



NORTHEAST FISHERIES CENTER

NEWSLETTER

NOVEMBER 1980

RESEARCH SPOTLIGHT

"THE ENVIRONMENTAL CHEMISTRY OF THE NORTHEAST'S MARINE FISHERIES RESOURCES AND HABITATS".	1
---	---

DIVISION/LABORATORY/PROGRAM REPORTS .

CENTER DIRECTORATE	7
RESOURCE ASSESSMENT DIVISION	7
MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM.	12
MARINE ECOSYSTEMS DIVISION	12
RESOURCE UTILIZATION DIVISION.	20
DIVISION OF ENVIRONMENTAL ASSESSMENT	24
AQUACULTURE DIVISION	30
PATHOBIOLOGY DIVISION.	33
NATIONAL SYSTEMATICS LABORATORY.	38
ATLANTIC ENVIRONMENTAL GROUP	39



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



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

RESEARCH ADMINISTRATION

CENTER DIRECTOR ROBERT L. EDWARDS

ASSISTANT CENTER DIRECTOR FOR FISHERIES MANAGEMENT/
WOODS HOLE LABORATORY DIRECTOR RICHARD C. HENNEMUTH

ASSISTANT CENTER DIRECTOR FOR ENVIRONMENTAL MANAGEMENT/
SANDY HOOK LABORATORY DIRECTOR CARL J. SINDERMANN

CENTER OPERATIONS OFFICER HERBERT STERN, JR.

CENTER PLANNING OFFICER GEORGE J. RIDGWAY

RESOURCE ASSESSMENT DIVISION CHIEF BRADFORD E. BROWN

MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM CHIEF RICHARD A. COOPER

MARINE ECOSYSTEMS DIVISION CHIEF/
NARRAGANSETT LABORATORY DIRECTOR KENNETH SHERMAN

RESOURCE UTILIZATION DIVISION CHIEF/
GLOUCESTER LABORATORY DIRECTOR LOUIS J. RONSIVALLI

DIVISION OF ENVIRONMENTAL ASSESSMENT CHIEF JOHN B. PEARCE

AQUACULTURE DIVISION CHIEF/
MILFORD LABORATORY DIRECTOR JAMES E. HANKS

PATHOBIOLOGY DIVISION CHIEF/
OXFORD LABORATORY DIRECTOR AARON ROSENFELD

NATIONAL SYSTEMATICS LABORATORY DIRECTOR DANIEL M. COHEN

ATLANTIC ENVIRONMENTAL GROUP DIRECTOR MERTON C. INGHAM

"NORTHEAST FISHERIES CENTER NEWSLETTER"

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

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

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

Editor's Note: The following "Research Spotlight" is the first of a series of feature articles on the NEFC's research and development programs. These articles will deal with one or more of the following: (1) the "why's" and "how's" of a program's activities, as contrasted with the regular monthly narrative reports by our divisions/laboratories/programs which deal more often with "what" are those activities; (2) the interrelationships among our research and development programs; and (3) the value and/or practicality of our information and advice to our scientific, technical, and public constituents.

The introductory article below--"The Environmental Chemistry of the Northeast's Marine Fisheries Resources and Habitats"--was prepared by Dr. John B. Pearce, Chief of the Division of Environmental Assessment, and focuses on the work of the Division's Environmental Chemistry Investigation. Permanent members of the Investigation are: Jay E. O'Reilly, Supervisory Ecologist; Christine A. Evans, Ecologist; Albert Matte, Oceanographer; Andrew F. Draxler, Chemist; Ruth I. Waldhauer, Chemist; and Vincent S. Zdanowicz, Chemist. The Environmental Chemistry Investigation, headquartered at the Sandy Hook Laboratory, seeks, through both field and lab studies, to determine the role of and relationship between two major components of marine ecosystems--basic nutrients/contaminants and phytoplankton.

The field studies involve surveys [as part of NOAA's Northeast Monitoring Program (NEMP), NMFS's Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP), and NEFC's Ocean Pulse Program (OPP)] of shelf and coastal waters from Nova Scotia to North Carolina. These surveys reveal information on nutrient and heavy metal concentrations, and on phytoplankton biomass and productivity. Such information ties in well with the studies of the Marine Ecosystems Division's Fishery Oceanography Investigation (i.e., relationships between water masses/movements and nutrient distributions/concentrations), Ichthyoplankton Investigation (i.e., relationships between phytoplankton biomass/productivity and ichthyoplankton distribution/abundance), and Ecosystem Dynamics Investigation (i.e., contributions of phytoplankton biomass/productivity to marine food webs).

The lab studies involve determinations of heavy metal concentrations in fish, invertebrate, and sediment samples, and of basic nutrient and organic compound concentrations in seawater samples, collected on the aforementioned surveys. These determinations contribute significantly to the studies of other Division of Environmental Assessment Investigations: Physiological Effects of Pollutant Stress (i.e., relationships between heavy metal concentrations and the physiological health of fish and invertebrates as observed in the field) and Coastal Ecosystems (i.e., the effects of sediment-borne heavy metals on benthic communities).

The Environmental Chemistry Investigation, through both inhouse and contract research, has just completed an intensive period of field and lab work. Findings from this research will be released around 1 March in NEMP's annual report on "Monitoring the Health of Marine Organisms and Their Habitat." However, these findings have been summarized below as the basis of this article.

THE ENVIRONMENTAL CHEMISTRY OF THE NORTHEAST'S MARINE FISHERIES
RESOURCES AND HABITATS

Introduction

Our inhouse studies emphasize the development of baseline data on the distribution and abundance of nutrients between the Canadian border and Cape Hatteras, as well as on chlorophyll standing stocks and primary production (as referred to here and hereafter, including phytoplankton but not macrophytes). An equally important effort is the development of information on levels of toxic trace metals in sediments and biota throughout the same geographic area. We are attempting, where previous information exists, to compare levels of trace metals in sediments between the early 1970's and 1980.

In addition to these studies, we have recently contracted to have certain finfish tissues, taken from samples collected from the coastal zone to the shelf-slope break between Georges Bank and Cape Hatteras, analyzed for organic contaminants, including oil and polychlorinated biphenyls (PCB's). Finally, we also have contracted to have sediments worked up for levels of PCB's, oil, and coprostanol--an indicator of pollution. Following is a brief summary of our findings.

Analysis of Sediments for Heavy Metals

Sediments reflect the input of contaminants to the environment in terms of both time and space. Accordingly, since April 1978, scientists of the Environmental Chemistry Investigation have participated in numerous OPP cruises to collect over 4000 samples of sediment, as well as of tissue from mollusks, crustaceans, and fishes associated with particular sediment types and locations. These samples have been and are continuing to be analyzed for contaminant concentrations, using the most accurate atomic absorption spectroscopy techniques. Through these analyses, our scientists are looking at a variety of trace metals (e.g., arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc) which are thought to affect the feeding, growth, reproduction, and recruitment of economically and ecologically important marine species. In turn, the concentration values of these trace metals are being portrayed on standard maps (Figure 1) so that baselines exist for: (1) comparison with the fragmentary information developed during the early 1970's, and (2) comparison with similarly comprehensive information to be developed in the future.

Most metals show low values in sediments of the continental shelf, except in areas such as the New York Bight, Delaware Bay and its offings, and Chesapeake Bay and its offings, where the values of metals such as chromium, copper, lead, nickel, and zinc have been shown to be unusually high (Figure 1).

Analysis of Sediments for Organic Contaminants

Under a contract with the Energy Resources Company, Inc. (ERCO), sediment samples from the Middle Atlantic Bight were collected and analyzed for PCB's, polyaromatic hydrocarbons (PAH's)--often related to petroleum pollution, and

coprostanol--indicative of sewage pollution. The results of these studies suggest a concentration of these pollution-indicating organic contaminants in the New York Bight Apex (Figures 2 and 3). Future research on the body burdens of these organic contaminants in Middle Atlantic Bight organisms, and on the mechanisms of contaminant transfer from sediments to organisms, will likely show a relationship between a sedimentary source and an organismal fate of these materials.

These data are a valuable baseline which allows us to detect changes in marine life in relationship to oil and natural gas exploration and development on the continental shelf. Without such baselines, future levels and/or elevations in sediment concentrations and body burdens of petroleum hydrocarbons could not be accurately ascribed either to offshore oil and natural gas activities or to other possible sources of organic contaminants. Future research, among other things, will look at sediments and fish tissues collected south of Cape Hatteras for elevated levels of organic contaminants.

Analysis of Demersal Finfishes and Epibenthic Invertebrates for Body Burdens of Petroleum Hydrocarbons, Polychlorinated Biphenyls, and Polyaromatic Hydrocarbons

During our recent Gulf and Atlantic Survey (GAS) cruise, we collected samples of demersal and some pelagic fishes, as well as selected epibenthic invertebrates, between the Canadian border and Cape Hatteras. The fish and invertebrates were trawl-collected and frozen-stored aboard vessel in a highly standardized way to avoid possible chemical contamination. Fish from selected stations located north of Cape Hatteras were provided to ERCO personnel for analyses. In a report dated 10 November 1980, the Principal Investigator for ERCO, Dr. Paul Boehm, noted contaminant levels in these fish.

Most silver hake contained detectable levels of petroleum hydrocarbons (i.e., greater than 1.0 ppm) with concentrations ranging from 6 to 90 ppm. The high incidence (i.e., 86%) of petroleum hydrocarbon contamination of this species was unique among the several species examined. The investigator reported a geographic dependence of petroleum hydrocarbon concentrations with pollutant sources--increasing concentrations of petroleum hydrocarbons were found with increasing proximity to the New York Bight. Likewise for PCB's in silver hake--the highest levels (i.e., 0.1-0.5 ppm) were found in fish from the New York Bight (Figure 4). PCB values were higher in silver hake than in any other finfish.

In red hake, the incidence of petroleum hydrocarbon contamination was less than in silver hake, 26% versus 86%. Hydrocarbon concentrations were lower, ranging from 1 to 5 ppm. Likewise, PCB concentrations were considerably reduced in the red hake.

One-third (31%) of the yellowtail flounder had petroleum hydrocarbon contamination, but, again, the concentrations (2-7 ppm) were lower than in silver hake. Ninety-four percent of the yellowtail flounder contained detectable levels of PCB's. There appeared to be little correlation between PCB and petroleum hydrocarbon levels in this species; in fact, some of the highest PCB levels were found in fish exhibiting low levels of petroleum hydrocarbons.

Winter flounder collected during GAS were relatively free of petroleum contamination--15% contained these substances. Samples collected during GAS were significantly lower in petroleum hydrocarbon concentrations than were fish taken during the Argo Merchant oil spill survey. PCB levels were quite low in this species, but while the petroleum hydrocarbon compounds in winter flounder did not seem to be related geographically to pollutant sources, elevated PCB values could be loosely ascribed to possible New York Bight sources.

Other species, including windowpane, haddock, Atlantic cod, fourspot flounder, and summer flounder, had varying levels of PCB's and relatively small incidence and amounts of petroleum hydrocarbons.

The epibenthic invertebrates generally contained no detectable hydrocarbons, but a Cancer sp. crab sample from the mouth of Delaware Bay contained very high levels (327 ppm) of petroleum hydrocarbons. The PCB concentrations varied for the epibenthic species, ranging from 0.001 ppm for sea scallops to 0.150 ppm for American lobsters on the outer New England shelf. Lobsters did contain high levels of PCB's at two stations.

In summary, the investigator indicated that PCB's and DDE (a derivative of DDT) compounds were more widespread than petroleum hydrocarbons, and often were distributed independently of petroleum hydrocarbons. He further noted that silver hake showed patterns of contaminant buildup which seem to be "forced by a New York Bight petroleum hydrocarbon and PCB source; the situation was less clear for the other species."

These data will be most useful for detecting any future changes in contaminant levels in these economically important finfish and invertebrate species. The results of the study so far suggest that in the future a greater emphasis should be placed on collections of benthic species which are thought to accumulate pollutants to a greater degree than finfish, and whose movements are generally much more geographically restricted, and hence bear a greater relationship to ambient levels of pollution.

Cultural Eutrophication of Coastal Waters

During the past 18 mo, we have participated in many OPP and MARMAP cruises to begin to define the extent to which anthropogenic impact and naturally forcing events may interplay in stimulating production of carbon at the base of the food chain. The findings to date are being portrayed on annual plots of mean production (Figure 5). We have found that the mean annual production of phytoplankton carbon ranges between 402 and 726 g/cm²/yr for the various regions. It should be emphasized, however, that these baseline annual estimates are preliminary and that additional analyses will have to be conducted in order to reinforce our present assumptions.

These estimates place the Cape Hatteras-Nova Scotia shelf among the most productive shelf areas in the world, eclipsing by factors of 2-7 such areas as the North Sea and Baltic Sea. The OPP's annual report will detail these findings. Other measurements (e.g., nutrients, chlorophyll) are also being considered in the annual report.

