphipods collected on the April-May cruise. Data on these are being collated.

Amphipods collected on Albatross IV Cruise No. AL 81-07 have been identified and prepared for histological processing. Amphipods were collected at 18 stations on the July cruise, and Ampelisca agassizi were taken at eight of these stations. Microsporidian infections were present in A. agassizi collected at six of the eight stations, with prevalences ranging from 1 to 38%. Ovigerous females of A. agassizi were collected at only three of the eight stations.

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- Newman, M. W. IPN virus disease of clupeid fishes. J. Wildl. Dis. (Abstract.) (S)
- Newman, M. W.; Lukacovic, R. IPN virus disease of clupeid fishes. Rapp. P.-V. Reun. Cons. Int. Explor. Mer. (Abstract.) (S)
- Robohm, R. A.; Brown, C.; Cox, M. E.; Blogoslawski, W. J. Evaluation of two commercial, miniaturized, multiple-test systems in identifying bacteria from marine fish and shellfish. Rapp. P.-V. Reun. Cons. Int. Explor. Mer. (S)

Rosenfield, A. Oyster cultivation in Chesapeake Bay. Underwater Nat. (S)

Visvesvara, G. S., Baxter, P. J.; Brandt, F. H.; Sawyer, T. K. Isolation of Rosculus sp. from a human nose and demonstration of anti-Rosculus antibody in human sera. J. Protozool. (Abstract.) (S)

### Reports

Sawyer, T. K.; Galasso, M. A.; Lewis, E. J.; Ziskowski, J. Gill fouling in rock crabs, Cancer irroratus. Northeast Monitoring Program Contract Report; 1981.

### NATIONAL SYSTEMATICS LABORATORY

Much effort was devoted to preparing for projected phase-out of the Laboratory by returning study material borrowed from collections all around the world and by cataloging specimens into the National Collections in the Smithsonian Institution, where they will be available to other research workers.

### Benthic Fishes Investigation

A draft was completed of D. Cohen's contribution to a coauthored section on the family Ophidiidae for Sea Fishes of South Africa. Work was done on a seminar on the deepsea smelt family Bathylagidae.

### Pelagic Fishes Investigation

Data on 18 specimens of Spanish mackerels were added to the computer-stored information base. Revisions were made on a coauthored manuscript on copepod parasites of scombrids. Anchovy collections in the Smithsonian and Harvard Museum of Comparative Zoology were surveyed. Data on the South American needlefish genus Potamorhaphis were summarized.

### Penaeoid Shrimp Investigation

Work was done both in the SEFC and here in Washington, DC, on a revision of the rock shrimp genus Sicyonia.

### Crustaceans Investigation

Corrections were made on the draft of the manuscript on "Shrimps, Lobsters, and Crabs of the Temperate Eastern U. S.," based on comments received from reviewers.

### Publications

Cohen, D. M. Saccogaster melanomycter (Ophidiiformes: Bythitidae), a new fish species from the Caribbean. Proc. Biol. Soc. Wash. 94(2):374-377; 1981. (P)

Pérez Farfante, I. Solenocera alfonso, a new species of shrimp (Penaeoidea: Solenoceridae) from the Philippines. Proc. Biol. Soc. Wash. 94(2):631-639; 1981. (P)

Williams, A. B.; Williams, D. McN. Carolinian records for American lobster, Homarus americanus, and tropical swimming crab, Callinectes bocourti, postulated means of dispersal. Fish. Bull. (US) 79(1):192-198;1981. (P)

## ATLANTIC ENVIRONMENTAL GROUP

### Ocean Monitoring and Climatology Task

The announcements contained on pages 52 and 53 of eddy conditions in the Georges Bank-Middle Atlantic Bight area were sent to the Commander of the Atlantic Area for the US Coast Guard for publication in the August and September 1981 issues of Atlantic Notice to Fishermen.

The cooperative Ship of Opportunity Program obtained 14 expendable bathythermograph (XBT) transects and four continuous plankton recorder (CPR) transects in July-August: five XBT and two CPR transects in the Gulf of Maine, four XBT transects off Southern New England, four XBT and two CPR transects across the shelf and slope off New York, and one XBT transect across the Gulf of Mexico.

### Ocean Dumping Task

Analysis of data collected from satellite-tracked buoys (03020 and 03021) continued.

