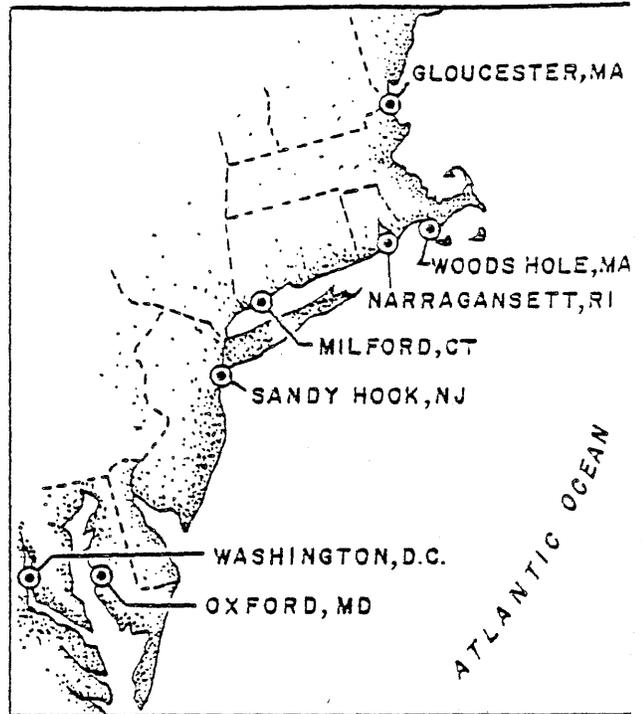


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APRIL 1978

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Editor, Jon A. Gibson



RESOURCE ASSESSMENT DIVISION

Resource Surveys Investigation

The second leg of the spring bottom trawl survey was conducted during 3-14 April aboard the R/V Albatross IV (Linda Despres, Chief Scientist) in the southern New England and southern edge of Georges Bank areas. The third leg of the survey aboard R/V Albatross IV (Linda Despres, Chief Scientist) started on 17 April and is expected to end in early May. The intended survey area for the third leg is the unfinished portion of Georges Bank and possibly part of the Scotian shelf, as time allows.

Jim Crossen participated in a 1-wk hydroacoustic cruise aboard the USSR R/V Argus. The purpose of the cruise was to conduct an experiment to determine the scattering characteristics of Atlantic mackerel concentrations.

Work on the BLM contract continues as before. We have completed the auditing and correction of all the special, monthly, and inshore cruise tapes brought from the Sandy Hook Laboratory. Some work is continuing with the tapes to check and eliminate minor errors and possible inconsistencies.

Tom Azarovitz met with BLM representatives Dean Parsons and Art Horowitz in New York to discuss priority species and other aspects of the work agreement. The following species from our trawl data were considered to be of highest priority: summer flounder, scup, weakfish, Atlantic croaker, red crab, Atlantic mackerel, black sea bass, tilefish, Loligo squid, American lobster, silver hake, red hake, bluefish, Illex squid, and sea scallop.

Age and Growth Investigation

Judy Penttila and Vi Gifford annotated the scale features of the haddock scale included in the proposal for developing the auto-age reader. Age samples completed included: yellowtail flounder (first quarter, 1977); Atlantic cod (Albatross IV Cruise No. AL 77-07); pollock (Albatross IV Cruise No. AL 77-12); redfish (Albatross IV Cruises No. AL 77-07 and No. AL 77-12); Atlantic herring (Anton Dohrn Cruise No. 78-01, Argus Cruise No. 78-03, and Albatross IV Cruise No. AL 78-04, Parts I and II); haddock (fourth quarter, 1977); and sea scallops (five commercial samples and Albatross IV Cruise No. AL 78-04, Parts I and II).

Kris Kantola described the structure and methods used in aging fishes to "Falmouth-out-of-school" students, and also assisted them in removing otoliths and scales, and in aging them.

Sandy Hook Investigation

Wallace Morse participated on the spring bottom trawl survey aboard the R/V Albatross IV from 2 April to 3 May.