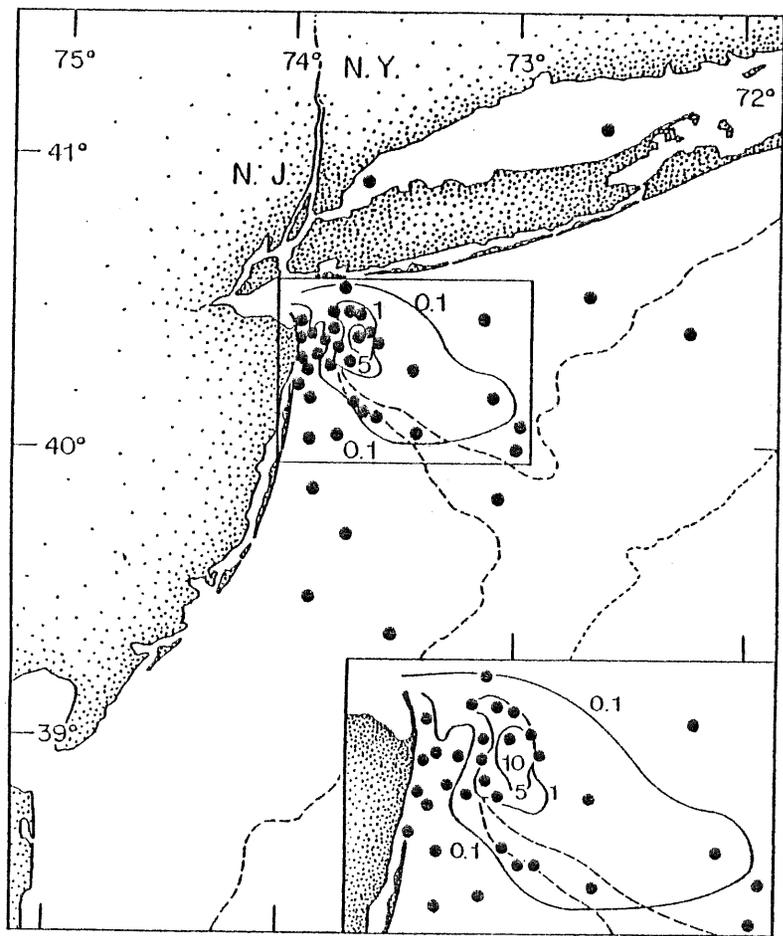


Figure 3. Coprostanol concentration (ppm) in sediments of the New York Bight.

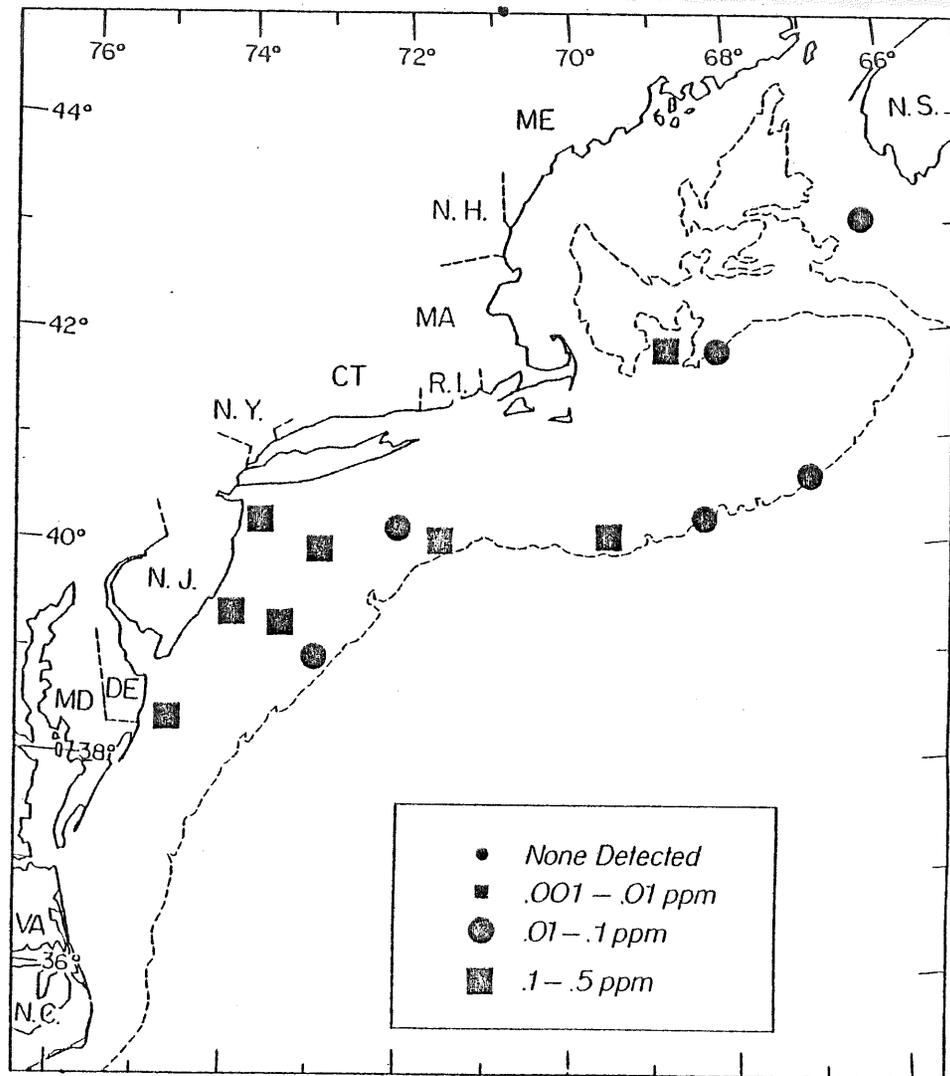


Figure 4. PCB concentration (ppm) in silver hake on the Northeast's continental shelf.

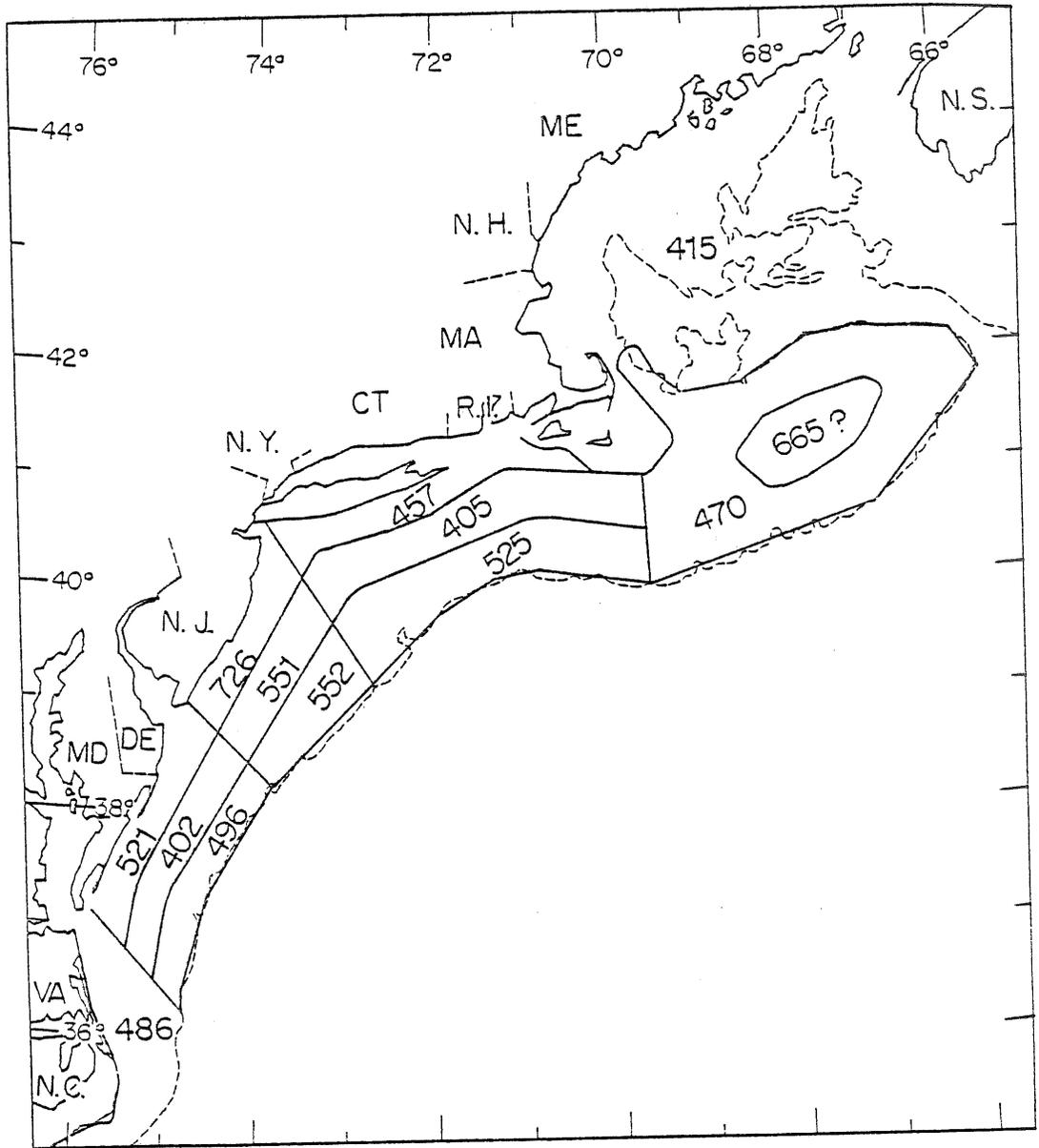


Figure 5. Phytoplankton primary production (g-C/m²/yr) on the Northeast's continental shelf.

CENTER DIRECTORATE

Fishery Technology

On 19 November, Dr. Perry Lane hosted a meeting of the New England Marine Advisory Service (NEMAS), an organization comprising representatives from Sea Grant, universities, states, and NMFS. This was part of a 2-day meeting to provide an in-service training for fishery specialists engaged in marine extension programs. Senior staff members of the Resource Utilization Division participated as lecturers and as sources of information during the sessions. For many of the NEMAS participants, this was their first exposure to the facilities and activities of the NEFC's Resource Utilization Division.

Special Scientific and Technical Projects

Ronald Smolowitz attended 2 wk of training in Miami to be qualified as an emergency medical technician.

Facilities-oriented projects at the Woods Hole Laboratory dominated the remaining period and involved pier construction, tank-room-to-office-space conversion, geotechnical and structural analysis, and the women's restroom expansion project.

Work continued on scallop drag drawings, clam system component design, and construction of a wire spooler.

Data Management

An updated requirements/feasibility study for the continuing development of a Northeast Regional Fisheries Information System (NERFIS) for NMFS was presented in early November to the NOAA Automatic Data Processing (ADP) Planning and Management Division. At that time, beginning discussions were held with them and with the DOC Information and Technical Policy Division on the preparation of a joint request for procurement of system-distributed minicomputers as outlined in the NERFIS study and in coordination with the Southeast and Southwest Fisheries Centers. Documentation in the form of an overview concept study and procurement initiatives should be completed by early February, with the request for proposal completed in the latter part of FY 1981.

On-the-job training continued for NEFC's NERFIS users on the use of the NOAA computer time-sharing vendor, ADP Network Services, Inc., with class sessions in job control language and file manipulation procedures being held at the Sandy Hook and Narragansett Laboratories.

RESOURCE ASSESSMENT DIVISION

Resource Surveys Investigation

Part III of the 1980 autumn bottom trawl survey was conducted during 20 October - 7 November with the NOAA R/V Delaware II. Henry Jensen was Chief Scientist, and Don Flescher, Evelyn Howe, and Eva Montiero also participated. The area surveyed covered Georges Bank and the eastern part of the Gulf of Maine.

During 12-21 November, the Delaware II completed the final leg of the 1980 autumn bottom trawl survey with Chuck Byrne serving as Chief Scientist and Linda Despres-Patanjo participating. The western portion of the Gulf of Maine was surveyed. Gear tests in the Southern New England area were also performed.

During 24-26 November, the gear testing was continued on Delaware II Cruise No. DE 80-08 in the same area. Chuck Byrne was Chief Scientist and Liz Bevacqua and Dennis Hansford participated.

Pat Twohig assembled and installed a third-wire, net-measuring system which was then successfully employed during the autumn survey and the gear experiments.

Station data from the vessel comparison experiments conducted during the summer bottom trawl survey between the Delaware II and the NOAA R/V Albatross IV have been processed and are now on tape. Station data from the shellfish assessment survey conducted in August by the Delaware II and the Georges Bank (northern edge and peak) sea scallop survey conducted by the Canadian R/V Prince are currently being processed. Malcolm Silverman, Evelyn Howe, and Eva Montiero continue to manage the bulk of this processing.

Tom Azarovitz, Chuck Byrne, Linda Despres-Patanjo, Liz Bevacqua, and Harold Foster completed a draft of the report to the Bureau of Land Management on historic trawl survey data. The report is currently under NEFC staff review.

Fishery Biology Investigation

Finfish

Sergio Iglesias of the Spanish Institute of Oceanography -- located in Galicia, Spain -- arrived on 3 November for a visit of several months with the Finfish Group. His primary interest is collaborating with our hake age readers to resolve age and growth problems related to the European hake (Merluccius merluccius). During this month, samples of otoliths were sectioned in preparation for this work and preliminary studies of otolith growth in young hake (young-of-the-year and yearlings) were completed.

Sherry Sass completed age determinations and data summaries for alewives collected on the 1980 spring bottom trawl survey. The 1979 commercial and research vessel survey scup scale samples were aged; the latter data were also summarized. Progress was made on the literature search for Ambrose Jearld pertaining to fish behavior as related to fishing activity. Mark Costa and Alicia Kelly impressed 1979 and 1980 commercial and research vessel survey scup scale samples.

Louise Dery, in addition to cooperative research with Mr. Iglesias, completed age determinations and data summaries for silver hake of the 1980 spring survey. Ages were also determined for several hundred American plaice as part of an aging method comparison study with Lorrie Sullivan of the University of Rhode Island (URI).

Shellfish

Mark Costa participated in two cruises, a bottom trawl survey and a gear comparison cruise, both aboard the Delaware II. Mark also prepared surf clams from the winter 1980 shellfish assessment survey for aging. Maurice Crawford continued in the aging of sea scallops from an early 1979 scallop survey and of surf clams from the winter 1980 shellfish assessment survey. Maurice also went to sea for the final leg of the fall bottom trawl survey aboard the Delaware II. Uvetta Dozier began working with the planimeter to measure the distance between annuli on the chondrophore of surf clams. Uvetta measured shells which were grown in the aquaculture system at the Milford Laboratory and whose exact ages are known. She also continued the aging of surf clams collected on the winter 1980 shellfish assessment survey, and has also become involved with the Woods Hole Laboratory's ADP Unit, batching and editing various jobs.

Age and Growth

Vi Gifford began training Kris Andrade to age redfish. They also proofread the redfish age validation paper.