### Publications

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

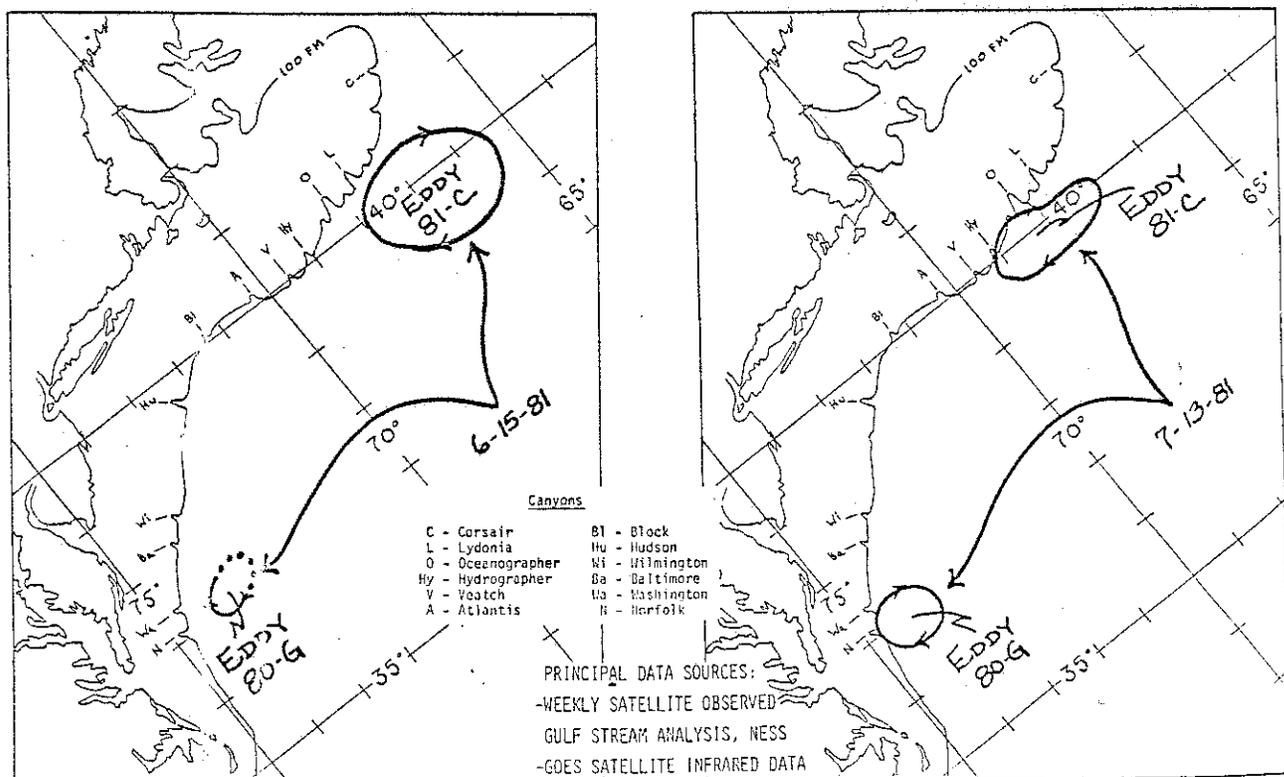
GULF STREAM EDDY LOCATIONS

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-July.

Eddy 80-G entrained Gulf Stream water throughout late June and early July as the eddy travelled southwest about 53 km (30 nm). The eddy now has a center position near 36.9°N, 74.2°W, east of Norfolk Canyon. Eddy 81-C appeared to be partly resorbed by the Gulf Stream during late June. In early July the eddy was smaller in diameter and surrounded by both shelf water and slope water entrainments. The eddy is now located near 39.8°N, 68.2°W, south of Oceanographer Canyon.

During the next 30 days Eddy 80-G may be resorbed by the Gulf Stream south of Norfolk Canyon. 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, RR 7, 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).



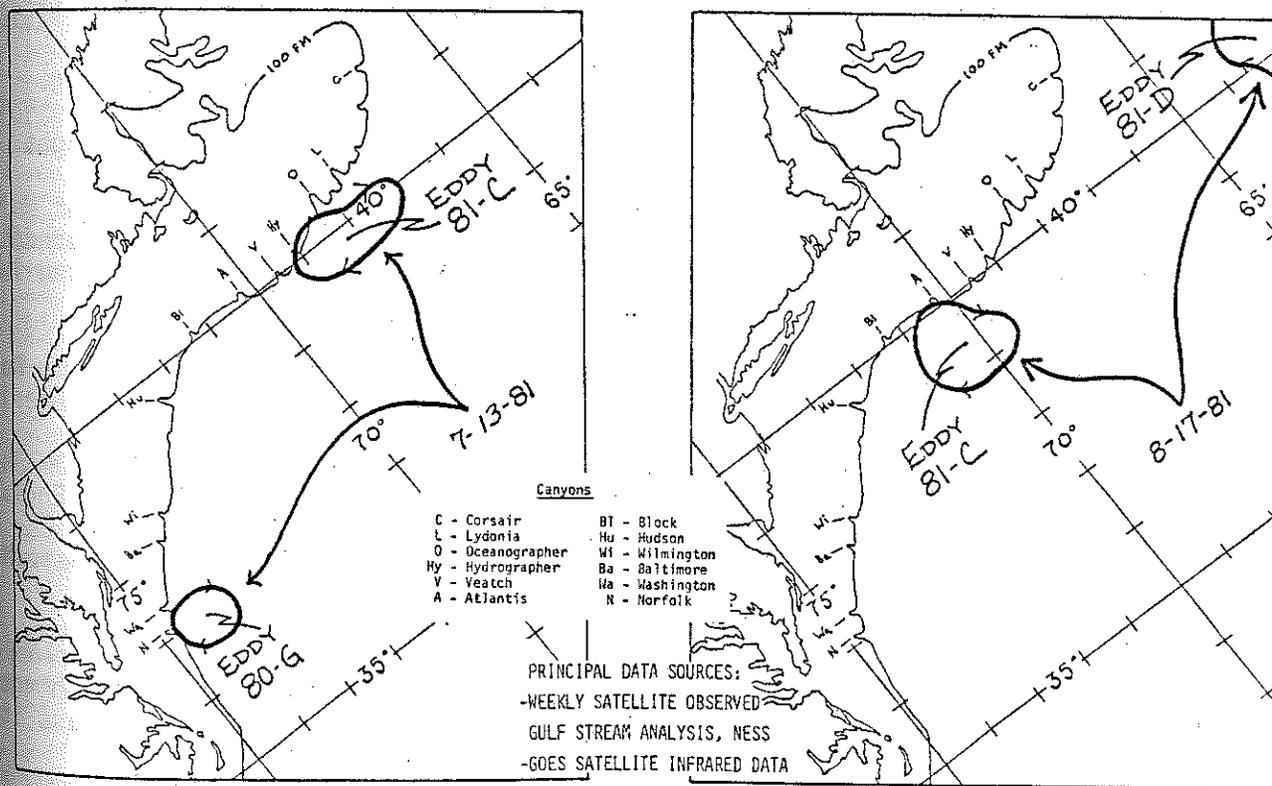
## GULF STREAM EDDY LOCATIONS

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-August.