At the request of the Mid-Atlantic Fishery Management Council, our personnel submitted a proposal to determine the spring recreational catch of Atlantic mackerel within the region. The proposal was accepted in mid-April and sampling was initiated immediately with in-house personnel. Recruiting and hiring of four port samplers (Robert Matus, William Rogers, Russell Terranova, and Paul Yuschak) were completed by the end of the month. Sampling was conducted from Delaware through New Jersey where the bulk of the mackerel were concentrated in late April.

Plans to shift sampling effort to New York were made. Personnel from the States of Delaware and New Jersey also conducted sampling in a cooperative effort to provide maximum data during the relatively brief spring mackerel season. New York State personnel were expected to participate starting in May. Tentative analysis of the early data indicates a larger catch than last year and general availability of mackerel closer to inlet areas.

Stuart Wilk attended an oversight hearing on bluefish before the Committee on Merchant Marine and Fisheries, House of Representatives, Washington, DC, on 24 April. Mr. Wilk and others of the investigation helped prepare background information for the statement presented at the hearing by Mr. William G. Gordon, Director, Northeast Region, NMFS.

Fishery Analysis Investigation (Report for March and April)

Paul Wood and Harold Foster have been working diligently on sea scallops and Atlantic cod, respectively. Paul has been working with the port samplers and processors.

Steve Murawski attended public hearings on surf clams in Philadelphia, PA; Ocean City, MD; Red Bank, NJ; and Atlantic City, NJ. He also attended a Mid-Atlantic Fishery Management Council meeting on 8-9 March, presented a series of talks to the Massachusetts Marine Educators Association, worked on a dynamic pool model of surf clams, attended a meeting discussing and assessing surf clams and quahogs, attended the Southeast Massachusetts Biological and Fisheries Series No. 6. S. Chang and P. Frank also attended the latter meeting.

Fred Serchuk: attended a Tri-State/Federal Blue Crab - Red Crab Scientific Committee Meeting on 7 March in College Park, MD, to review assessment and status of red crab populations in Northwest Atlantic waters; attended a public hearing on surf clam regulations in Philadelphia on 7 March; attended the March Mid-Atlantic Fishery Management Council meeting on 8 March in Philadelphia; attended the March New England Fishery Management Council meeting on 9 March in Peabody, MA, to provide scientific advice on groundfish plans; presented a series of four, 30-min talks to the Massachusetts Marine Educators Association on population dynamics - population estimation on 19 March in Woods Hole; attended the IYABA meeting in Woods Hole on 30 March; assembled data for a surf clam presentation to US Congressmen from New Jersey and Virginia; started analysis of 1978 shellfish assessment cruise results; submitted abstracts for presentation at the annual meeting of the American Fisheries Society in August on Atlantic cod assessments, management of groundfish under extended jurisdiction, and a computer simulation of anadromous rainbow trout populations; updated data on Atlantic cod landings for 1975-77 by gear type, market category, statistical area fished, and quarter/year for both Georges Bank and Gulf of Maine stocks; analyzed Atlantic cod landings for 1975-77 by vessel category, month and quarter/year fished, days fished, trips accomplished, cod landed, total catch landed, and catch per day and catch per trip; analyzed sea scallop landings for 1975-77 by vessel category, gear type, and area fished; analyzed frequency distribution of scallop catch per day per vessel by vessel category and area fished for 1975-77; continued analysis of sea scallop research survey results from 1975 and 1977 cruises on Georges Bank and in the Mid-Atlantic; met with Brooks Townes from the "National Fisherman" to discuss resource assessment activity under extended jurisdiction; met with Peter Larson from the Bigelow Laboratory to discuss sea scallop research; attended the ICES North Sea Groundfish Working Group meeting in Charlottenlund, Denmark, during 2-9 April; presented a talk at the Massachusetts Maritime Academy's Fisheries