Kris Andrade and Melinda Grace processed frozen samples of research vessel survey finfishes for scales and otoliths. Aging completed during November included: fourth quarter 1972 commercial redfish (first aging completed); second quarter 1972 commercial redfish (second aging completed); summer 1979 research vessel survey haddock (aged and sent to the ADP Unit); and third quarter 1980 commercial yellowtail flounder (aging completed).

Fishery Assessment Investigation

Senior Assessment Scientists

Vaughn Anthony prepared, for Center planning purposes, detailed analyses of the relationships between Resource Assessment Division activities and the strategic goals and objectives of NMFS.

Mike Sissenwine prepared for the US-Canada meeting on research vessel surveys, and met informally with Jeff Evans of the Woods Hole Oceanographic Institution (WHOI) to discuss fishery modeling.

Steve Clark reviewed a completion report for Maine's project on the environmental physiology of northern shrimp. He also provided preliminary 1980 autumn bottom trawl survey results for Atlantic cod, haddock, and yellowtail flounder to the staff of the New England Fishery Management Council (NEFMC).

Emory Anderson was involved in planning for research proposed in conjunction with the upcoming Polish directed fishery for Atlantic mackerel. Emory made a presentation on the proposed Polish fishery and related research activities to the Mid-Atlantic Fishery Management Council (MAFMC) at its November meeting. The MAFMC voted their concurrence to the recommended fishery which will be conducted outside the foreign fishing windows and will be monitored at all times by US observers or scientists. The program has been authorized by the NMFS Regional Director, the Polish Government has been notified, and word is now being awaited as to when the vessels will arrive and fishing will begin.

Fred Serchuk, along with Paul Wood, performed an analysis and evaluation of proposed Atlantic cod spawning closure areas on Georges Bank, which are being considered for possible inclusion in the Interim Groundfish Management Plan currently being developed by the NEFMC. Fred also began analysis of preliminary catch data of Atlantic cod from the 1980 autumn bottom trawl survey, and shell height - meat weight relationships for sea scallops collected during the 1980 sea scallop research survey. Fred summarized and presented 1977-79 sea scallop height-weight data to the South Atlantic Fishery Management Council for their use in evaluation of the proposed 30-meat-count-per-pound provision contained in the Draft Sea Scallop Fishery Management Plan. He also participated in the autumn bottom trawl survey aboard the Delaware II during 1-7 November.

Staff

Margaret McBride continued to work on statistical analyses of the summer Albatross IV - Delaware II gear comparison experiments, testing differences between vessels, gear, and time of day.

Emma Henderson continued developing plans for upgrading assessment software, as well as reviewing draft manuscripts for Division staff.

University and Research Institute Relations and Activities

Jeffrey Riegel of Southampton College (Long Island, New York) and Thomas Koob of the Harvard Medical School participated in the autumn bottom trawl survey ending 21 November.

Special samples collected for various academic and research institutions outside NMFS during the autumn bottom trawl survey included: witch flounder samples for Dr. Michael Ross of the University of Massachusetts, American plaice scales and otoliths for Lorretta Sullivan of URI, weakfish samples for Gary Shepard of Rutgers University, fish otolith samples for Richard Brodeur of Oregon State University, yellowtail flounder samples for Shawn McCafferty of the State University of New York at Stony Brook, electric organs from electric rays for Dr. John Cohen of the Harvard Medical School, shipworm samples for Dr. Carl Berg of Harvard University, Dichelopandalus spp. shrimp samples for Dr. Earl Weidner of Louisiana State University, sea anemones for Dr. Allen Bernheimer of the New York School of Medicine, otolith samples for Dr. Pieter Gaemers of the Museum of Geology and Mineralogy in Leiden (Netherlands), haddock and yellowtail flounder stomach samples for Ruth Turner of the Harvard University Museum of Comparative Zoology, liparid and hookear sculpin samples for Ken Able of Rutgers University, and various fish samples for Mabel Brown of the Barnstable (Massachusetts) School System.

Meetings and Appointments

Meetings

On 4 November, Steve Clark, Margaret McBride, and Gordon Waring attended the Woods Hole Laboratory Equal Employment Opportunity (EEO) Committee meeting.

A survey of affirmative action practices at the Woods Hole Laboratory during the past 5 yr was initiated.

On 5 November, Emory Anderson attended a meeting of the Scientific and Statistical (S&S) Committee of the MAFMC in Philadelphia.

On 6 November, Emory Anderson served as a member of the Center Awards Committee at the Woods Hole Laboratory.

On 7 November, Fred Serchuk met in Woods Hole with Saul Saila and Karen Marti of URI's Graduate School of Oceanography to review the final report on "Development of Techniques for Aging Sea Scallops."

On 12 November, Fred Serchuk met with Gib Chase of the US Army Corps of Engineers to discuss possible assistance in evaluating an economic study, related to fishery resources, currently being performed by the Corps.

During 12-14 November and 13-14 November, respectively, Tom Azarovitz and Mike Sissenwine attended a workshop on "Research Vessel Trawl Surveys for Ground-fish" in Ottawa, Ontario.

During 12-14 November, Emory Anderson attended the MAFMC meeting held in Montauk, New York.

On 13 November, Gordon Waring attended a public hearing on the proposed spawning area/time closures for Gulf of Maine Atlantic herring held in Rockland, Maine.

On 17 November, Fred Serchuk attended a meeting with Lloyd Randolph, Regional Director of Federal Programs for the Equal Employment Opportunity Commission, in Woods Hole to discuss the Woods Hole Laboratory affirmative action plans.

During 17-19 November, Mike Sissenwine and Dennis Hansford participated in presentations at the NEFC Workshop on Cooperative Student Programs. Margaret McBride and Rhett Lewis helped in organizing this workshop. Many Division members attended parts of the workshop.

During 17-21 November, John Nicolas and Mike Sissenwine attended the Workshop on Humpback Whale Population Dynamics held at the New England Aquarium in Boston.

On 19 November, Fred Serchuk and Paul Wood met with Ron Smolowitz and Vern Nulk at the Woods Hole Laboratory to discuss sampling and experimental designs for evaluating scallop dredge performance for an experimental sea scallop dredge constructed by the Fisheries Engineering Investigation at the Gloucester Laboratory.

On 24 November, Emory Anderson discussed the status of silver hake stocks and associated problems with Pat Gerrior of the Northeast Regional Office's Fisheries Development Services Branch at a meeting in Woods Hole.

Appointments

Fred Serchuk was appointed to the National Membership Committee of the American Fisheries Society for the 1980-81 year.

Publications

Lange, A. M. T.; Sissenwine, M. P. Biological considerations relevant to the management of squid, Loligo pealei and Illex illecebrosus, of the Northwest Atlantic. Mar. Fish. Rev. 42(7-8):23-30. (P)

MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

No report received. The September-November reports will be included in the December issue.

MARINE ECOSYSTEMS DIVISION

Ecosystem Dynamics Investigation

Ed Cohen, Marv Grosslein, and Mike Sissenwine completed final revisions to the Georges Bank energy budget. In addition to the major comparison with the North Sea, the Georges Bank energy budget was compared to a recent energy budget for the Nova Scotian shelf. Although there are important differences in some of the calculations used for the Georges Bank and Nova Scotian budgets (e.g., production-to-biomass ratios of pelagic and demersal fishes were quite different, and certain major pelagic species such as Atlantic herring were not included in the Nova Scotian estimates), it appears that pelagic fish production on the Nova Scotian shelf is low relative to total primary production compared with the North Sea (as is the case for Georges Bank). The same apparent discrepancy holds for the whole of the New England shelf (i.e., Gulf of Maine and Middle Atlantic Bight plus Georges Bank) even if one assumed that annual primary production for these waters adjacent to Georges Bank is no higher than that assumed for the North Sea, namely about 100 g-C/m²/yr. In fact, the most recent calculations by Jay O'Reilly indicate that primary production for these areas is at least three times that level. Thus, it appears that there may be significant differences in the food web between the Northwest and Northeast Atlantic ecosystems. Clarifying this problem will be one of the major focuses for the Ecosystem Dynamics Investigation.

Along these lines, Mike Pennington and Ed Cohen revised a generalized daily ration model originally derived by Mike a few years ago in an attempt to clarify the derivations and interrelationships of several daily ration models in the literature (including those of Eggers and of Elliott and Persson). Estimating daily ration from field data is treated from the standpoint of effects of sampling distribution through space and time. Although the method is simple and can be used with available stomach data, it does not obviate the need for experimental estimation of digestion rates for accurate estimation. The modeling group conferred with Ted and Ann Durbin on the possibilities for further experimental work at URI, particularly on young silver hake which they are now successfully holding in experimental tanks. The next step will be to apply the

generalized model to the available food habits data to provide first approximations to the predator-prey matrixes for GEORGE, the multispecies model.

Wendell Hahm and Ed Cohen began work on a paper detailing the variables, driving functions, equations, and the underlying rationale for the various mechanisms and processes which control GEORGE. These include recruitment processes as well as predator-prey interactions and environmental variations. In addition, they completed a critique of an ecosystem model produced by the Rand Corporation which has been applied to a multispecies situation in a Dutch estuary. Despite claims of success, the Rand model does not reflect an understanding of the actual characteristics and complexity of biotic and abiotic oceanographic processes, and therefore, appears to be of limited value for clarifying ecosystem dynamics or for simulating multispecies interactions.

Mike Pennington presented the paper, "Statistical Procedures for the Analysis of Trawl Surveys" at a trawl survey workshop in Ottawa, Ontario. Two aspects of abundance indexes are discussed in the paper: (1) the relation between an indicator and the actual population, and (2) the measurement of precision and accuracy. Techniques are given to construct stratified estimators when catchability differs among the strata which will in many situations have a known relationship to the true population. To ascertain the overall accuracy of a survey index, a method is proposed which will measure bias as well as precision of a particular indicator of abundance. The same sort of technique can also be used to combine seasonal estimators into a single annual index.

A revision was made in the paper, "Efficient Estimators of Abundance for Marine Surveys." The paper focuses on the estimation (e.g., Delta distribution) of the arithmetic mean (parameter) within a stratum. One implication of the results is that though the suggested estimator is the most efficient estimator of the mean and hence has a smaller variance than any other estimator, its variance is larger than the variance which is usually associated with the ordinary sample mean. This is because the sample variance is often much smaller than the true variance due to the highly skewed distributions from which we are sampling.

Marv Grosslein continued liaison with Richard Bachus of WHOI regarding NEFC contributions to the proposed book on Georges Bank, and also promoted participation of NEFC scientists in the Gulf of Maine oceanographic workshop scheduled for March 1981. He attended meetings with representatives from the New York field office of the Bureau of Land Management and US Geological Survey and also several WHOI scientists regarding monitoring studies on Georges Bank, and he took part in a panel discussion on "Georges Bank--Fish vs. Oil," sponsored by the Massachusetts League of Women Voters. As a member of the S&S Committee of the NEFMC, Marv also provided some guidance on development of a document by Thurston Burns and Michael Fogarty (both of the Resource Assessment Division) summarizing American lobster data collection methods by New England States. The S&S Committee and other NEFMC committees are evaluating the various data collection methods, and considering possible benefits from establishing a single uniform system for all states.

John Hauser, a programmer-analyst in the Marine Ecosystems Division at the Woods Hole Laboratory, started work in November. He was hired chiefly to assist

the Ecosystem Dynamics, Benthic Dynamics, and Fishery Oceanography Investigations as needed. John's first task involves plotting programs for summarizing the 1973-76 size-specific food habits data in formats useful for the development of control functions in predator-prey matrixes of GEORGE. He is also working on data formatting and listing routines for diet overlap in fish.

Ichthyoplankton Investigation

Our second MARMAP survey of this fiscal year, and last of the calendar year, is underway. It will end on or about 23 December. Joe Kane is Field Party Chief on Parts I and II. He will be relieved by Myron Silverman on the third and final leg of the cruise. Doris Finan and Annette Pratt are assisting on Part I. Cindy Fahay, Don McMillan, and Carolyn Griswold will take over their duties after a scheduled port call at Woods Hole. Having completed the Middle Atlantic subarea, the vessel is now working in the Southern New England subarea.

Representatives of the principal investigations involved in MARMAP I surveys met at the Sandy Hook Laboratory on 12 November to review survey operations, consider recommended changes in survey design, and review overall logistics of the entire program for the remainder of FY 1981. Persistent slippage in schedules related to data flow continues to be a factor, but for the most part, the mood was upbeat. Everyone in attendance seemed pleased with accomplishments during the past year. In short, we have met or exceeded our objective of six surveys per year in each of the past 4 yr and results of our collective efforts are beginning to surface. It was pointed out, however, that with the current vessel schedule we will complete a maximum of five surveys in FY 1981. Foreign participation in the coming year remains a question mark and survey coverage is lacking during mid-spring and virtually the entire summer. Other topics of discussion included: status of equipment, safety at sea, a review of progress at the Polish Plankton Sorting and Identification Center, responsibility for forwarding survey information to Canada, and the current status of the survey technician program on Albatross IV.

Cindy Fahay attended a 1-day meeting at the Narragansett Laboratory where Dr. Joseph Berry presented a progress report on his work with the Yale University map analysis package.

Larval Dynamics Investigation

Experimental Studies

Processing of samples and analysis of data from the 1980 joint NMFS-US Fish and Wildlife Service (FWS) striped bass study were continued. Plots of cumulative daily larval mortality are showing some interesting trends between hatcheries and between females from the same hatchery. These trends will hopefully correlate with data on growth, body burdens, and condition indexes.

The FY 1980 NEMP report was prepared. This report summarized the results of our work with biochemical indexes of condition in larval fish and in particular the effects of temperature on the relationship between the RNA-DNA ratio and the growth rate in the larvae of summer and winter flounder.

Attempts to induce spawning in summer flounder with human gonadotropin were unsuccessful. The fish are now being induced with carp pituitary extract. Summer flounder eggs obtained from the US Environmental Protection Agency's (EPA) Water Quality Laboratory in Narragansett were run in a standard viability test using wild plankton and cultured ciliates as food. No survival was observed in groups fed only ciliates.