Eddy 80-G was resorbed by the Gulf Stream east of Cape Hatteras during the last week of July. Eddy 81-C travelled west about 186 km (100 nm) and now has a center position at 39.4°N, 70.3°W, south of Atlantis Canyon. Eddy 80-D formed during the second half of July and has moved west to a center position at 40.3°N, 62.4°W, east of Corsair Canyon and far offshore of the 100 fm line.

During the next 30 days Eddy 81-C may move southwest to a center position east of Hudson Canyon; Eddy 81-D may travel west to a position southeast of Corsair 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, RR 7, 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).



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 1 July, Fred Serchuk attended a New England Fishery Management Council (NEFMC) meeting in Danvers, Massachusetts.

During 1-10 July, Vaughn Anthony participated in the ICES Advisory Committee for Fisheries Management meeting in Copenhagen, Denmark.

On 8 July, Brad Brown met in Washington, DC, with the Fishery Task Force of the Ocean Policy Committee of the National Academy of Sciences to review NMFS budget proposals.

On 8 July, Mike Sissenwine attended an Executive Committee meeting of the NEFMC in Danvers, Massachusetts.

On 8 and 9 July, John Boreman attended a workshop in New York City on establishment of a monitoring program for the Hudson River ecosystem.

On 14 July, Brad Brown met with Carl Sindermann and others to discuss the proposed Atlantic herring parasite study.

On 15 and 16 July, Brad attended the Center Board of Directors meeting.

On 17 July, Fred Serchuk attended a meeting of the Sea Scallop Oversight Committee of the NEFMC in Danvers, Massachusetts.

On 20 July, Fred attended a public hearing on the NEFMC's Interim Groundfish Fishery Management Plan in Hyannis, Massachusetts, and another public hearing in New Bedford, Massachusetts, on the 21st.

On 23 July, Linda Despres-Patanjo presented a paper she coauthored with Robert Murchelano at the annual meeting of the Eastern Fish Health Section of the American Fisheries Society, held in Starkville, Mississippi.

On 23 July, Detra Green attended a meeting in Boston of Southern New England Section of the American Fisheries Society's Northeast Division.

On 27 July, Fred Serchuk attended a NERO staff meeting in Gloucester, Massachusetts.

On 27 July, John Boreman and Vaughn Anthony attended a meeting in Washington, DC, of the Planning and Coordinating Committee for the Emergency Striped Bass Study.

During 27 July-20 August, Henry Jensen participated in a sea scallop survey aboard the Canadian R/V Prince. The survey was conducted on parts of the Scotian Shelf and eastern Georges Bank.

On 28 and 29 July, Fred Serchuk attended NEFMC meetings in Danvers, Massachusetts. Vaughn Anthony attended on the 29th.

During 3-7 August, Fred Serchuk attended the joint annual meeting of the Shellfish Institute of North America and the National Shellfisheries Association in Williamsburg, Virginia.

On 5 August, Mike Fogarty attended a meeting in Saugus, Massachusetts, of the NEFMC's Lobster Plan Development Team.

On 6 August, Emory Anderson and John Boreman attended a Mid-Atlantic Fishery Management Council (MAFMC) meeting in Philadelphia.

On 7 August, Steve Clark attended a meeting of the Atlantic States Marine Fisheries Commission's Northern Shrimp Technical Committee in Greenland, New Hampshire.

On 10 and 11 August, Anne Lange participated in the International Squid Symposium in Boston.

During 10-13 August, Joan Palmer attended the joint annual meeting of the American Statistical Association and the Biometric Society in Detroit.

On 11 August, Mike Fogarty attended the MAFMC's Summer Flounder Scientific and Statistical (S&S) Committee meeting in Philadelphia.

On 11-12 August, Mike Sissenwine attended a Northeast Fishery Management Task Force meeting in Portland, Maine.

During 12-14 August, Brad Brown and Ken Sherman participated in a meeting of the task force for the Antarctic Living Marine Resources Convention. Recommendations for the organization and initial work of the scientific committees and for commission structure were drawn up.

On 13 August, Emory Anderson attended a meeting in Gloucester, Massachusetts, of the Squid-Mackerel-Butterfish FMP Review Team.

On 17 August, Fred Serchuk participated in a meeting in Woods Hole with the NEFMC staff on updating the sea scallop FMP.

On 18 August, Vaughn Anthony and Mike Fogarty attended a meeting in Danvers, Massachusetts, of the NEFMC's Lobster Oversight Committee.

On 20 August, Vaughn Anthony and Mike Sissenwine met with Harry Marshall, Senior Deputy Assistant Secretary of State, and with Woods Hole Laboratory administrative staff.

On 21 August, Brad Brown met with Wells Burgess of the Fisheries Section of the Department of Justice.

On 26 and 28 August, Anne Lange met with Lou Goudreau and Bob Riedman of the NEMFC staff and Jim Sargent with the Woods Hole Laboratory ADP Unit to discuss 1980 commercial data preparation.

On 28 August, Fred Serchuk presented a surf clam assessment overview at the joint meeting of the MAFMC S&S Committee and the Surf Clam/Ocean Quahog Advisory Subpanel in Dover, Delaware. Emory Anderson also attended.

#### Manned Undersea Research and Technology Program

Dick Cooper presented talks on MURT monitoring studies of Georges Bank and the Georges Bank submarine canyons to: (1) Hampton Institute, (2) Bigelow Laboratory of Ocean Science, (3) State of Maine's Boothbay Harbor Laboratory, (4) Marine Technology Society's annual meeting, and (5) various local groups on Cape Cod.

Alan Hulbert presented a paper titled "Asteroids as Environmental Indicators" at the International Echinoderm Conference in Tampa, Florida.