Lecture Series on 12 April on "Biological Advice in Fisheries Management: Stock Assessment, Data and Methodologies;" presented a talk at the First Annual NEFC Research Meeting on 25 April entitled "F. Serchuk Sea Sampling Saga: Cod, Scrod, Discards, Die-Hards, and Try-Hards in the New England Groundfish Fishery;" attended a "Northeast Clam Industries-Management for the Future" workshop held during 28-29 April in Hyannis, MA; presented a paper on "Population Dynamics and Management Strategies for Offshore Surf Clam Populations in the Mid-Atlantic Area" at the latter meeting; assembled and prepared reports on biological aspects of optimum yield for Georges Bank haddock and Georges Bank and Gulf of Maine Atlantic cod with staff members of the Resource Assessment Division; coordinated and planned arrangements for the First Annual NEFC Research Meeting on 24-26 April; analyzed Atlantic cod landings for 1975-77 by area caught, port landed, and market category; updated spring and autumn survey abundance indices for Atlantic cod in the Gulf of Maine and Georges Bank; prepared and submitted an abstract for a sea scallop presentation at the 1978 Annual NSA-SINA Meeting in June in New Orleans; continued analysis of surf clam - ocean quahog survey data; and analyzed results of the first mesh selectivity experiment for evaluation of long-term benefits from mesh increases in the Atlantic cod and yellowtail flounder fisheries.

Fishery Assessment Investigation

Emory Anderson devoted most of his time during the month to the preparation of a paper dealing with the review of the Northwest Atlantic mackerel fishery which will be presented at the ICES symposium on pelagic fish stock management in July in Aberdeen, Scotland. On 5 April, Emory was one of a group of invited speakers at the First Annual Jersey Shore Fishing Conference held in Sea Bright, NJ. This conference was an attempt by several people from that area associated with the fishing industry to assemble a panel of individuals representing commercial and recreational fishing, Coast Guard, NMFS, and assorted other groups or interested people related to the marine environment to discuss matters of general interest and concern to the audience. Emory was in Dartmouth, NS, during 10-12 April to confer with Polish and Canadian scientists on assessment matters. On 27 April, Emory also traveled to the Sandy Hook Laboratory for discussions with Darryl Christensen concerning the recreational fisheries census recently begun in the Mid-Atlantic area under contract to the Mid-Atlantic Fishery Management Council.

Steve Clark attended a State-Federal Lobster Scientific Committee meeting during 17-18 April in Boston at which time the assessment was completed for the draft Lobster Management Plan. Steve and Thurston Burns also completed work on an assessment of pollock.

A number of Investigation personnel presented papers at the First Annual NEFC Research Meeting (IYABA) held in Woods Hole during 24-26 April: (1) Bill Overholt -- "Effects of Environmental Factors on Trawl Survey Operations as Evidenced by a Doppler Speed Log;" (2) John Nicolas (Resource Surveys Investigation) and Bill Overholtz -- "NMFS Marine Mammal Observation Program;" (3) Gordon Waring (Fishery Systems Investigation) and Thurston Burns -- "The International Herring Tagging Program;" (4) Steve Clark -- "Georges Bank Haddock - Past, Present, and Future;" (5) Frank Almeida -- "The Status of the Three Silver Hake Stocks off the Northeast Coast of the United States;" and (6) Steve Clark -- "Application of Bottom Trawl Survey Data to Fish Stock Assessments."

Frank Almeida attended the meeting of the ICNAF Assessments Subcommittee held in Dartmouth, NS, during 4-12 April as an observer from the US. Frank has continued assembling silver hake data for the upcoming assessments.

Bill Overholtz has been working up the Atlantic mackerel catch data from the winter Argus and spring Albatross IV trawl surveys and has also worked on the haddock biostatistics and other data needed for that assessment.

Thurston Burns completed coding and auditing the January-March 1978 commercial length-frequency samples. He also prepared a preliminary offshore lobster assessment report as input to the draft Lobster Management Plan.