Population Processes

This month's activities were devoted almost entirely to the preparation for and execution of Albatross IV Cruise No. AL 80-11 (interdisciplinary sampling studies of larval fish and prey microdistribution and associated processes) during 3-14 November 1980. Members of the Plankton Ecology Investigation (Jack Green and Donna Busch) and Fishery Oceanography Investigation (Ron Schlitz, Gil Dering, Derek Sutton, Tom Laughton, and Art Allen) joined forces with the Larval Dynamics Investigation on this cruise to field test an assortment of biological and oceanographic gear and instruments in the most efficient, integrated manner to develop an interdisciplinary sampling strategy for the investigation of fine-scale physical and biological processes which may be responsible for the microdistribution of fish larvae and their prey organisms. Initial gear testing and experiments were made at the site of the 1978 larval Atlantic herring patch study --the coastal Nantucket Shoals waters just east of Nauset Harbor, Cape Cod. Simultaneous physical and biological observations were repeated every 6 hr for 24 hr at a fixed station and for 24 hr following a drogue. These series were made at an offshore station (110-m bottom depth) and inshore station (44-m bottom depth) for comparison. Details of the cruise will be evaluated to develop a strategy for investigating the survival of Atlantic cod and haddock larvae on Georges Bank next spring (1981).

Randy Goodlet, a biological laboratory technician, began work 17 November 1980 as a temporary employee; he will be helping us with the processing of zooplankton samples collected with our multiple opening-closing net and environmental sensing system (MOCNESS).

Dave Potter attended a managers' meeting on NEFC solar projects held in Boston on 18 November with Ray Maurer and Al Blott and members of the Small Business Administration to review a proposal by one of the contractors.

Hal Merry, Dave Potter, and George Bolz attended the Northeast Computer Show in Boston on 21 November.

Benthic Dynamics Investigation

Rich Langton left for his new job as Director of the Bureau of Marine Science in the Maine Department of Marine Resources; Rich will be on leave without pay for 1 yr and for the time being, Marv Grosslein will serve as Acting Chief of the Investigation.

Ray Bowman continued to work on a detailed study of the food habits of silver hake, but also devoted considerable time to: (1) inventory and storage of stomach samples prior to Jim Towns' (a biological technician) resignation, and

(2) to reviewing the status of Jim's work assignments. He also began preparation for sampling stomachs on the January 1981 bottom trawl survey cruise.

Roger Theroux worked on the northern benthic invertebrate biomass report and conferred with Arthur Merrill and Ruth Turner on a review of his bivalve mollusk manuscript. The rest of his time was spent on meetings or consulting with groups (both within and without the NEFC) who requested information or data related to our benthic studies. These included the following: (1) Tom Leschine, Judy Spiller, and Ann Martin (WHOI Marine Policy and Ocean Management Program), and Marv Grosslein and John Hauser (NEFC) relative to joint efforts for further refinements of Georges Bank drill-site study data; (2) Ann Martin relative to the contents of the Georges Bank benthic data file; (3) John Lindsay (Quantitative Ecology, Inc., in Durham, New Hampshire) relative to his interest in doing polyhaileids for us, and a request for reprints on underwater photography papers; (4) Don Maurer (University of Delaware) relative to interpretation of a data set from Georges Bank sent to him earlier in the month; (5) Robert Reid (Sandy Hook Laboratory) relative to information in the Continental Margin Program data file prepared by John Hathaway; (6) George Heimerdinger (NOAA Environmental Data and Information Service, National Oceanographic Data Center) relative to the Continental Margin Program data file and our biological input for the Middle Atlantic Bight data subset; and (7) Kenneth Critchlow (Dames and Moore) relative to a request for data from canyon areas adjacent to Georges Bank drill sites--assembling material for response.

Plankton Ecology Investigation

Jack Green participated in Albatross IV Cruise No. AL 80-11 to test the plankton pumping system that was used on the Soviet R/V Evrika last spring. The system proved to be reasonably easy to manage even in moderate seas and operated reliably for the entire period. Paul Fofonoff has completed work on one multiple-rosette sampling station from Evrika Cruise No. 80-02 and is currently working on a more detailed sorting of the plankton pump samples from this cruise. He is in the process of writing a report on his methods of identification for naupliar stages of Paracalanus parvus and Pseudocalanus minutus. Joe Kane served as Chief Scientist for this first leg of the fall MARMAP cruise and will continue through the second leg. Prior to going to sea, Joe was working on stomach analyses of Atlantic cod and haddock larvae from the MOCNESS samples of Evrika Cruise No. 80-02. From 3 to 14 November, Donna Busch participated in Albatross IV Cruise No. AL 80-11, interdisciplinary sampling studies of larval fish and prey microdistribution and associated processes. She conducted the chlorophyll and in-situ fluorescence aspects of the studies. She also prepared a shipment of phytoplankton samples -- collected on a MARMAP survey (Albatross IV Cruise No. AL 80-10) by technicians from the Environmental Chemistry Investigation -- for transport to Gdynia, Poland.

Mr. James Hankins of the National Aeronautics and Space Administration (NASA) in Huntsville, Alabama, and Technical Project Manager for the Narragansett Laboratory's solar energy grant, "Project SUNFISH," met with the Solar Committee and toured the facility on 13 November. This is one of 40 solar projects nationwide that Mr. Hankins will be managing for the US Department of Energy. He made several suggestions on overall system design, siting, and procurement. As a result of his visit, the Narragansett Laboratory will initiate a preliminary design contract to sharpen design requirements and provide a cost study (BTU's/\$) of both active and passive components.

Robert Marak attended the 19 November workshop in Woods Hole on cooperative student programs.

On 12 November, Robert Marak attended a MARMAP meeting held at the Sandy Hook Laboratory.

Final sea trials of the acoustic-link opening-closing plankton samplers were held in Narragansett Bay. All five samplers worked very well in all modes of operation--individually and simultaneously. Housings are now being fitted to cover the solenoid and spring mechanism. It is hoped these will be used in early spring as part of the process-oriented cruise on Georges Bank.

Biostatistics

A remote-sensing data-link proposal was drafted by Julian Goulet. This proposal seeks funding from NASA to test the feasibility of linking remotely sensed data sets and ship survey data sets for demographic analyses of marine populations. Julien Goulet wrote, tested, and debugged a financial reporting program for Jane Allen. The program sorts, tabulates, and totals all entries into the financial reporting system input file. Cindy Jones spent a considerable amount of time researching the literature on species diversity indexes. There seems to be no ideal index applicable to planktonic communities. Karen Johnson continued to work on an atlas of trawling locations. Problems have developed in getting the FISHMAP package to operate on the Zeta plotter. Otis Jackson of the Woods Hole Laboratory is now working on the problem. Karen also began working on adapting a fisheries production model for use in the Sigma-7 computer in Woods Hole.

Tom Plichta, Robert Sand, and Steve Eldridge have: (1) generated listings for Marv Grosslein which compare Atlantic herring larvae abundance in 0.333 and 0.555-mm bongo nets (about 30 cruise master files were examined); (2) entered and edited zooplankton volume data from 25 cruises, under the aegis of the International Commission for the Northwest Atlantic Fisheries (ICNAF), on CALL files; and (3) merged the following data into the following cruise master files:

Master File	Data
DL8003	station
DL8003	net tow
DL8003	larval
AL8002	station
AL8002	net tow
AL8002	larval
DL8002	larval
AR7805	larval
WI7903	larval
WI8002	larval
EK8004	station
EK8004	net tow

Fishery Oceanography Investigation

Despite problems with weather and ship's equipment, Albatross IV Cruise No. AL 80-11 during 3-14 November provided a good opportunity to investigate small-scale environmental influences on larval survival. Ron Schlitz, Art Allen, Derek Sutton, Gil Dering, and Tom Laughton participated in the cruise with Greg Lough as Chief Scientist. The principal instruments we supplied were the Neil Brown CTD (conductivity-temperature-depth) system with associated deck gear, including the Tektronix graphics terminal and the newly rebuilt Cyclesonde vertical current profiler. The CTD system worked perfectly except for some problems with recording the raw data on tape, probably because of losses in the conducting hydro-cable. The Cyclesonde also worked well, but difficulties with the data-handling component prevented actual readout of current data on shipboard. Gil Dering has been working on the problem, has salvaged the data from the November cruise, and expects to eliminate the difficulty before the next cruise.

Five members of the Investigation (Gerry Metcalf, Bob Buckman, Art Allen, Helen Gordon, and Dan Rogers) participated in Leg I of Albatross IV Cruise No. AL 80-12, the final MARMAP cruise of CY 1980. Bruce Davis left for a job with the US Fish and Wildlife Service in South Carolina after nearly a year with us, Marianna Pastuczak arrived from the Polish Sea Fisheries Institute in Gdynia on a 3-mo visa to work with Dan Patanjo and Ron Schlitz on the nutrient data from the ICNAF Larval Herring Program. She and Dan have been busy organizing the data and plotting nutrient distributions. Karen Lennon, a senior at Falmouth High School, arrived on a stay-in-school appointment. She has been assisting in the processing of oceanographic data.

Sam Nickerson supervised the salinity-determination operation which has also involved Dan Patanjo, Derek Sutton, Tom Laughton, and Bob Buckman. In addition, Sam has read the expendable bathythermograph (XBT) traces from the fall bottom trawl survey on Delaware II. Tom has been drawing the last few hydrographic sections along the Nantucket Shoals flux experiment line in preparation for a data report. Derek has been repairing lights from our guard buoys. Ron Schlitz has been revising his paper on mechanisms of nutrient supply for Georges Bank, as well as his coauthored paper on Georges Bank mean circulation. Steve Ramp has been examining the relationships of fluctuations in both the Northeast Channel and Nantucket Shoals flux experiment line flow with warm-core ring movements and shifts in the shelf-slope front.

Steve Ramp gave a talk on atmospheric effects on Northeast Channel flow to a group of Naval Reserve meteorologists. Dan Patanjo and Red Wright attended a MARMAP review and planning session at the Sandy Hook Laboratory. Red Wright and Ron Schlitz met several times at WHOI with other principals in the flux experiment to organize plans for data reports and initial presentation of results.

Oceanic Gamefish Investigation

In November, tags were returned from 22 sharks representing the following species: blue (10), sandbar (9), mako (1), dusky (1), and blacktip (1). Seven of the blue shark returns were at liberty for over a year. The most interesting returns came from two blues that made transatlantic movements of over 3000 mi from the US to the offings of the Cape Verde Islands. The Japanese longline

fisherman who returned one of the Cape Verde recaptures also sent us a tag from a blue shark tagged by biologists at the Plymouth, England, laboratory. That shark had been recaptured on the same day. Another blue shark tagged off Maryland was recaptured after 5 yr off Guadeloupe, West Indies (approximately 1800 mi). The single mako return was at liberty 412 days and traveled from Virginia to St. Lucia, West Indies (1700 mi). Returns from the other species were primarily short-term recaptures with the exception of the one sandbar shark which was at liberty for 3 yr and traveled from the Atlantic into the Gulf of Mexico (New Jersey to Alabama--1200 mi).

Stomach contents were examined from two blue sharks that were fed Atlantic mackerel, tagged with a transponding sonic sensor, and followed during the Bird of Passage cruise last summer.

Nancy Kohler presented a seminar to the URI Graduate School of Oceanography on liver weight and condition of the blue shark. Wes Pratt continued attempts to examine vertebrae in shortfin mako for evidence of growth-related features. A silver nitrate method used on British blue sharks by our colleague, Dr. John Stevens, worked well, while hematoxylin, alizarin, and Mallory's stain gave less distinctive results when used on the vertebral faces. Alan Lintala embedded in paraffin a large fraction of the reproductive tissue sampled last spring and summer.

Dr. Perry Gilbert of Cornell University and Mote Marine Laboratory visited the Narragansett Laboratory and shared his work with us. He gave an informal seminar and showed the staff his unique film on skate reproduction including the only footage ever taken of copulation. Plans were made for cooperative sampling of reproductive tissue next summer.

Wes Pratt had a photographic exhibit, "The Web of Life in Narragansett Bay," as part of the URI Graduate School of Oceanography's Public Lecture Series on 5 November.

Meetings and Visitors

On 6 November, Bob Edwards, Helen Mustafa, and Ken Sherman visited Dean John Knauss at URI to discuss the establishment of an oceanographic remote-sensing facility.

Eric Schneider of the EPA's laboratory in Narragansett visited our Narragansett Laboratory to discuss research programs related to outer continental shelf development of gas and oil with Bob Edwards and Ken Sherman.

On 10 November, Frank Fels of RCA, Inc., discussed optional equipment for the proposed Northeast Area Remote Sensing System to be housed at URI.

On 13 November, Luther Bivins and Kurt Stehling of the NOAA Office of Ocean Technology and Engineering Services, visited the Narragansett Laboratory to review progress on the development of the high-speed plankton sorting system.

On 18 November, Ken Sherman participated in the cooperative education workshop at Woods Hole.

On 19 November, Marty McClure of URI visited Ken Sherman regarding plans for the remote sensing program.

From 20 to 21 November, Ken Sherman was in Washington, DC, to participate in a review of the physiological ecology program of the US Department of Energy.

Publications

Pratt, H. L.; Casey, J.; Conklin, R. B. Observations on large white sharks, Carcharodon carcharias, off Long Island, N.Y. Copeia. (S)

Jeffries, H. P.; Sherman, K.; Maurer, R.; Katsinis, C. Computer-processing of zooplankton samples. Estuar. Perspect. 1980. (P)

RESOURCE UTILIZATION DIVISION

Fisheries Engineering Investigation

Preliminary fishing trials of the experimental scallop drag were completed. Additional trials will continue as weather permits.

Testing of a new juvenile sampler aboard a commercial vessel was done. Further modifications and testing appear to be necessary.

Engineering Assistance to Other Center Programs

Cooperation with AEG's sampling on the ferry (M/V Marine Evangeline) crossing to Yarmouth, Nova Scotia, was completed in November by Al Blott.