#### Marine Ecosystems Division

During 29 June-13 July, Ken Sherman traveled to Lowestoft, United Kingdom, to preside as Chairman of the ICES Larval Fish Ecology Working Group Meeting. He then continued on to Gdynia and Szczecin, Poland, to attend the ICES Advisory Committee on Marine Pollution meeting and to meet with the Director and scientists at the Plankton Sorting Center.

On 7 July, Chuck Stillwell testified on swordfish food habits during a court case involving the Food and Drug Administration versus Globe Sea Food of Boston, for transporting swordfish with greater than 0.1 ppm mercury across state lines.

On 8 July, Robert Marak and Robert Edwards attended a meeting with Dean John Knauss at URI regarding joint research.

On 21 and 22 July, Julien Goulet and Tom Plichta attended a meeting of the Northeast Regional Fisheries Information System Technical Advisory Group at Narragansett.

On 23 July, Robert Edwards traveled to Narragansett to attend a meeting with EPA regarding the Memorandum of Understanding and the Research Agreement between NEFC and the EPA's Environmental Research Laboratory at Narragansett.

On 27 July, David Mountain met with Ken Sherman regarding FY 1982 plans for the Fishery Oceanography Investigation.

On 30 July, Ray Maurer, Jack Green, and Tom Halavik met with Jim Hall and Bob Osten of Solar Design Associates to review progress on the architectural and engineering phase of our solar project. Drawings for the greenhouse and active systems were presented and explained by Jim and Bob. Key decisions were made which will allow for a swift completion of Narragansett's solar design. The proposed greenhouse culture tank configuration was approved by Jim Hankins (NASA Project Manager) based on the Solar Design Associates' cost/performance analysis and discussions with Ray Maurer and Bob Osten. A site visit was planned by Jim Hall on 4 August to aid in final design of the domestic hot water system.

On 31 July, Donna Busch and Jack Green met with Creighton Wirick of Brookhaven National Laboratory to observe his chlorophyll monitoring and data logging equipment.

On 4 August, Jack Green, Ray Maurer, and Donna Busch met with Jim Hall, Solar Design Associates, to finalize details of plans for solar modifications at the Narragansett Laboratory.

On 4 August, Ken Sherman attended a meeting at EPA regarding joint work between EPA and NEFC. Dr. Pearce was also in attendance.

On 7 August, Greg Lough and Roz Cohen met with Lynn Bass (EPA, Narragansett) and Kay Paine (Woods Hole Laboratory ADP Unit) to discuss future needs on the new PDP11/70 system.

On 12 and 13 August, Jack Casey lectured and exchanged information with the Southeast Region's foreign fisheries observers in Pascagoula, Mississippi. He discussed shark identification to facilitate our cooperative arrangement under which observers tag sharks aboard foreign longline vessels which fish inside the US Fishery Conservation Zone.

During 12-14 August, Ken Sherman traveled to Washington, DC, to participate in a meeting of the US Antarctic Research Planning Group.

During 16-18 August, Ken Sherman attended meetings at the NOAA Environmental Research Laboratories' (ERL) Boulder, Colorado, facilities regarding MARMAP and fisheries research.

On 18 August, there was an apprenticeship program evaluation meeting at the Narragansett Laboratory to evaluate this summer's apprenticeship program and to propose and discuss improvements for future apprenticeships.

On 20 August, Ken Sherman and Frank Steimle (Sandy Hook Laboratory) met at the Narragansett Laboratory to work on a presentation to be given in Washington, DC, on the 21st regarding EPA/NEFC joint work.

On 20 August, Ron Schlitz chaired a meeting for planning the work on the September warm-core ring cruise with the other personnel to be on board.

On 21 August, Ken Sherman and Tudor Davies (EPA) were in Washington, DC, to present plans for a joint EPA/NEFC ecosystem assessment program to the Director of EPA's Water Resources Division.

On 24 August, Julien Goulet and Bob Payne (EPA) visited Kay Paine (Woods Hole Laboratory) and Skip Little (WHOI) to discuss a potential linkup between WHOI's VAX and the EPA's PDP11/70 computers.

On 25 August, Bob Greenan (NEFMC) visited the Narragansett Laboratory to transfer data from tapes provided by Kay Paine to the URI computer.

On 26 August, David Mountain, Jack Green, Ray Maurer, Jerry Prezioso, and Ron Schlitz participated in a research coordination meeting for the Stvor. This work will focus on hydrography and distribution of euphausiids and saury along the slope/shelf front.

On 26 August, Ken Sherman met with Peter Cornillion and Marty McClure (URI), Bob Edwards, and Helen Mustafa at the Narragansett Laboratory before traveling to the Milford Laboratory for the Center Board of Directors meeting to be held the 27th.

On 27 August, Ron Schlitz attended a warm-core ring executive committee meeting in Narragansett to coordinate ship operations in September.

On 27 August, Robert Marak, Jack Casey, and Marv Grosslein participated in a joint US-USSR and US-Cuban fisheries research meeting at the Woods Hole Laboratory. Three Cuban scientists discussed the possibility of cooperative research.

On 28 August, Julien Goulet, Jack Casey, Mike Couturier, and Sandy Lundin met with Bob Payne and Lynn Bass to discuss data structures and transfer of data and programs to the PDP11/70.

On 28 August, David Mountain and Ron Schlitz met with Anatoliy Bendik, the Stvor Chief Scientist, to discuss the warm-core ring study.

On 31 August-2 September, Ken Sherman traveled to Boulder, Colorado, for the NMFS-ERL Working Group meeting to review the national perspective of MARMAP.

Ed Cohen and Marv Grosslein met with Alassane Samba from Senegal about the multispecies modeling approach at NEFC, and also with Willa Nehlsen (EPA) about modeling and approaches to studying possible changes in fish production from eutrophication of Chesapeake Bay. Mike Pennington and Marv Grosslein consulted with Woolcott Smith (WHOI) on his contract work for NEFC on stock recruitment data analysis approaches. Marv Grosslein attended two meetings of the Editorial Committee for the book on Georges Bank.