Emma Henderson continued work on summer flounder and red hake assessment data.

Brian Hayden has worked on a variety of assignments including retrieval of data from autumn trawl surveys for 1963-65 and 1972-77, retrieval of catch per tow values for bluefish from 1963-77 summer and autumn trawl surveys, pollock growth curve, and catch data on white hake.

Hillary Herring joined the Investigation this month and has worked primarily on generating red hake monthly length-frequency summaries from 1977 US industrial catch samples and extracting catch by area by year. She has also begun work on aging goosefish.

Fishery Systems Investigation

Assessment activity continued during April. In addition, Michael Sissenwine and Otis Jackson calculated the theoretical consumption and production rate of six species of fish on Georges Bank for the period of 1963-72. This analysis is part of a Center-wide study of the Georges Bank ecosystem.

Gordon Waring and Michael Sissenwine attended meeting in Boothbay Harbor, ME, which reviewed the status of knowledge on Sissenwine also attended the first meeting of the State-Federal Striped Bass Committee in Salisbury, MD, and a New England Regional Fishery Management Council meeting in Peabody, MA.

Gordon Waring, Anne Lange, and Margaret McBride presented papers at the First Annual NEFC Research Meeting. The titles and abstracts of their papers are attached to the program of the meeting.

Michael Sissenwine submitted a paper entitled "Is MSY an Adequate Foundation for Optimum Yield" to Fisheries.

Manuscripts

Serchuk, F. M., S. A. Murawski, and B. E. Brown. 1978. Assessment of offshore surf clam populations in Mid-Atlantic waters: data, methodologies, and analyses, questions and answers. NEFC Woods Hole Lab. Ref. No. 78-25. 3 p.

Serchuk, F. M. 1978. Sea sampling trip, M/V TREMONT, December 16-19, 1977. Trip description and results. NEFC Woods Hole Lab. Ref. No. 78-16. 12 p.

Serchuk, F. M. 1978. An introduction to stock assessment techniques. I. Population estimation. NEFC Woods Hole Lab. Ref. No. 78-28. 20 p.

MARINE ECOSYSTEMS DIVISION

Environmental Assessment Highlight

On 10 April 1978 approximately 3 wk after the grounding of the barge Ocean 250 and subsequent gasoline spill, Caroline Griswold and Jerry Prezioso participated in a 1-day follow-up cruise on the R/V Strider. The same sampling grid

was used as for R/V Strider Cruise No. 78-01. Plankton and neuston samples were collected at 9 and 18 stations, respectively.

During the month 23 fish samples from R/V Strider Cruise No. 78-01 were analyzed by ERCO for gasoline hydrocarbons. Analyses of plankton communities and benthic samples are underway. Fish embryos picked from the neuston samples were examined by Arlene Longwell of the Milford Laboratory. High percentages of dead embryos were found and this was attributed to the gasoline. Further analyses will be performed on embryos from the water column samples and from the plankton and neuston samples collected on the follow-up cruise.

Larval Physiology and Biochemistry Investigation

The studies of larval haddock and Atlantic cod growth and survival in a competitive situation were continued along with a study of the daily mortality rate of winter flounder larvae. The cooperative study with EPA on the effects of oil exposure during gonad maturation on winter flounder larvae was also extended through the period.

Larry Buckley presented a paper entitled "Biochemical Studies of Larval Fish Development" at the First Annual NEFC Research Meeting.

Ecosystems Dynamics Investigation

Marv Grosslein, in conjunction with Rich Langton and Mike Sissenwine, prepared a paper on "Recent Fluctuations in Pelagic Fish Stocks of Georges Bank Area in Relation to Species Interactions," as well as a revision of a paper on the accuracy of survey data with Mike Pennington.