Research Vessel Activities

Renovations to the Gloucester Laboratory's R/V Gloria Michelle are continuing with projects such as rebuilding the deck house and pilot house, and re-outfitting the vessel for compatibility with our research programs. This included bringing her into drydock for inspection and installation of transducers, through-the-hull fittings, painting the bottom, and installation of a heating system.

The Gloucester Laboratory's other research vessel, the Rorqual, was used for the preliminary tests of the scallop drag.

Facilities

Building heating, hot water, and plumbing systems are being overhauled.

Resource Development and Improvement Investigation

The study to determine the advantages of pasteurizing blue crab meats in plastic pouches (blue crab meats are currently pasteurized in metal cans) is continuing.

Arrangements are in progress with a local processor to prepare "U.S. Grade A" frozen fish for the project to determine the economic feasibility of producing

and distributing "U.S. Grade A" fillets of haddock, Atlantic cod, pollock, ocean perch, and winter flounder. Trips were made to Albany, New York, and Detroit, Michigan, to explain the objectives and details of the project to the management of two supermarket chains that are to sell the "U.S. Grade A" frozen fillets. In Albany, New York, six test supermarkets will sell "U.S. Grade A" frozen fillets of these species. The sales will be followed and compared with the sales of ungraded frozen fish in three control stores from the same supermarket chain. We are still arranging for the sale of the graded fish in the Detroit, Michigan, supermarkets. We welcome Debra Dyer who will be working on the guaranteed quality frozen fish project.

Product Quality, Safety, and Standards Investigation

Product Quality

Red hake fillet blocks were examined after 50 wk of storage at either -20° or -80°F as part of the time-temperature tolerance study; no significant change has occurred in any of the parameters being measured from the previous examination at 40 wk.

Similarly, with red hake blocks frozen at three different rates (i.e., ultra fast, fast, and slow), no important changes were observed, after 22 wk of storage at 0°F , from the last observation made at 16 wk. The samples frozen in liquid nitrogen are still rated best in texture.

An experiment was initiated on fresh red hake canned under vacuum (after nitrogen purging) and stored at refrigerator temperatures above freezing. Dimethylamine (DMA), trimethylamine, and formaldehyde will be monitored at daily intervals. The results from this experiment, combined with the results of previous studies with nonfrozen red hake packed in plastic films with various oxygen transmission rates, will be integrated into a paper on the role of oxygen on the enzymatic production of DMA and formaldehyde. Ron Lundstrom will present this paper at the International Institute of Refrigeration meeting next summer.

The Association of Official Analytical Chemists' Statistical Consultant and General Referee have approved the design of a collaborative study of a method for fish species identification using agarose gel isoelectric focusing. The study will be conducted during December and January, and will include collaborators from 13 laboratories including 10 from the US, 1 from Canada, 1 from the United Kingdom, and 1 from the Republic of South Africa.

The exhaust hood for the microbiology lab has arrived, and after installation, the preliminary phase of the Ames testing, such as calibration of test strains, will be initiated.

Product Safety

A shipment of eight fish samples representing the fall collection was received from the Gulf Coast Research Laboratory. This shipment officially terminates the contract with the Gulf Coast Research Laboratory. Workup of these samples and others from Texas A & M University for PCB determinations is now in progress.

Two new printed circuitry boards were replaced in the amplifier section of our electron-capture detector. Background level was checked and found to be satisfactory. The AS-100 autosampler has been malfunctioning due to a leak in the injection port system which has since been corrected.

Two new basic programs were written for the PCB work. We are also attempting to analyze for PCB's by high-performance liquid chromatography utilizing a reverse-phase column.

Product Standardization

An initial draft of a "U.S. Standards for Grades of Fresh and Frozen Fish Steaks" has been prepared and is being reviewed informally.

The commenting period on the "Advance Notice of Proposed Rule Making" of the "U.S. General Standards for Grades of Shrimp" published in the Federal Register of Tuesday, 5 August 1980, has been extended from 1 October 1980 to 1 January 1981 at the request of industry. Additional comments are being received from both US Department of Commerce (USDC) inspectors and industry.

A proposed draft of an interim commercial item description for frozen fish sticks and fish portions has been prepared and sent to the NMFS Central Office for review and comments.

University Contacts

Kate Wiggin traveled to URI to assist Ken Simpson and Cindy Seidel with the setup of their new isoelectric focusing lab and equipment.

We supplied information on nonenzymatic production of DMA and formaldehyde in fish to Linda Groner of Cornell University.

We supplied information on agarose gel isoelectric focusing to Al-Awfy Hamad of URI and also to Sheila Stiles at the Milford Laboratory.

Kurt Wilhelm met with Dr. Ernest Johnson of the University of Massachusetts, Dr. Chong Lee of URI, and Ron Segars of the US Army's North American Research and Development Command's Natick Laboratories to discuss objective methods of fish texture analysis.

Dr. Tyre C. Lanier of North Carolina State University was contacted concerning the Third National Technical Seminar on Mechanical Recovery and Utilization of Fish to be held during 1-3 December 1980 in Raleigh, North Carolina.

Dr. Herbert O. Hultin of the University of Massachusetts Marine Station in Gloucester was contacted concerning statistics on volume of imported seafoods, and concerning a peer review of a research paper on biochemical changes in preserved fish.

Technical Assistance

Information and technical assistance were given in the following areas: preparation of salt fish; plant sanitation and processing methods; seafood consumption questionnaire; aquaculture; fish canning; Sea Grant project proposal; nutritional value of seafoods; identification of fish oils in harbor water; shelf life of frozen Argentine whiting; chlorination; "Definitions and Tables of Defects" for eight underutilized species in different forms; underutilized species; absorption systems for freezing fish at sea; area fish processing facilities; hydraulic clam dredge systems; construction and operation of otter trawls; facilities for live holding of lobsters; eels; cost factors in the development of a squid fishery in Argentina; squid technology; dipping fresh fish fillets in potassium sorbate to extend storage stability; fish processing equipment; pickling and smoking fish; heading and gutting of small fish; potassium sorbate dip to extend the fresh storage life of fish fillets; resource material for a science fair project on environmental pollution; legal minimum length of lobsters in five southern states; sources of supply for lobsters and forms in which to preserve them for export to Germany; publications on consumer education; New England fisheries; resource potential and seasonal availability of underutilized species from Maine to the Carolina's; planning for the 1981 Atlantic Fisheries Technological Conference; sources of dried and salted cod fish; and ingredients used on minced fish.

Meetings, Visitors, and Training

Meetings

Bob Learson attended the New England Fisheries Steering Committee Meeting and the New England Fisheries Development Foundation meeting on 14 November and the Gloucester Fisheries Association meeting on 10 November.

Joseph H. Carver attended a meeting with US Department of Agriculture (USDA) officials in Washington, DC, to resolve comments on commercial item descriptions for canned salmon and tuna.

Perry Lane attended a meeting of the New England Marine Advisory Service (NEMAS) Board of Directors in Exeter, NH, and a meeting sponsored by NEMAS for fishery advisory specialists in Gloucester.

Visitors

Dr. Zbgniew S. Karnicki from the United Nations Food and Agriculture Organization (FAO) in Rome visited the Gloucester Laboratory on 24 and 25 November to discuss research on underutilized species.

Mr. William Gordon from the Battelle Memorial Research Institute (Columbus, Ohio) and Dr. Andre Ayerbe from Battelle's facility in Geneva, Switzerland, visited the Gloucester Laboratory to discuss our research on reformed fishery products.

On 31 October, John Ryan escorted four representatives of the Peoples Republic of China, engaged in a FAO-sponsored study of food hygiene, through several plants under USDC inspection to observe sanitation practices. They were also given a description of Gloucester Laboratory activities by the Laboratory and Deputy Laboratory Directors.

Training

Elinor Ravesi and Judi Krzynowek attended a 1-wk training course on "Advanced Management Skills for Women."

John Ryan attended training courses on "Managing Assertively" and "Stress Management Training."

Publications

Ampola, V. G. The quality of squid held in chilled seawater versus conventional shipboard handling. Mar. Fish. Rev. 42(7):74-76;1980. (P)

Seidel, C. R.; Krzynowek, J.; Simpson, K. L. International study on Artemia from five geographical locations. Persoone, G.; Sorgeloos, P.; Roels, O.; Jasper, E. eds. The brine shrimp, Artemia. vol. 3. Ecology, culturing, use in aquaculture. Wetteren, Belgium: Univera Press; 1980: 375-382.

DIVISION OF ENVIRONMENTAL ASSESSMENT

Biological Oceanography of Stressed Ecosystems Investigation

Phytoplankton Growth

Algal bioassay data obtained in 1980--totaling 2601 cell counts--were reduced to mean daily division rates and tabulated. Throughout the assays, nitrogen was usually the nutrient most critically limiting growth of the diatom Thalassiosira pseudonana. Phosphorus and trace metals were also frequently growth limiting in combination with nitrogen, however, and their importance sometimes exceeded that of nitrogen. On a few occasions, a lowering of the growth rate due to scarcity of silicate and vitamin B₁₂ was evident. Variation of importance of the nutrients was seen from station to station and between water layers at the same locale. The results, in general, suggest a complex picture of chemical fertility rather than regulation of phytoplankton growth by a single nutrient.

Preparations were made for assay sampling on the December NEMP cruise. These included acid cleaning of 120 sample bottles and washing like numbers of fiberglass prefilters and membrane filters.

Phytoplankton Species Composition

Water samples for phytoplankton analysis were processed from Albatross IV Cruise No. AL 80-10. Similar samples are currently being collected on Albatross IV Cruise No. AL 80-11 and Delaware II Cruise No. DE 80-09 (an OPP-NEMP survey).

Final ADP operations have been completed for samples from Soviet R/V Belogorsk Cruise No. 78-04, compiling all data from Dr. Harold G. Marshall and Mrs. Myra Cohn in their cooperative study on phytoplankton populations on this cruise. These data will be published in a forthcoming NOAA Technical Report for which the "Introduction" and "Methods" sections have been completed.

Data compilation has been completed by Mrs. Cohn for Delaware II Cruises No. DE 79-03 and DE 79-05, and these await processing by the Sandy Hook Laboratory ADP Unit.

A joint publication with Dr. Marshall titled "Phytoplankton Community Structure in Northeastern Waters of the United States: I, October 1978" is in the editorial review process prior to publication.

Seabed Metabolism

Bill Phoel and Steve Spina completed the reduction of seabed oxygen consumption data obtained on the September 1980 NEMP cruise. For the same cruise, Steve and Andy Draxler (Environmental Chemistry Investigation), completed preliminary flux-rate calculations of ammonium between the seabed and overlying water. These data are being analyzed and integrated with seabed metabolism data from eight previous cruises dating from February 1975 for inclusion into the first annual NEMP report.

Preliminary results indicate that:

1. Abnormally high or abnormally low rates of seabed oxygen consumption, when compared with baseline levels, can indicate environmental impacts both temporally and areally as indicated by the extremely high values found around the epicenter of the anoxic event off New Jersey in 1976.
2. The New York Bight continental shelf has significantly higher (and much more variable) rates of seabed oxygen consumption than areas of the shelf south and north of the Bight. Specific impacted sites, such as the sewage sludge dump and dredge spoil dump, as well as the mouths of estuaries, e.g., Block Island Sound, have the highest oxygen consumption rates measured as well as extremely high variability.
3. The regression analysis of seabed oxygen consumption on ambient bottom temperature for NEMP cruises in September 1979, March 1980, and September 1980 were significant at the 95% levels. The correlation coefficients, however, were weak.
4. Regressing seabed oxygen consumption on ambient dissolved oxygen concentrations for the same three cruises indicated a significant regression (at the 95% level) for only the March 1980 cruise. In all cases, the correlation coefficients were extremely weak but also negative. Oxygen consumption rates, inversely associated with dissolved oxygen concentrations, suggest that the oxygen consumption is influencing the dissolved oxygen concentrations in the bottom water.

Bill Phoel presented some of the data at the September NEMP meeting at the University of New Hampshire. He also attended the 7th Annual Aquatic Toxicity Workshop in Montreal, Canada, where he presented a paper, coauthored by A. F. J. Draxler, titled "In situ Measurements of Nitrogen Excretion and Oxygen Consumption as Determinatives of Stress in Asterias vulgaris."

Bill also assisted Dr. J. Morgan Wells, NOAA Diving Coordinator, in instructing experienced NOAA and non-NOAA divers in recompression therapy and chamber operation at the Southeast Fisheries Center's chamber complex in Miami, Florida. The workshop was to provide these divers with hands-on chamber operations and familiarize them with diving accident management procedures.

Coastal Ecosystems Investigation

Benthic Communities

Bob Reid, Ann Frame, Flo Wood, and Dave Radosh spent much of the month in preparing the initial NEMP annual report. Bob continued to compile what historical information exists on sediments and benthic macrofauna of the standard NEMP benthic stations, and began analysis of data from April and September 1978 and December 1979 cruises. Emphasis will be placed on species richness, cluster analysis, lognormal distributions, and populations of amphipod species, in attempting to discern spatial-temporal trends in benthic communities and the relation of these trends to environmental quality. Dave and Flo coded and otherwise prepared the benthic data for computer analysis. Ann worked on comparing species identification for contract-processed benthic samples with those for samples sorted in-house.

Dave also prepared for the December NEMP cruise, and dove with Clyde MacKenzie to conduct: (1) population studies of surf clams, and (2) experiments on effects of contaminated sediments on clam setting, burrowing, and contaminant uptake. We advised FWS personnel on ways of assessing blue crab populations in a portion of the Arthur Kill River which is scheduled for dredging, and consulted with the Northeast Regional Office's Environmental Assessment Branch on a design for sampling surf clams and other benthic macrofauna in areas off southern Long Island being considered for beach nourishment-related dredging. We loaned sampling equipment to NOAA's Office of Marine Pollution Assessment for a cruise to study impacts of the IXTOC oil spill. Steve Fromm joined our Investigation as a technician this month.