#### Resource Utilization Division

Louis Ronsivalli and Dan Baker visited Amoriggi Seafoods in Rhode Island to discuss plant design and equipment layout.

Kate Wiggan and Pat Donahue traveled to Nova Scotia on board the M/V Marine Evangeline for purposes of water sampling.

Ron Lundstrom and Fred Correia attended a meeting at the request of the New England Fisheries Development Foundation to hear a presentation by two former URI students on the application of glucose oxidase to preservation of fish.

Ron Lundstrom presented the paper, "Dimethylamine and Formaldehyde Production in Fresh Red Hake: The Effect of Packaging Material Oxygen Permeability and Cellular Damage," by Lundstrom, Correia, and Wilhelm, at the 1981 meeting of the International Institute of Refrigeration (IIR) held at Cambridge, Massachusetts. Joe Licciardello presented the paper, "Frozen Storage Stability of Red Hake Fillet Blocks," by Licciardello, Ravesi, Lundstrom, Wilhelm, Correia, and Allsup. The papers will be published as part of the conference proceedings.

At the Atlantic Fisheries Technologists Conference (AFTC) in Norfolk, Virginia, Ron Lundstrom presented the paper, "Enzymatic Dimethylamine and Formaldehyde Production in Minced American Plaice and Blackback Flounder Mixed with Red Hake TMAO-ase," by Lundstrom, Correia, and Wilhelm; Kurt Wilhelm presented his paper, "Objective Measures of Textural Toughening in Red Hake"; and Joe Licciardello presented the paper, "Keeping Quality of Fresh and Frozen Sand Lance," by Licciardello, Ravesi, and Allsup.

Joe Licciardello and Ron Lundstrom attended the AFTC Executive Committee meeting.

J. Krzyonewek, K. Wiggin, P. Donahue, and J. Mendelsohn attended the IIR meeting in Cambridge, Massachusetts.

D. Dyer attended the International Squid Symposium in Boston, Massachusetts.

Tom Connors and Dan Baker attended the IIR meeting in Cambridge, Massachusetts, where Dan also presented a paper, "The Proper Handling of Seafoods from Ocean to Table." Tom narrated the slide presentation of the Gloucester Laboratory's functions to the delegates from the IIR who toured the Laboratory.

Fred King participated in four local meetings in August -- the IIR meeting in Cambridge, Massachusetts, during 3-6 August; the New England Fisheries Development Foundations's Seminar on New Seafood Products, held in Boston on 7 and 8 August, and its International Squid Symposium, held there during 10-12 August; and the New England Fisheries Institute meeting of 29 August in Gloucester.

#### Division of Environmental Assessment

On 1 July, Frank Steimle presented a 30-min seminar on the oxygen depletion situation along the New Jersey coast to an informal assemblage of representatives and guests from the National Park Service, New Jersey Marine Sciences Consortium, New Jersey Department of Environmental Protection, and Sandy Hook Laboratory personnel.

On 7 and 8 July, Dr. John Pearce chaired the NEMP management team meeting held at Rockville, Maryland. Frank Steimle and Bob Reid also attended and participated. The group discussed the finalization of the NEMP annual report for 1980, as well as problems concerned with vessel time and the development of future NEMP reports. Presentations were made by Wes Hull (about ship time), and Jim Audet [in regard to National Oceanographic Data Center (NODC) activities as they relate to NEMP].

Bob Reid and Frank Steimle participated in an NEFC review of Environmental Assessment Division programs at the Sandy Hook Laboratory on 3 July.

On Thursday, 9 July, Dr. Pearce and Dr. Thomas met with Dr. Edwards and the staff at the University of Massachusetts concerned with remote sensing activities. This was in relation to the developing MACH program for remote sensing in estuaries and the coastal zone. Protocols for groundtruth measurements were discussed as well as the use of NEARSS as a communication link between satellites and users.

On Wednesday and Thursday, 15 and 16 July, Dr. Pearce participated in the Center Board of Directors meeting at Woods Hole. In addition, he was involved with the Promotion Review Committee and a new committee set up to review promotion activities within the Center.

On Friday, 17 July, Dr. John Pearce met with Mr. Louis Ronsivalli, Mr. Don Gadbois, and Dr. Paul Boehm (Energy Resources Co., Inc.) at the Gloucester Laboratory to discuss future NEMP activities in relation to chemical analyses for pollutants.

On 20 July, Frank Steimle and Bob Reid attended a review of the NOAA Office of Marine Pollution Assessment's Hudson-Raritan Estuary project plans for FY 1982.

On 21 July, Dr. Pearce met with the Center Director and Mr. Jim Audet of the NODC to discuss NODC efforts in regard to data processing and statistical programs for environmental data. In the afternoon, Dr. Pearce gave a talk at the Woods Hole Laboratory. The talk was about recent findings by the Ocean Pulse and Northeast Monitoring Programs.

On 22 July, Dr. Pearce gave a talk at the New Jersey Marine Sciences Consortium summer program. The lecture was on benthic communities and their importance in marine fisheries and marine pollution research.

Dr. John Graikoski traveled to Washington, DC, on 22 July to confer with representatives of the Cryovac Corp. and with the NMFS Central Office staff on test procedures to evaluate the safety of vacuum-packed fresh fish.

On 28 July, Frank Steimle presented a 50-min lecture on the history, use, and effectiveness of artificial reefs as fishery management tools to a New Jersey Marine Sciences Consortium class.

On 27 July, Dr. Pearce gave a talk at the Milford Laboratory on recent findings which have developed from the Ocean Pulse and Northeast Monitoring Programs.