Mike Pennington attended the course, "Modern Techniques in Time Series Forecasting and Dynamic Model Building," given in Princeton, NJ, taught by G. E. P. Box, et al. It covered the latest methods of model detection and forecasting using what has become known as the Box-Jenkins technique. This system has great flexibility in that it can easily handle such things as seasonal effects and interventions (e.g., oil spills, power plant start-ups, etc.) in the overall time series used to model the particular phenomenon of interest. Mike Pennington also presented a short note at the IYABA meeting in Woods Hole on the relative efficiency of bottom trawl survey long tows versus short tows when sampling from a contiguous population such as plankton or fish. Marv Grosslein and Mike Pennington are finishing the final draft of the paper, "Accuracy of Abundance Indices," which will be presented by Dr. Grosslein at the ICNAF meeting in May.

During the month of April, Ed Cohen worked on the energy budget of Georges Bank in order to refine the zooplankton component in view of the new data recently received from the Polish Sorting Center. He also prepared a seminar for the phytoplankton group at the University of Rhode Island Department of Oceanography, as well as two papers for the First Annual NEFC Research Meeting (IYABA). Ed Cohen also spent time setting up equipment and giving instructions for the Soviet scientists aboard the R/V Argus. Assistance also was provided for Marv Grosslein and Rich Langton to set up the computer runs for their food chain paper.

Pat Carter was involved in the analysis of chlorophyll data and programming related to the chlorophyll analysis, and assisted Rich Langton with tabulation of food chain data.

Recruitment Processes Group

Most of the work this month for this group focused on the analysis of larval Atlantic herring data from 56 cruises during 1968-78. Greg Lough and George Bolz have been devoting full time to the analysis since the February larval herring survey and presently are evaluating various methods of estimating initial larval production and back-calculating spawning stock size. The analysis is about 70% complete so that a summary report is expected by June. We have nearly finished sorting and measuring ichthyoplankton from 106 standard stations of last winter's larval herring survey, Albatross IV Cruise No. 78-02 (14 February-8 March). These data will then be incorporated into the 1977 season's production and mortality estimates. Our first estimate of early larval production for the 3 yr (1968-70) of piggy-back bottom trawl survey plankton data prior to the start of the ICNAF Larval Herring Surveys, was based on the normal curve approximation method used by Alan Saville (Aberdeen Laboratory). Production of larvae was relatively low during the 1968-70 seasons, comparable to the 1971 and 1972 seasons; however, production was an order of magnitude greater in 1970 than in 1969 and 1968.

Roz Cohen and Greg Lough had several conferences this month with Woolcott Smith (WHOI statistician) regarding interpretation of multivariate analyses of larval herring condition factor - gut content data from three winter surveys, and also analyses of vertical distribution zooplankton data from the October 1974 larval herring experiment.

Elizabeth Stein (University of Massachusetts co-op student) spent most of a week helping Rich Langton tabulate food chain data and Dana Temple (another University of Massachusetts co-op student) spent several days gathering plankton equipment for MARMAP surveys.

Robert Livingstone is writing a manuscript summarizing haddock maturity data which is to be completed by June.

Fishery Oceanography Investigation

Our ability to operate independently as a current-meter facility came closer to realization in April as Gil Dering approached completion of the test box he has been building. In the meantime the current meters recovered in March have been inspected and any failings are being tracked down and repaired. The releases have been renovated and are ready for use again. Gil has also designed a new interface board for the test box which will be used both at NEFC and WHOI, and he checked out our deck gear for loan to EG&G Consultants, Inc., to recover some of their moorings on Georges Bank.

Preliminary processing of the tapes from the second setting of current meters has been completed by Steve Ramp and the work of filtering and producing analytical plots can begin. Steve has also looked at the tapes from the third setting: four of the eight appear to have given complete records, one was a complete failure, and three have given partial records--about a 75% data recovery in all.

Plotting of data from bottom trawl survey and larval herring cruises has been continued by several individuals under the direction of Sam Nickerson. The backlog of salinity cases from the first two series of MARMAP cruises was cleaned up and we should have some relief from that chore for a few weeks.

Anne Dorkins and Dan Patanjo returned to sea, this time on Argus for the first MARMAP leg. Ron Kirschner and Tim Cain will take the second leg in May.