Benthic Energetics

This month Frank Steimle completed planning and coordination of the December OPP cruise on the Delaware II and prepared the cruise report for the October/November OPP survey on the NOAA R/V Kelez. He also worked with John LeBaron of the Sandy Hook Laboratory ADP Unit to generate summarized listings of all calorimetric data, including conversion programs to produce values on a dry-weight, ash-free dry-weight, and wet-weight basis. Frank and Janice Ward continued revisions of manuscripts. Russ Terranova worked on calorimetric analyses of a recent set of samples provided by the Resource Assessment Division's Resource Surveys Investigation. Upon completion of these samples, we will have caloric values for all major forage species of northeastern waters, as identified by the Marine Ecosystems Division's Benthic Dynamics Investigation. Entire collections

will concentrate on seasonal and geographic variations within especially important species. Dorothy Jeffress and Janice Ward continued working on the invertebrate life history file and the New York Bight apex biomass study, which is now 60% complete.

Janice Ward provided Mr. James Mansky of the US Army Corps of Engineers in New York with life history information on several polychaete species which are to be used in PCB and heavy metals analyses of the New York Bight apex dredge spoil dumpsite.

Environmental Chemistry Investigation

During November, several members of this Investigation participated in the first leg of the MARMAP survey on Albatross IV. Jim Duggan and Bob Fitzgerald measured netphytoplankton/nannophytoplankton chlorophyll-a throughout the water column at 52 stations. Hank Rota and Tom Kienzle filtered seawater for nutrient (ammonium, nitrite, nitrate, silicate, phosphate, and dissolved organic nitrogen and phosphorus) analyses at approximately 30 stations. Jim Nickols measured integral daily rates of phytoplankton organic production at approximately 16 stations.

During the month, 4060 nutrient analyses were performed on seawater samples collected during OPP and MARMAP surveys.

A semiautomated, persulfate-oxidation technique for total or dissolved organic nitrogen and phosphorus determinations was evaluated. Initial results indicate this method to be useful in routine measurements of dissolved organic nitrogen analyses on seawater collected during shelf surveys from April 1979 to the present.

Trace metal analyses were completed for sediments collected during OPP surveys: R/V Advance II Cruise No. 79-01, Albatross IV Cruises No. AL 79-07 and AL 79-10, Kelez Cruises No. KE 79-10 and KE 80-07/08, and Delaware II Cruise No. DE 79-11. We began analyses of trace metal content (i.e., silver, cadmium, chromium, copper, nickel, lead, and zinc) in muscle tissue composites collected in the New York Bight in August 1980.

Phytoplankton organic carbon production rates measured during Albatross IV Cruise No. AL 80-02, a MARMAP survey, were computerized, edited, and used to update our first annual estimates of shelfwide primary productivity.

Considerable time was spent by all members of this Investigation preparing figures and text for the first annual NEMP report.

A manuscript titled "A Manual for the Measurement of Chlorophyll a in Netphytoplankton and Nannophytoplankton" by Chris Evans and Jay O'Reilly was circulated for comments.

Physiological Effects of Pollutant Stress Investigation

Lab-reared surf clams and bay scallops have been placed in two diluters. The surf clams and bay scallops are being exposed to either silver (AgNO_3) or copper ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$) at concentrations of 0, 1, 5, and 10 $\mu\text{g}/\ell$. Forty-five animals of each species are being exposed at each test concentration.

The redesigning of a diluter was completed this reporting period. Adult and juvenile blue mussels have been placed in this diluter and are being exposed to silver (AgNO_3) at concentrations of 0, 5, 25, and 50 $\mu\text{g}/\ell$.

Experiments with lab-reared blue mussels exposed to either copper or silver continue. Growth is being measured on a monthly basis, with dead organisms being removed daily.

Routine analyses for trace metals and PCB's in fish tissues continue. Previously, we had collected livers from three-to-five flounders to make up a single sample for PCB analyses. We have now found that we can analyze a single liver sample, thus we will be collecting individual samples in the future.

Physiology

American lobsters exposed to cadmium for 30 days were removed from a diluter system for study. Respiratory and blood studies were made and a variety of tissues were prepared for examination by scanning electron microscopy. These lobsters exposed to cadmium in solution will be compared to a similar group receiving cadmium from contaminated food.

Sampling of the Long Island Sound Mini-Pulse stations continues. Analyses of windowpane (flounder) blood plasma samples for sodium, potassium, calcium, and osmolality are complete through the September collection. Windowpane were collected for lab exposure studies to either cadmium or copper. These tests will last 60 days and hematological tests and respiration measurements will be made.

Biochemical Effects

Analysis was completed on rock crab hearts from Albatross IV Cruise No. AL 80-09 (an OPP survey), and continued on sea scallop adductor muscle samples from Albatross IV Cruises No. AL 80-06 (a resource assessment survey) and AL 80-09 (an OPP survey).

Bill Steiner (Behavior of Marine Fishes and Invertebrates Investigation) helped us to obtain live sea scallops from a population off the New Jersey coast; these will be used in a long-term (6 mo), sublethal, silver-exposure test, with at least three sampling periods. In this study we will examine scallop kidney tissue for the first time, and we also plan to monitor the relative uptake of both silver and copper. The latter exercise stems from serendipitous observations made in the Milford Laboratory with blue mussels, slipper limpets, and sea scallops (thus far). These bivalve mollusks, when silver-exposed, tend to accumulate more copper than when they are copper-exposed. There were enough scallops taken to provide us additionally with a kidney pool of sufficient size to allow the development of optimal protocols for several enzymes that we hope will prove to be useful indicators of metabolic stress in this tissue.

Anaerobic Bacteriology/Metabolism

Monthly activities included participation in the recent OPP survey on Kelez Cruise No. KE 11-80. Bottom and top waters were analyzed for our target group of bacteria. Sediments were obtained from 17 stations for lab evaluation.

Most of the month's activities were directed towards report preparation. These included: an annual summary of OPP activities, New York Bight annual sampling (bacteriological aspects), final report on the outgrowth of Clostridium botulinum on heated American oysters (a cooperative study with the NMFS Charleston Laboratory), and an abstract on bacteriological studies for presentation at the American Society of Microbiology's annual meeting.

Behavior of Marine Fishes and Invertebrates Investigation

As part of our activities we are analyzing data from a series of studies designed to estimate prey consumption rates in bluefish as well as identify factors affecting those rates. These studies were conducted on two different schools of fish, one with a mean weight per fish of 5.3 kg and the other 1.4 kg. Results to date have provided estimates of daily consumption rates for periods up to 343 days for the two groups, both in terms of actual number of grams of prey consumed as well as kilocalories of prey per kilogram of bluefish. Although the data are still being analyzed, it appears that both season and intervals between meals influence these rates. The final results of these studies should provide a conservative prediction of the impact of this predator on prey populations.

Meetings and Training

Meetings

Jay O'Reilly attended an IYABA meeting at the Oxford Laboratory on 25 November.

Bori Olla participated as a member of the EPA review team evaluating the "Investigation of Level and Effects of Pollutants in Saline Lakes and Littoral Marine Environments Project" of the Academy of Scientific Research and Technology and the Institute of Oceanography and Fisheries in Cairo, Egypt. During 2 wk in November, he toured and met with the staffs of the Mediterranean, El Ghardaga Aswan, and Lake Quaroun Laboratories.

Training

From 17 to 19 November, Janice Ward and Frank Steimle attended a course on the use of the System 1022 data management system.

Publications

Johnson, R. W.; Bahn, G. S.; Thomas, J. P. Synoptic thermal and oceanographic parameter distributions in the New York Bight apex, on June 23, 1977. Photogram. Eng. Remote Sens. (A)

Pearson, W. H.; Sugarman, P. C.; Woodruff, D. L.; Blaylock, J. W.; Olla, B. L. Petroleum hydrocarbon detection by the Dungeness crab, Cancer magister. Fish. Bull. (US) 78(3);1980. (A)

AQUACULTURE DIVISION

Aspects of Nutritional Requirements of Mollusks Investigation

Preparations are in progress to bring about certain changes in the species of algae that are grown in the semicontinuous culture system. Recent experiments on food utilization of the juvenile American oyster clearly demonstrated that the alga Chlorella autotrophica is not a useful food organism even if feeding is conducted for 3 mo. Therefore, this latter species has been phased out of the culture system and replaced by other species. Phaeodactylum tricornutum was shown to be a mediocre food source for juvenile oysters. Consequently, the number of carboys containing P. tricornutum cultures is being drastically reduced. Recently, culture carboys have developed problems of unusual levels of bacterization. A massive effort is underway to locate the source of this problem and to rebuild carboys and inoculate them with axenic cultures.

Stock cultures and special strains were all subcultured on schedule. Cultures were provided for a student, Mr. W. Walsh, at the University of Connecticut Graduate School.

Experimental feeding studies to effect size increases in juvenile oysters are being continued with additional types of data now being collected. The rate of uptake of algal cells in the different groups of oysters is being determined. Whereas it has always been assumed that high concentrations of animals yield a slower rate of growth than lower concentrations because of competition for a limited food supply, our data show this assumption to be incorrect. These experiments demonstrate that oysters kept in the lowest concentration have the most efficient utilization of the available food cells, while oysters in the highest concentration are the least efficient.

A temporary appointment of a laboratory assistant, Mr. Michael Cram, was made to assist in the algal food production work.

Spawning and Rearing of Mollusks Investigation

Measurements of hatchery-reared bay scallops that are now growing in five locations along the Connecticut coastline show a slight growth advantage in the more eastward sites. In the rapid growth phase that occurs in this species in September and October, scallops grew at a rate of 0.38 mm/day at three sites east of Niantic, and at a rate of 0.32 mm/day at two sites west of Milford.

Most of the bay scallop overwintering experiment has been deployed. The poor survival of scallops last year has prompted us to pursue this aspect more intensely than before. We are examining the timing of our winter seeding, the importance of substrate type, and the effects of density and depth.

A modest cooperative effort to determine the applicability of our bay scallop culture methods for South Carolina waters has been started with the

South Carolina Department of Marine Resources. We have deployed four lantern nets--containing scallop seed we produced--at an artificial reef site about 8 mi east of Charleston. A similarly deployed control population is being grown in Long Island Sound.

Some lab experiments on the rate that starfish consume scallops of various sizes and at different temperatures have been started. Newly settled starfish appear in our grow-out systems in midsummer and feed on attached fouling organisms until they grow to a size when they can attack the scallops. These experiments will show us when this predation becomes important.

Surf clams grown in the tank farm this past summer have been recovered and survival was found to be unrelated to density. Average survival was about 82%. The growth of clams, however, was found to be density dependent. The clams were maintained in 10-m x 1-m tanks receiving seawater at 50 l/min. Growth of clams at 250/m² was significantly lower than clams at 100/m². The data will be analyzed to determine the optimal yields with respect to space and pumping costs.

Surf clams maintained in cages at a depth of 10 m in Long Island Sound have shown a substantial growth increment during October. Similar groups of clams in the tank farm system did not increase in length during this period. Fluorescence level of seawater remained low in October and apparently was a limiting factor.

Aquacultural Genetics Investigation

Cytological-Cytogenetic Measures of Contaminant Effects on Fish

On the most recent OPP survey, Kelez Cruise No. KE 80-11, during 28 October-6 November, and on a Mini-Pulse cruise of the Milford Laboratory's Shang Wheeler to Long Island Sound in October, samples of circulating blood were collected from approximately 550 fish. Species were the windowpane, winter flounder, fourspot flounder, summer flounder, yellowtail flounder, haddock, silver hake, weakfish, striped mullet, butterfish, and scup. Samples were taken at more than 15 sites along the coast, from Chesapeake Bay to the tip of Long Island and in Long Island Sound. Head kidney tissue in addition was sampled from about 200 fish for study of hematopoiesis. The object of the overall study is the application of the micronucleus test for chromosome mutation to circulating blood and hematopoietic tissue of resource species as monitored in the field.

Appropriate methodology is still being developed for convenient scoring of the erythroblasts and immature erythrocytes. Smears of the circulating blood of all fish sampled on this most recent cruise, however, have already been spot-checked for cases of extraordinarily high incidences of micronuclei (which were detected in about 5% of the 127 Atlantic cod sampled and in about 14% of 22 red hake sampled). No such additional cases were found, although the number of fish and sites sampled could be considered initially adequate only for about three of the several species.

Larger numbers of windowpane have been sampled for blood than of any other single fish species, 222 from cruises in July, October, and November 1980. These were collected at 13 different sites. Roughly one-half of the fish came from three sites in Long Island Sound sampled monthly on the Mini-Pulse cruises of

the Shang Wheeler. Two of the windowpane from the presumed cleaner area of Long Island Sound showed elevated incidences of micronuclei over the other specimens, all of which were spot-checked even though percent-micronucleated cells was not remarkably high as for some Atlantic cod and red hake. The windowpane may be showing slightly elevated levels of micronuclei in larger numbers of fish than seems the case for other species examined. This point can be elucidated only on the actual scoring of large numbers of erythrocytes currently underway, and with statistical comparisons of fish sampled in different areas.

Windowpane blood collected on the October and November cruise of the Kelez in coastal waters showed an enhanced fragility of the erythrocytes, and a distinct spindling of the cells in about one-fifth of all fish sampled. This latter phenomenon was not observed in samples of windowpane taken in Long Island Sound in the same time period, using presumed identical methodology. It was observed to a lesser degree in other windowpane sampled in the same area on the same cruise, but not to any significant degree on other cruises or with other species. Whether this might be attributable to an abnormal condition of the fish blood or to some unknown variation in the preparation of the blood smear is undetermined.

An incidental finding was the detection of an intra-erythrocyte protozoan in fourspot flounder collected at one sample site.

Experimental lab studies aimed at measuring the efficiency of the micronucleus test on fish are continuing. It is hoped that additional samples of Atlantic cod and red hake can be taken along with kidney tissue. Calculations of "background" mutation incidences are to be made for Atlantic cod, red hake, windowpane, and Fundulus sp. (the latter being the experimental fish now in use).