On 6 August, Frank Steimle and Dr. Pearce attended a meeting of the New York Bight Advisory Group at the EPA's Edison (New Jersey) Laboratory. The principal purpose was to review the current dissolved oxygen levels along the New Jersey coast and to arrive at decisions concerned with announcing the decision as it existed at that time. There did not appear to be a potential problem and it was agreed that any announcement should indicate simply that there had been no major problems during the past summer and there was little likelihood of one developing this fall. Both Mr. Steimle and Dr. Pearce presented results of current OPP and NEMP efforts and discussed future monitoring activities. Prior to the meeting of the Advisory Group, Mr. Steimle and Dr. Pearce talked about current activities being developed jointly between the NEFC and EPA's Narragansett Laboratory. The EPA Region II personnel, led by Dr. Peter Anderson, indicated some of their very real concerns for future monitoring efforts and described some of the deliverables and needs which they have in terms of managing ocean dumping in the Middle Atlantic Bight. The Region II personnel strongly suggested that they had need for input both from NEFC/NMFS/NOAA, as well as from their EPA researchers.

Ann Frame met with polychaete taxonomists Nancy Maciolek and Jim Blake at the Battelle Laboratory in Duxbury, Massachusetts, on 17 and 18 August, to iron out inconsistencies in identifications.

On 20 August, Frank Steimle met with Ken Sherman at the Narragansett Laboratory to review details of the OPP to help develop further cooperative activities with EPA groups in New England.

From 10 to 13 August, Sukwoo Chang attended the annual meetings of the American Statistical Association and Biometric Society in Detroit, Michigan.

Aquaculture Division

E. Rhodes attended the joint Shellfish Institute of North America-National Shellfisheries Association annual convention in Williamsburg, Virginia.

Pathobiology Division

Dr. Rosenfield met at the Sandy Hook Laboratory with Drs. Sindermann and Pearce regarding programs on 25 July; attended a NOAA Office of Marine Pollution Assessment-State University of New York-sponsored meeting on Chesapeake Bay research interactions and data management and synthesis at the EPA Region III Field Laboratory in Annapolis, Maryland, on 29 July; participated in the National Shellfisheries Association Board Meeting and consulted with disease experts on future pathobiology contracts and monitoring studies at Williamsburg, Virginia, during 3-7 August; discussed Pathobiology Division plans at the Gloucester Laboratory and the Milford Laboratory during 19-22 August; discussed Pathology Division plans with the Center Director on 27 August at the Milford Laboratory; and on 28 August, attended the Joint Subcommittee on Aquaculture meeting with Mr. Kern at the US Department of Agriculture in Washington, DC.

On 2 July, Dr. Blogoslawski returned from a 10-day research field trip to Homer, Alaska. He completed a series of experiments showing that ozonized ice was effective in preserving salmon.

Ms. Roe participated on the NEMP biological effects survey aboard the Albatross IV from 6 to 23 July.

Dr. Murchelano attended the Eastern Fish Health Workshop at Starkville, Mississippi, during 21-23 July, and discussed Pathology Division programs with the Center Director on 27 August at the Milford Laboratory.

Dr. Brown attended the Eastern Fish Health Workshop at Starkville, Mississippi, during 21-22 July, and presented a paper on "Characterization of Exotoxin Produced by a Shellfish-pathogenic Vibrio sp."

Mr. Michael Calabrese collected fish in the Arthur Kill at Sandy Hook on 23 and 24 July and again on 20 and 21 August.

Dr. Sawyer conferred with the Director of the Marine Science Program at Hampton Institute in Virginia Beach on 17 and 18 August, discussed Pathology Division programs with the Center Director on 27 August at the Milford Laboratory, and conducted a NEMP crab collection at Sandy Hook on 28 August.

On 5 August, Dr. Blogoslawski presented a paper on "Occurrence of Bacteria Pathogenic to Oyster Larvae: a Long Island Sound Study" at the 73rd joint Shellfish Institute of North America-National Shellfisheries Association meeting in Williamsburg, Virginia.

Dr. Robohm accompanied six chemistry professors from China on a tour of the Milford Laboratory on 6 August. The professors from Beijing, Qinquhua, Tian-jin, and Nanjing Universities and from Hua-dong Institute of Chemical Technology, were also visiting Fairfield University and the University of Connecticut prior to attending the 6th International Conference of Chemical Education at the University of Maryland.

Dr. Johnson attended the Executive Board and the Annual Meetings of the Society for Invertebrate Pathology at Bozeman, Montana, during 16-21 August.

Mr. Newman attended the Wildlife Disease Association meeting at Laramie, Wyoming, during 19-22 August.

#### National Systematics Laboratory

Dr. Isabel Canet worked at the SEFC and University of Miami.

Dr. Austin Williams presented a lecture on "Crab Life Histories in East Coast Estuaries" at the Calvert Marine Museum in Solomons, Maryland.

#### Atlantic Environmental Group

Reed Armstrong attended the Gloucester Laboratory Program Review for the IYABA Committee on 13 and 14 July.

During 14-16 July, Mert Ingham took part in discussions of the NEFC's participation in the National Climate Plan and attended a Center Board of Directors meeting in Woods Hole.

Amy Friedlander traveled to Ann Arbor, Michigan, during 1-8 August with a group from URI to attend a workshop on applications of remote sensing in oceanographic research.

On 13 August, Reed Armstrong gave an invited presentation on physical oceanography of the Middle Atlantic Bight to the "Fishing by Temperature Conference" held at the Cook College of Rutgers University and sponsored by the New Jersey Marine Advisory Service.

On 13 August, Melissa Hughes boarded the M/V Oleander to travel to Bermuda for deployment of the fast CPR in concert with the normal SOOP run. She returned to Narragansett on 20 August.

Mert Ingham visited the Woods Hole Laboratory on 20 August to present a seminar on "Weather Conditions in the Maine-Virginia Coastal and Offshore Area during the 70's," and to confer with staff.