Ron Kirschner prepared and issued the report on the March SOOP runs across the Gulf of Maine. Red Wright and Bob Pawlowski prepared data summaries for Annales Biologique (Volume 34) for 1977, and the report by Robert Pawlowski, Red Wright, and Sam Nickerson on surface temperature and salinity during the 1972-73 bottom trawl cruises was finally issued. Bob Pawlowski gave a talk on the subject during the First Annual NEFC Research Meeting in Woods Hole.

Lt. Robert Pawlowski completed his 3-yr tour of duty with our unit and returned to sea on the NOAA Ship Kelez. His work with the group has been invaluable and he will be missed. A replacement NOAA Corps officer is expected in the fall.

Ichthyoplankton Investigation

We are presently conducting the fourth of our six-times-yearly ichthyoplankton surveys from Cape Hatteras to the Gulf of Maine. At the same time, personnel from this Investigation are participating in the first "Ocean Pulse" cruise, and a two-part cooperative cruise with Brookhaven National Laboratory.

Efforts to catch up with the backlog of ADP-related work for the BLM contract have been temporarily stymied by the need to reprogram existing files to conform to the interim ADP plan. In the meantime, we are continuing to prepare figures depicting distribution and abundance of fish eggs taken on semiannual surveys for 1973-76. Table formats have been tentatively established for hydrographic data. We are awaiting the return of digitized temperature data from NOAA to begin preparation of pertinent tables.

Peter Berrien gave a paper at the First Annual NEFC Research Meeting entitled "Atlantic Mackerel and Yellowtail Flounder Egg Production and Spawning Population Estimates for 1977."

Mike Fahay spoke on, "Degrees of Development of Larval and Adult Characters in Ophichthid Eels."

Tom Morris participated in cruises aboard the Argus from 25 March to 8 April and from 13 to 27 April.

Plankton Ecology Investigation

Doris Petrie has been determining total dry-weight biomass from a series of 540 plankton samples. Delaware II Cruise No. DE 77-03, Delaware II Cruise No. DE 77-05, Goerlitz Cruise No. 77-01, and Albatross IV Cruise No. AL 77-02 are completed. Approximately 25% of the samples have been done. And, the biomass values and carbon and caloric equivalents of such heretofore neglected organisms as Sagitta limacina and Oikopleura sp. have been worked out based on literature data.

Doris Petrie gave a poster session presentation at the First Annual NEFC Research Meeting--"A Technique for Measuring Zooplankton Biomass." Jack Green presented a paper entitled, "Preliminary Estimates of Secondary Production on Georges Bank."

Biostatistics Unit

The two student programmers in the Biostatistics Unit have been dealing with all of the unforeseen problems which in fact have occurred in assuming responsibility for the MARMAP Information System (MIS). No data have been processed since 24 March when the conversion of the MIS was necessitated by the impending conclusion of the research and development contract with the University of Rhode Island.

In the absence of computer processing capabilities, members of the Unit have been summarizing data for use in several papers on ichthyoplankton and zooplankton which are being prepared for Annales Biologiques and upcoming international meetings. Linda Cummings lasted through a bottom trawl survey on Albatross IV Cruise No. AL 78-04.

Dave Bearse and Tom Plichta gave a presentation at the poster session of the First Annual NEFC Research Meeting concerning "Ichthyoplankton and Zooplankton Data Processing within the Marine Ecosystems Division."

Jerry Prezioso's poster session presentation was entitled, "An Investigation of Predation Patterns of Chaetognaths from Albatross IV Cruise No. AL 74-11."

Plankton Sorting Group

The major goal continues to be the processing of the 1977 MARMAP zooplankton samples. This month we have completed samples from the areas of Georges Bank and the Gulf of Maine for April, May, and June. Copepodite stages I-III of Calanus finmarchicus were abundant on Georges Bank for March-April and in the Gulf of Maine area for April-May. Metridia lucens copepodites (I-II) were also numerous in the Gulf of Maine in the April-May samples.