Selection Experiments on the American Oyster

During the past month, activities were concentrated on preparations for winter storage of the oyster stocks. The annual census of the experimental oyster population in the selection program has begun. The number of oysters in the 1976 year class, the oldest of our experimental stocks, decreased from 3698 oysters to 2512 oysters, a 32% loss. This represents an improvement over last year's loss when 41% of this year class died. Since December 1976, 88% of this year class has died. The 1977 year class decreased from 6207 oysters to 2660 oysters, a 57% loss. This year's loss is a slight increase over last year's loss of 54%. Ninety-one percent of this year class has died since December 1977.

Experimental Inbreeding and Hybridization of Oysters

With limited space available for overwintering, stocks are being consolidated. Oysters from all year classes appear to have added new growth. The groups are being divided among underwater and suspension docks, and indoor and outdoor tanks for the winter. Repairs were made and trays rewired for underwater dock use.

Spat from the last group of cultures comprised of Crassostrea gigas, and crosses of a Texas female x Texas male and a Connecticut female x Connecticut male of C. virginica, were placed in a small recirculating unit. The seawater is

changed and food added to the system several times a week. Other juvenile oysters from these same crosses are being maintained for the present in static seawater. Shell color and shape appear to differ for some of these groups of recently metamorphosed spat.

Computer analyses continue on the Milford Laboratory's terminal. Results of preliminary calculations on the hybrid crosses were confirmed. There may be a difference in survival and growth between reciprocal hybrid crosses of Texas and Connecticut oysters, depending on which is the female in the cross.

Meetings and Visitors

Visitors to the Milford Laboratory included Duncan Brown of the Shellfish Research Laboratory in Carna, Galway, Ireland; John Karlson and Doug Lapin of the Rhode Island Division of Fish and Wildlife; and Tom Nunn of WHOI.

Ron Goldberg met with Donna Busch of the Narragansett Laboratory and Ambrose Jearld and Maurice Crawford of the Woods Hole Laboratory to discuss research projects of mutual interest.

PATHOBIOLOGY DIVISION

Comparative Invertebrate Pathology Investigation

As previously reported, sea scallops from Maine were found with multiple abscesses. During this reporting period, it was determined that these lesions were caused by a yet unidentified gram-negative bacterium. Lesions from the scallop have now been examined by transmission electron microscopy (TEM). The TEM studies confirmed the bacterial nature of the infecting organisms which measure $0.5 \mu\text{m} \times 1.5 \mu\text{m}$. Bacteria in the center of the lesions appeared swollen and exhibited bipolar staining. Phagocytosis by host cells appeared to be ineffective in controlling the growth of the bacteria. Most host cells in the lesion were undergoing lysis and bacterial cell division was observed. Also of considerable interest was the presence of a bacteriophage. The virus particles measure 45 nm, and may aid in the identification of the bacterial pathogen.

During the reporting period, Mr. Farley made written and visual preparations for attendance at the 11th International Symposium of the Princess Takamatsu Cancer Research Fund in Tokyo, Japan. While there, he participated in a special symposium, "Phyletic Approaches to Cancer." A paper titled "Phylogenetic Relationships Between Viruses, Marine Invertebrates and Neoplasia" was presented by Mr. Farley who also chaired the session on viral aspects.

The Histology Unit prepared over 650 sections of various fish and shellfish tissues for study by resident pathologists.

Microbial Ecology and Parasitology Investigation

Statistical analyses of data from a 2-yr study on the relationship between sewage bacteria and pathogenic amoebae have been completed by LCDR Carl Berman. The first data set derived from a sediment survey in Narragansett Bay, Rhode Island, showed that there was a significant correlation between high total coliform

and fecal coliform bacterial numbers and the frequency with which amoebae appeared in cultures of sediment. In the Rhode Island survey, six culture dishes were prepared from sediments of 31 stations located from 0.5 mi off Providence to seaward for 56 mi. All stations which yielded three-to-six positive cultures per set had a minimum of 46 fecal coliforms and 140 fecal streps per 100 grams of sediment. Bacteriological studies by CPT Newt Adams and CDR Jack Gaines of the US Food and Drug Administration (FDA) in Davisville, Rhode Island, provided excellent data which were essential for testing the statistical validity of the bacteria-amoebae relationship. A manuscript for submission to the Marine Pollution Bulletin describing this work is now in preparation.

Results of similar studies in the Philadelphia-Camden sewage disposal site have been analyzed and summarized in a draft manuscript which has been circulated to collaborating coauthors from FDA and EPA laboratories. The draft report includes observations made on cultures prepared from 459 sediment samples taken at and distant from the sewage site. Fifty-three percent of the stations positive for fecal coliforms yielded amoebae and 75% of the stations positive for fecal streps also yielded the amoebae. Results of the surveys provided information which exceeded our original expectations and which clearly demonstrates that the cyst-forming protozoans may serve as persistent biological indicators of high bacterial populations in coastal and offshore marine sediments.

The first phase of our cooperative study with Dick Greig of the Milford Laboratory on metal levels and gill condition in eastern rock crabs has been completed. Gills from 98 animals have been analyzed for copper, lead, cadmium, and silver, and gills from a second group of 98 have been analyzed only for copper and cadmium. Digestive glands (hepatopancreas) from 50 of the animals also have been analyzed; 34 for the four metals, and 16 for just copper and cadmium. Gills from all crabs have been examined for the presence of melanized cellular nodules, hemolymph coagulation, gill swelling, and gill necrosis. Such pathological conditions have been experimentally induced in shrimp and lobsters after exposure to various heavy metals or chemical irritants. An index has been developed to categorize rock crabs according to their health as indicated by gross and microscopic estimates. Comparative analyses are now in progress to determine whether or not there is a correlation between pathological manifestations and heavy metal burdens. Preliminary data have shown that the lowest levels of copper occur in newly molted specimens. The low levels are a logical consequence of dilution subsequent to an increase in body mass and larger blood volume following ecdysis. Our initial data cut has shown that the highest value for copper in the hepatopancreas was four times higher than the highest value detected in the gills. In the event that our histological evaluation on gills does not correlate well with metal values, it will be necessary to conduct new studies on organs which have less tissue mass than do the gills. Two manuscripts are being prepared to document the results of our studies.

Fish Pathology Investigation

Considerable time has been spent planning a multidivisional study of red hake from the New York Bight with integumental ulcers. In 1978, John Ziskowski noted the presence of these lesions in red hake from western Raritan Bay and the sewage sludge dumpsite in the Bight apex. Attempts to establish the etiology of

the lesions were made at that time, but yielded inconclusive results. In 1979, the prevalence of ulcerated fish was low and no attempts were made to resume etiologic studies.

Since several of the NEFC's research divisions contain individuals who could meaningfully contribute to an investigation of this resource problem, it was apparent that a task force study might provide meaningful information in a relatively short period of time. Since the hake are presently migrating to the Bight and will remain in it only until April, it is necessary to organize the research team and initiate the research planned as quickly as possible. Several memorandums have been prepared which outline the intended studies and an organizational meeting was held for participants on 2 December at the Milford Laboratory. Presently, the task force consists of individuals from the Environmental Assessment, Pathobiology, and Resource Assessment Divisions. As soon as the fish are abundant in the Bight (as determined by trawl surveys), the collection of fish with lesions for lab study will begin.

The FWS's National Fish Health Laboratory has made its virology lab available to our Fish Pathology Investigation for cell culture and virus isolation studies utilizing clupeid fishes. Mr. Newman has mastered the necessary techniques and studies are currently underway utilizing clupeid fishes (Atlantic menhaden, alewives, blueback herring, hickory shad, and American shad) from the Chesapeake Bay and from the Merrimack River, Massachusetts. Filtrates from individual fishes are being examined for cytopathologic effects utilizing menhaden kidney and chinook salmon embryo cell lines.

A mass mortality of American eels is occurring at the Cape Cod National Seashore. Moribund eels have been obtained from the mortality area and are being examined for histopathology at the Oxford Laboratory.

As part of an OPP study, light and electron microscopic studies of the morphology of the olfactory organs of the striped killifish have been initiated. With the scanning electron microscope, it has been possible to resolve the areas containing receptor cells versus areas of indifferent or nonsensory cells. The receptor cells are confined to islandlike regions having diameters of 10-30 μm and bear numerous ciliated and/or microvillous processes. The indifferent epithelium was unciliated and the cell surfaces were covered with microridges (as has been observed for the epidermis of numerous teleosts). In cooperation with Dr. R. Steere of the USDA in Beltsville, Maryland, the cellular junctions and intramembranous particle distribution of the receptor-cell processes are being studied with freeze etching. Experiments using copper as a heavy metal toxicant will be initiated when the studies on normal tissue are more complete.

Diseases of Larval Mollusks Investigation

In our toxic-effect studies, the optimal incubation period has been determined for maximum toxin production by a pathogenic Vibrio sp. and will be used for all subsequent studies using the toxin. A study is now being conducted to determine a treatment which will alter the toxin without adversely affecting bivalve embryonic development. Proteolytic activity of the crude filtrate has been decreased using several treatments; however, filtrate electrophoresis showed that in each case the band containing the toxin persisted even after the treatments. The one exception has been a heat treatment which denatured all the proteins.

While some ozone detoxification occurred near the end of a test with paralytic shellfish poison-contaminated surf clams, mouse bioassays indicated that results are not significant. A repeat of this test is warranted, using ozone doses below 0.10 mg/l.

The November sampling cruise to four Long Island Sound shellfish beds provided 24 bacterial isolates which were subjected to biochemical testing. Since oyster larvae are not available in the winter months, challenge experiments to determine pathogenicity prevalence are deferred until March 1981. However, 71 bacterial isolates from previous cruises were biochemically evaluated in the interim, eliminating our backlog of isolates.

Because microscopic counting of large numbers of oyster hemocytes on cell culture dishes has proved to be tedious and time consuming, alternative cell counting methods are being sought. One method, using the Millipore π MC particle counter on fixed stained cells attached to gridded Petri plates, proved to be inaccurate. A second method is now being evaluated. This consists of chemically dissolving cells and measuring their protein content with a rapid, protein-dye-binding technique. Hopefully, a full range of cell counts can be correlated linearly with total protein content.

In previous work, two miniaturized multiple-test systems were found unreliable in identifying pathogenic bacteria of marine origin. One of these, the Minithek system, is being reevaluated after modifying the bacterial suspension broth. Bacteria isolated from oyster beds in Long Island Sound are currently being identified by their conventional biochemical reactions, and simultaneously tested in the Minithek system using modified broth. This testing will continue for several months.

University Relations

Dr. Murchelano attended a meeting held at the Oxford Laboratory on 5 November with University of Maryland scientists to discuss remote sensing in Chesapeake Bay and formation of an NEFC (Oxford Laboratory) cooperative institute with the University of Maryland.

Drs. Rosenfield and Murchelano attended a planning meeting at the Center for Environmental and Estuarine Studies in Horn Point, Maryland, on 25 November to further implement the NEFC/University of Maryland institute.

Dr. Blogoslowski met with and provided reprints to Mr. Trevor O'Neil of Yale University's School of Forestry. Mr. O'Neil is studying the effects of sewage chlorination on marine life in New Haven Harbor.

Dr. Blogoslowski conferred with students and with Colin Campbell and John Condon of Fairfield University on a field project studying degradation of fuel oil in Johnson's Creek in Bridgeport, Connecticut. The students have isolated an apparent marine hydrocarbonoclastic microorganism and sought techniques for identification. Dr. Blogoslowski will supervise their research.

Meetings, Talks, and Visitors

Meetings and Talks

Dr. Rosenfield met with the Peoples Republic of China (PRC) Aquaculture Delegation in Seattle, Washington, on 19 and 20 November to discuss work-study plans for future US/PRC aquaculture projects.

Dr. Sawyer attended scientific sessions of the Atlantic Estuarine Research Society meeting during 5-8 November at Virginia Beach, Virginia; Dr. Sawyer also attended the cooperative education workshop at the Woods Hole Laboratory on 17 and 18 November.

Mr. Kern attended a Center Incentive Awards Committee meeting at the Woods Hole Laboratory on 6 and 7 November.

Mr. Farley attended the 11th Annual International Symposium of the Princess Takamatsu Cancer Research Fund in Tokyo, Japan, during 11-13 November, and presented a paper on "Phylogenetic Relationships Between Viruses, Marine Invertebrates and Neoplasia."

Dr. Blogoslawski, Milford Laboratory, attended a planning meeting of the FDA-State of Connecticut training course on shellfish depuration in Danielson, Connecticut, on 7 November; he also attended the International Ozone Association Board of Directors meeting on 14 November in New York City.

Dr. Brown and Ms. Hundley, Milford Laboratory, attended the cooperative education workshop on 17 and 18 November at the Woods Hole Laboratory; Ms. Hundley participated in the Co-op Student Panel Discussion. Dr. Brown also attended the IYABA meeting at the Oxford Laboratory on 25 November.

Dr. Murchelano discussed strategic planning and marine recreational fisheries initiatives with Dr. Ridgway at the Sandy Hook Laboratory on 19 November.

Ms. Sherry Lonergan, a temporary biological laboratory technician, entered on duty at the Milford Laboratory on 17 November.

Drs. Blogoslawski, Robohm, and Brown, Milford Laboratory, presented a seminar to the four PRC visitors at the Milford Laboratory.

Dr. Richard Smucker of the University of Maryland's Chesapeake Biological Laboratory presented a seminar on "Biology of Chitin(s) Ecology" at the Oxford Laboratory on 19 November.

The Oxford Laboratory hosted the IYABA Committee meeting on 25 November.