Amy Friedlander attended a precruise briefing at the Woods Hole Laboratory on 20 August.

On 27 August, Ron Schlitz of the Woods Hole Laboratory, Terry Joyce of WHOI, and Glen Flierl of MIT visited Woody Chamberlin and Amy Friedlander to discuss remote sensing support of the upcoming warm-core ring cruise.

## SEMINARS

### Resource Assessment Division

On 9 July, Mike Sissenwine presented "An Empirical Examination of Species Interactions in Fish Populations Off the Northeast U.S.A." at the WHOI Biology Seminar Series.

On 19 July, Brad Brown gave a seminar at the Shoals Marine Laboratory.

On 18, 19, and 24 August, Mike Sissenwine lectured on multispecies assessment models at the Woods Hole Laboratory.

On 13 and 14 August, Vaughn Anthony presented two seminars at the Shoals Marine Laboratory.

### Marine Ecosystems Division

On 13 July, Norton Strommen, US Department of Agriculture's Chief Meteorologist, gave a short talk to the Investigation Chiefs on the National Climate Program.

## VISITORS

### Resource Assessment Division

On 21 August, Brad Brown met with Allasande Samba of Senegal to discuss multi-species fishery research and management.

### Marine Ecosystems Division

On 23 July, Luther Bivins, Stan Alper (NOAA Office of Technical and Engineering Services) and Bob Wolfe (NMFS Central Office) visited Ken Sherman at the Narragansett Laboratory regarding cooperative work.

### Resource Utilization Division

Visitors to the Gloucester Laboratory were Dr. William Cowie of Unilever Laboratory in Aberdeen, Scotland, on 13 August; Dr. Chen Xiubai of Shandong College of Oceanology in Qingdao, Peoples Republic of China (PRC); Mr. Zang Ming of Quindao Marine Fisheries, Inc., in Qingdao, Shandong, PRC; and Mr. Cong Ziming of the Chinese Association of Refrigeration in Beijing, PRC, all on 12 August.

### Aquaculture Division

Dick Harris and a group from Cooperative Educational Services in Norwalk, Connecticut, and Russell Wuertz of New Haven, Connecticut, visited the Milford Laboratory.

### Pathobiology Division

Visitors to the Oxford Laboratory during the reporting period were Dr. Victor Downorra of the Fisheries Department in Ghana; Dr. G. Downorra of the University of Maryland at College Park; Ms. Julia Hatcher of Peoria, Illinois; Mr. and Mrs. James Brubaker of Birmingham, Michigan; and members of the American Littoral Society which held its annual picnic at the Oxford Laboratory on 2 August.

### National Systematics Laboratory

Mr. W. Akers of Lake Worth, Florida, and M. W. How of the Skidaway Marine Institute visited Dr. Williams for information on crustaceans.

Mr. Eric Anderson of the Virginia Institute of Marine Science (VIMS) visited Dr. Cohen to discuss research on eelpouts.

### Atlantic Environmental Group

Marty McClure and Jim Griffin of URI, and Fabian Polcyn, a research engineer with the Environmental Research Institute of Michigan, visited AEG on 13 August.

### UNIVERSITY AFFAIRS

#### Resource Assessment Division

Steve Clark coordinated NEFC participation in the Shoals Marine Laboratory Summer Program on Appledore Island, Maine. Brad Brown lectured on 19 July and Vaughn Anthony on 13 and 14 August.

Fred Serchuk met with a student at the University of Massachusetts to discuss an autumn internship in the Fishery Assessment Investigation, with a graduate student from Cornell University to discuss Division activities, and with a graduate student at URI on American plaice assessment.

Margaret McBride provided yellowtail flounder age-length keys to Bill Overholtz at Oregon State University.

Steve Murawski and Loretta O'Brien worked with Mike Ross of the University of Massachusetts on analysis of witch flounder data.

Gregory Brown of Hampton Institute participated on the summer bottom trawl survey.

Research samples collected during the 1981 summer bottom trawl survey included spiny dogfish specimens for a study being conducted by the Virginia Institute of Marine Science.

### Marine Ecosystems Division

In July, personnel from the Narragansett and Woods Hole Laboratories participated in the US Merchant Marine Academy Management Internship Program. Midshipman Kathleen Duffy spent 2 wk with us learning what the NEFC is all about. She spent considerable time with just about all the investigations at both laboratories, as well as being briefed on our operational techniques.

### Resource Utilization Division

Al Blott, Jack Moakley, and John Kenney met with people at URI to discuss the implementation of our cooperative agreement. Present at the meeting from URI were representatives of the Departments Oceanography, Ocean Engineering, Fisheries and Marine Technology, and the Marine Advisory Service.

### Aquaculture Division

A National Cancer Society fellow doctoral student of the University of Southern California spent 1 wk at the Milford Laboratory training on fish cytogenetics.

E. Rhodes visited the newly acquired Fort Stark Campus of the University of New Hampshire to help in seawater system design.

### Pathobiology Division

Dr. Sawyer conferred with Dr. Eugene Small of the University of Maryland concerning ciliate diseases in oysters, and instructed students in marine microbial ecology at the Chesapeake Biological Laboratory in Solomons, Maryland, on 24 July.

On 24 July and 28 August, Dr. Blogoslawski met with Dr. Kuck to discuss continuing cooperative experiments on paralytic shellfish poisoning with Fairfield University. Progress has been made in defining methods for tagging the UV-invisible toxin with a fluorescent dye. Thus, the toxin can be readily detected and easily separated.

### National Systematics Laboratory

Dr. Cohen participated in Ph.D. qualifying exams for two VIMS students.

Dr. Collette taught a course in ichthyology for Northeastern University.

### PERSONNEL

#### Resource Assessment Division

Brad Brown, Jack Pearce, and Bob Murchelano developed a report on NEFC grade structure of personnel promotions for the Center Director. Most of the Division personnel attended one of the General Workforce Performance Appraisal System training sessions given by NERO on 9 July and 7 August.

Margaret McBride and Rhett Lewis will continue their graduate studies at Oregon State University this fall.

Evelyn Howe retired from the Resource Surveys Investigation on 22 August. Evelyn had been at the Woods Hole Laboratory since March 1963. She will be sorely missed.

On 25 August, Anne Lange met with the Judy Brennan-Hoskins Memorial Award Committee to select the 1981 recipient.

#### Marine Ecosystems Division

On 8 July, George Bolz, Roz Cohen, and Dave Potter attended a training session in Woods Hole on the General Workforce Performance Appraisal System.

On 9 July, Greg Lough, Julien Goulet, and Robert Marak attended a supervisor's training exercise in Woods Hole on the General Workforce Performance Appraisal System.

During 10-12 August, there were consecutive General Workforce Performance Appraisal System meetings held for the scientists and staff in the conference room at the Narragansett Laboratory and directed by Jim Taormina.

Reva (Gerry) Kuhlman, Purchasing Agent for the Narragansett Laboratory, resigned her position on 28 August to move to Pennsylvania.

#### Resource Utilization Division

Several of the Gloucester Laboratory staff attended a briefing session on the General Workforce Performance Appraisal System.

Fred Correia has left his position as chemist at the Gloucester Laboratory to pursue graduate studies at the State University of New York at Stonybrook where he will be working towards his Ph.D. in molecular biology.

#### Division of Environmental Assessment

On 27 July, Dr. Pearce met with Division personnel at the Milford Laboratory in regard to merit pay and other personnel matters.

#### Pathobiology Division

Dr. Rosenfield attended a training course on the General Workforce Performance Appraisal System at Woods Hole from 9 to 11 July; he attended a Center Board of Directors and a Center Promotion Review Committee meeting at Woods Hole from 15 to 17 July.

Dr. Murchelano attended a Center Board of Directors and Center Promotion Committee meeting at Woods Hole from 15 to 17 July. He attended a 1-day training session on the General Workforce Performance Appraisal System at the Sandy Hook Laboratory on 24 August. He also discussed Factor IV Committee business with Dr. Laurence at the Narragansett Laboratory on 28 August.

Dr. Brown attended the Office of Personnel Management workshops and Federally Employed Women's 12th National Training Program held 15-18 July in Indianapolis.

Dr. Sawyer attended a 1-day training session on the General Workforce Performance Appraisal System at Sandy Hook on 27 August.

Mr. Andrew Blizzard, a volunteer summer student, has returned to school.

Mr. Michael Calabrese, a biological laboratory technician, began a temporary appointment on 13 July.

Mr. Chris Fleurer, who participated in a special National Science Foundation-sponsored project for handicapped students, has returned to Gallaudet College in Washington, DC, to continue his studies.

#### Atlantic Environmental Group

The General Workforce Performance Appraisal System training meeting was attended by Jack W. Jossi on 9 July.

#### EEO ACTIVITIES

##### Resource Assessment Division

On 6 August, Brad Brown keynoted a panel presentation on opportunities for minorities and women in marine science at the National Marine Educators Association annual meeting at Texas A&M University.

Rhett Lewis discussed plans for a Centerwide EEO/multiethnic training session with Dr. Bailey Jackson of New Perspectives, Inc., in Amherst, Massachusetts.

Fred Serchuk discussed Division research and general activities with summer students in the Division.

On 8 July, the monthly Woods Hole Laboratory EEO Committee meeting was attended by E. Montiero, A. Thoms, L. Despres-Patanjo, S. Clark, M. Crawford, D. Hansford, R. Lewis, M. Sissenwine, and G. Waring.

On 4 August, the monthly meeting of the Woods Hole Laboratory EEO Committee was attended by Eva Montiero, Linda Despres-Patanjo, Steve Clark, Dennis Hansford, Mike Sissenwine, Gordon Waring, Louise Dery, and Sherry Sass.

On 4 August, Sherry Sass attended a meeting of the Woods Hole Laboratory Federal Women's Program.

Sherry Sass completed arrangements for an October Federal Women's Program workshop.

## Marine Ecosystems Division

On 23 July, a film, "You Can," was presented to the Narragansett Laboratory staff. The film deals with the handicapped.

On 4 August, Ray Bowman attended the monthly Woods Hole Laboratory EEO meeting.

On 6 August, Roz Cohen attended a Federal Woman's Program meeting in Woods Hole.

The Narragansett Laboratory was pleased to join EPA in the 1981 Minority Apprenticeship Program. Robert Clemetson and Paul Francis ended their 8-wk apprenticeships in the Plankton Ecology and Apex Predators Investigations on 21 August. Their duties included an opportunity to participate in the FIBEX (First International Biomass Experiment) project, providing critical data for estimating size and density of Antarctic krill swarms. Bob and Paul aided in the process of calibrating the Image Scanning System and developing length/weight relationships for adult and larval stages of krill. In addition, they participated in the initial phases of computer analysis of fisheries data.

## PUBLIC AFFAIRS

### Center Directorate

During 29 July-4 August, Jon Gibson and Perry Lane (Gloucester Laboratory) joined Bill Gordon and Bob Hutton of the NMFS Central Office, Bob Kifer and Vincent DiBona of NERO, and Carl D'Epiro and his wife (retired NMFS employees) to prepare and man the NMFS exhibit at the National Boy Scout Jamboree at Fort A. P. Hill near Fredericksburg, Virginia.

### Resource Assessment Division

During 22-26 July, Don Flescher displayed his fish mounts at the marine exhibit section of the Barnstable County (Massachusetts) Fair.

### Aquaculture Division

R. Mercaldo, J. Widman, and E. Rhodes participated in the annual Milford (Connecticut) Oyster Festival.