Visitors

Visitors to the Oxford Laboratory during November included Dr. Steve Sulkin and Mr. Tim Cole of the University of Maryland's Center for Environmental and Estuarine Studies in Cambridge, Maryland; Dr. Richard Smucker of the Chesapeake Biological Laboratory in Solomons, Maryland; Dr. Carolyn Brown of the Milford Laboratory; Dr. Robert Edwards and Ms. Helen Mustafa of the Center Directorate; Mr. Ralph Mayo of the Woods Hole Laboratory; Dr. Carl Sindermann and Mr. Jay O'Reilly of the Sandy Hook Laboratory ; Drs. Eugene Small, Rita Colwell, Robert Ragan, Joseph Kavanagh, and Angel Bailey of the University of Maryland in College Park, Maryland; Dr. Vic Klemas of the University of Delaware in Lewes, Delaware; Mr. Eli Reiharz of the Maryland Geological Survey in Baltimore, Maryland; Ms. A. Natalie of Fairfax, Virginia; and Ms. Marjorie McLaughlin of Easton, Maryland.

Publications

Beardmore, J. A.; Barker, C. J.; Battaglia, B.; Berry, R. J.; Longwell, A. C.; Payne, J. F.; Rosenfield, A. The use of genetical approaches to monitoring biological effects of pollution. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 179:299-305;1980. (P)

Farley, C. A. Phylogenetic relationships between viruses, marine invertebrates and neoplasia. Proc. Int. Symp. Princess Takamatsu Cancer Res. Fund 11:22-23;1980. (Abstract.) (P)

Murchelano, R. A.; Rosenfield, A.; Swann, B. J. A National Registry of Marine Pathology. Proc. 11th Annu. Conf. Int. Assoc. Aquat. Anim. Med.; 1980:22. (Abstract.) (P)

NATIONAL SYSTEMATICS LABORATORY

Penaeoid Shrimp Investigation

Research continued on the systematics of the rock shrimps (Sicyonia) and on Indo-West Pacific members of the family Solenoceridae.

Crustacea Investigation

Good progress is being made on readying for publication Austin Williams' handbook on shrimps, lobsters, and crabs of the temperate eastern US, which the Smithsonian Press has agreed to publish. Text for 23 families is now on magnetic discettes; text for 23 families remains to be set, plus the introduction and bibliography.

Benthic Fishes Investigation

Family sheets and species identification sheets for the families Gadidae from the tropical eastern Atlantic and Bregmacerotidae and Moridae from the western Indian Ocean were completed for FAO. D. M. Cohen participated in submersible dives of the Johnson Sea-Link off Ft. Pierce, Florida, on an Oculina reef at 250 ft.

Meetings

Austin Williams attended an Atlantic Estuarine Research Society meeting and a meeting of the Estuarine Research Foundation Governing Board, both in Virginia Beach, during 5-7 November.

Visitors

Dr. Giambruno Grippa of the Museo Civico di Storia Naturale in Milan, Italy, visited Dr. Canet, and Dr. Peter Gaemers of the University of Leiden, an expert on fossil otoliths who is studying gadid otoliths, spent 2 wk working here.

Publications

Cohen, D. M. Family Gadidae. FAO Species Identification Sheets for Fishery Purposes in the Eastern Central Atlantic. (S)

Cohen, D. M. Families Bregmacerotidae and Moridae. FAO Species Identification Sheets for Fishery Purposes in the Western Indian Ocean. (S)

Pérez Farfante, I. A new species of rock shrimp of the genus Sicyonia (Penaeoidea), with a key to the western Atlantic species. Proc. Biol. Soc. Wash. 93(3):771-780. (P)

ATLANTIC ENVIRONMENTAL GROUP

Ocean Monitoring and Climatology Task

While the Northeast Region Fishery Information System is being developed, AEG has continued to work with the MARMAP Information System (MIS) as an interim means of meeting many of its data processing needs. Jack Jossi, who coordinates this effort, reports on the status of programming and data base activities in the MIS in the following write-up:

First, the MAP program has been rewritten and will now produce numerical or symbol displays of:

1. Normalized abundances of:
 - a. ichthyoplankton larvae orders, families, genera, or species;
 - b. zooplankton taxa;
 - c. tar balls;
 - d. plastics by type;
 - e. dry-weight biomass;
 - f. ash-free dry weight;
 - g. total carbon biomass; and
 - h. zooplankton displacement volume;
2. Any scalar value stored in an MIS master file;
3. Vessel track; and
4. Buoy track.

Second, a 3-yr computerized time series of bottom temperature data at standard depths along the Ambrose Light-to-Deepwater Dumpsite (DWD) 106 transect has been added to the MIS. A similar 5-yr series has been prepared for the 71°W-longitude transect. Programming to calculate interpolated 10-day values, long-term 10-day means, anomalies, and standard deviations has been completed. A 6-yr time series of surface water mass for the "NMFS/US Coast Guard Cooperative Neuston Program" (NEUST) stations has been compiled and added to the MIS.

Third, programming has been completed to reformat digital cassette data from the undulating oceanographic recorder (UOR) for use in MIR. Interface circuitry is being constructed to allow the UOR microprocessor-based translator to "talk" to the ITEL computer at URI. Programming on the translator has also been completed to convert analog cassette, temperature, depth, and time data from the Hardy continuous plankton recorder (CPR) to digital, MIS-compatible form.

Fourth, standardization of data logging for all aspects (XBT, CPR, UOR, NEUST) is complete.

Fifth, all data for MARMAP operational test phase cruises I and II now reside in the MIS ready for atlas preparation.

Sixth, we have reached the halfway point in our efforts to compile an in-house data base on all ship-of-opportunity XBT data (1971-present). Processing of XBT data currently being collected will take advantage of a tabletop digitizer recently acquired by the Ocean Dumping Task. Also, we have modified one of our XBT units for digital cassette recording and have reached the final stages in programming to add these data to the MIS.

Seventh, the National Ocean Survey's TIDE data set has been updated to include 1976 and 1977 recordings.

Eighth and finally, the Nantucket Weather Station data set has been analyzed and new data for its update have been requested from the Environmental Data and Information Service's National Climatic Center. Similar data for the Offshore Texas Tower No. 2 have also been requested.

In other work, the following announcement of eddy conditions in the Georges Bank - Middle Atlantic Bight area was sent to the Commander of the Atlantic Area for the US Coast Guard, for publication in the December issue of Atlantic Notice to Fishermen:

AEG/November 13, 1980

GULF STREAM EDDY LOCATIONS

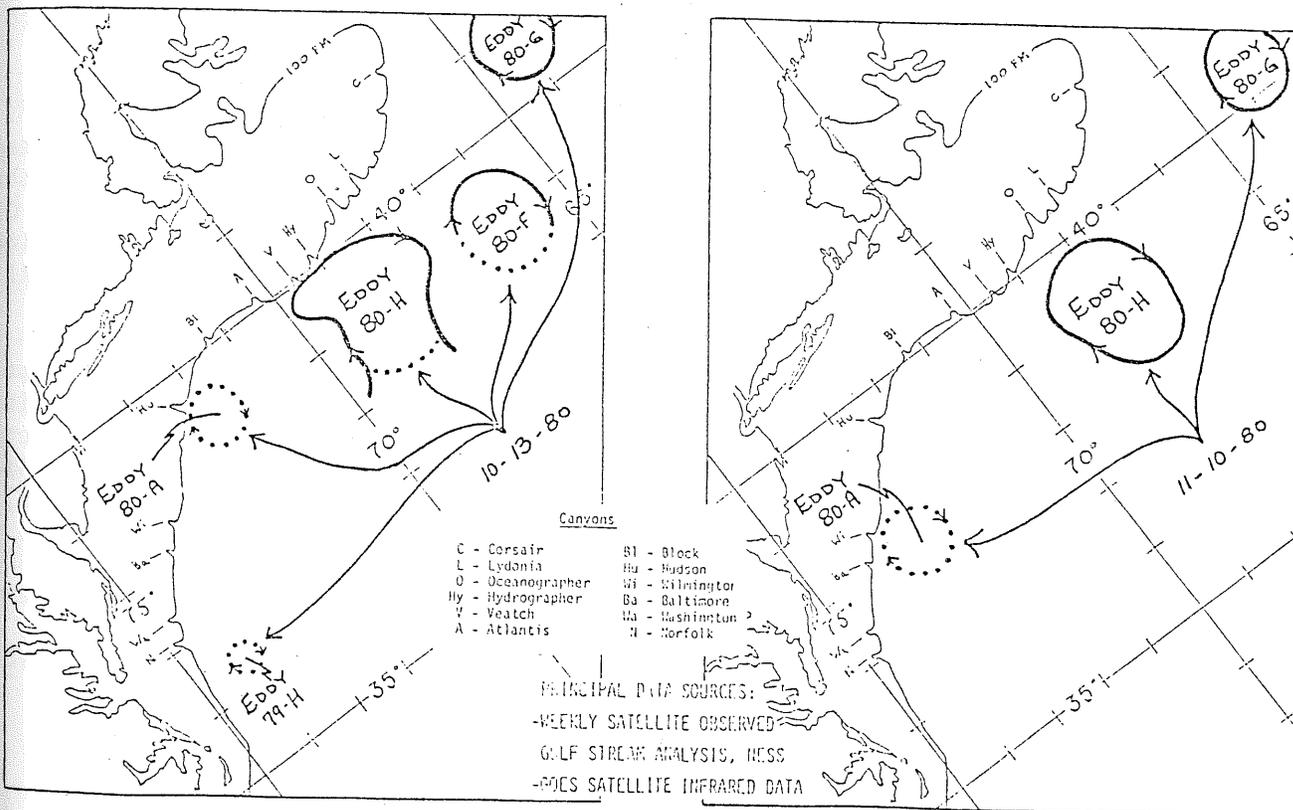
The Atlantic Environmental Group of the National Marine Fisheries Service reports that three warm core Gulf Stream eddies were present off the northeast coast of the United States in mid-November.

Eddy 79-H was resorbed by the Gulf Stream about 23 October at 36.5°N, 73.0°W. Eddy 80-A disappeared from the satellite imagery and has been tracked using only entrainment features for the past 60 days. The eddy was positioned incorrectly

in the mid-October analysis, but correct charts for mid-October and mid-November appear below. Eddy 80-A traveled southwest about 150 km (80 nm) to a position centered near 38.0°N, 73.2°W, east of Baltimore Canyon. Eddy 80-H detached from the Gulf Stream, but continues to entrain Gulf Stream water. The eddy moved east for 70 km (37 nm) to a center position of 39.0°N, 68.0°W. Eddy 80-F was completely resorbed by the Gulf Stream in early November at 39.5°N, 66.5°W. Eddy 79-G was overrun by a large Gulf Stream meander in early November and emerged in mid-November at 40.4°N, 63.8°W. The eddy moved 60 km (32 nm) to the southeast of its mid-October position.

During the next 30 days Eddy 80-A may move south to a center location southeast of Norfolk Canyon; Eddy 80-H may remain large and move west to a position south of Veatch Canyon; Eddy 80-G may move west to a center position east of Lydonia 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).



The activities of AEG utilizing satellite infrared imagery and derived products were featured in a recent article in Science News (Vol. 118, p. 330-332, 22 November 1980) titled "Ring Around the Gulf Stream." The article mentions the eddy-tracking efforts of Woody Chamberlin, Jayne Fitzgerald, and Lee Crist and relates their description of eddy 79-H, which was unusually large and long-lived.

Arrangements were made through John Kundrat of the National Weather Service's National Meteorological Center's (NMC) Ocean Services Group for AEG to receive by mail the following products for the western North Atlantic: (1) weekly computer listings of bathy message data from reporting ships, (2) 5-day computer plots (maps) of surface salinity and temperature (SST) values from bathy messages, and (3) 5-day computer plots of SST values from the Cooperative Ship of Opportunity Program.

AEG had ceased to receive item (1) last March while procedures were being re-worked at NMC. It has been suggested to Kundrat that it would be useful for the plots and listing to be brought into time phase with one another, as well as with the oceanographic analysis chart production schedule.

The cooperative Ship of Opportunity Program obtained six XBT transects and two CPR transects in November: two XBT and one CPR transect in the Gulf of Maine, one XBT transect off Southern New England, two XBT and one CPR transect across the shelf and slope off New York, and one XBT transect across the Gulf of Mexico.

Ocean Dumping Task

A report of circulation and water mass studies at DWD 106 was submitted for inclusion in the NEMP annual report. In this report are the results from the first two full-scale radio-direction-finding (RDF) buoy experiments at DWD 106. Data from the third RDF experiment (May 1980) are presently being processed. Wind data from the May 1980 experiment will be processed and portrayed by the URI data projects group.

Satellite-tracked buoys 3020 and 3021, although maintaining communication with Service ARGOS, are continuing to show that the loss of both drogue units has occurred. Data from buoys 3020, 3021, and 3022, upon arrival at Narragansett, Rhode Island, are archived for later processing. Data from buoy 3022 in addition are copied and sent to Mr. Gary Williams (Clearwater Consultants) in Boston, Massachusetts.

Dr. Philip Richardson (WHOI) has expressed interest in providing data processing services for the Ocean Dumping Program's satellite-tracked buoys in return for inclusion of those data into WHOI's data base. A meeting to discuss these matters is scheduled for 3 December.

Meetings

On 6 November, Steve Cook attended a Center Incentive Awards Committee meeting in Woods Hole.

Mert Ingham spent the week starting 17 November at the Sandy Hook Laboratory working with NMFS scientists on the first NEMP annual report.

Reed Armstrong attended an IYABA meeting which was held at the Oxford Laboratory on 25 November.

Mert Ingham, Woody Chamberlin, and Janet Hess attended a meeting of the steering committee of the Northeast Area Remote Sensing System in Boston, Massachusetts, on 25 November.

On 29 November, Grayson Wood departed for Plymouth, England, where he will accept the first production model undulating oceanographic recorder to be used in AEG's Ship of Opportunity Program.

Publications

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

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

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

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

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

Reports

Bisagni, J. J.; Kester, D. R. Physical variability at an East Coast United States offshore dumpsite. Proc. First Int. Ocean Dump. Symp.; 1978 October.

Armstrong, R. S. Hydrodynamics of the Buccaneer Gas and Oil Field. Jackson, W. B. ed. Environmental assessment of an active oil field in the northwestern Gulf of Mexico. NOAA Final Report to EPA: Proj. No. EPA-IAG-D5-E693-E0; 1980. 41 p.