A poster presentation was made at the First Annual NEFC Research Meeting in Woods Hole. The information provided a visual and graphic summary of Centropages typicus distribution on Georges Bank in the fall of 1971-75.

At the request of Bori Olla, identifications were completed on a series of invertebrates to be used as a reference collection for fish stomach content analysis.

Karen Wilkie has joined the Plankton Sorting Group this month as a University of Rhode Island 1040 appointment.

Joe Kane participated in the bottom trawl survey aboard Albatross IV.

US-USSR Joint Research

During 25 March-8 April, a joint research cruise was conducted aboard R/V Argus to investigate primary production on Georges Bank, in southern New England, and in the New York Bight. Donna Busch served as coordinator for arrangements among the three participating organizations, NEFC, AtlantNIRO, and Brookhaven National Laboratories, and participated in chlorophyll and zooplankton sampling.

Primary production measurements (^{14}C) were made daily at stations chosen by Brookhaven National Laboratories. Oblique and vertical zooplankton hauls (0.505, 0.333, 0.165, and 0.053-mm mesh nets) were taken to determine distribution of zooplankton. Aliquots from vertical hauls were used for dry weight determinations of biomass. The contents of the small-mesh nets were analyzed daily by an Argus scientist, Slava Sushin.

Samples were also taken for chlorophyll, nutrient, and microzooplankton analyses. Chlorophyll analyses were completed on board, and remaining samples will be processed in the respective laboratories. Routine hydrography was also conducted, including measurements of temperature (surface bucket and XBT), salinity, depth, and oxygen.

Of particular interest to Brookhaven National Laboratories and NEFC scientists were studies of phytoplankton conducted by Dr. Vinogradova from AtlantNIRO. She analyzed phytoplankton for species composition, total-count (live and dead) cell volumes, and conducted primary productivity studies using ^{14}C and autoradiographical techniques. She will continue these analyses after returning to Kaliningrad in May.

The cruise reflected enthusiastic cooperation among scientists of the three organizations. Data were shared and analyzed jointly to investigate the Georges Bank - southern New England ecosystems.

During 13-27 April, a joint MARMAP-USSR cruise was conducted from Cape Hatteras to southern New England. Jack Green constructed an on-deck incubator for ^{14}C primary production studies on that cruise and for use on the final leg of the MARMAP cruise (7-24 May). A scientist from Argus, Igor Krasovsky, is responsible for the primary production work on the ship, and will return on R/V Belogorsk in August to continue these investigations using equipment supplied by NEFC. Slava Sushin, a microbiologist aboard Argus, will also return in the fall to attempt analysis of microbiological samples with Ray Maurer using the image analyzer at the Narragansett Laboratory.

Image Analyses Project

A review of the image analysis proposal to NOAA's Office of Ocean Engineering was held in Washington, DC, on 19 April. Ken Sherman, Bob Marak, and Perry Jeff attended the day-long review, discussing image analysis and its application as a tool in plankton research.

On 24 April Ray Maurer presented a paper entitled, "Image Analysis, a Revolutionary Tool for Plankton Research," at the First Annual NEFC Research Meeting. This paper described the initial work being done at the Narragansett Laboratory. Illustrations of counting and sizing plankton organisms were shown. In addition, it was demonstrated that image analysis could be used as a quantitative research tool in oil contamination studies, marine mammal investigations, and calculating areal distributions of water masses.

Benthic Dynamics Investigation

Updating of the quantitative data base pertaining to the New England macrobenthic invertebrate fauna was completed. Evaluation and analyses of this data set were continued. The Gastropoda section for a report on the distribution of this New England fauna was nearly completed. Good progress was also made in assembling information for a study of bivalve mollusk distribution.

A protocol for sampling fish stomachs for food habits analysis was revised. This revision resulted from a meeting of NEFC staff members concerned with fish food habits held at the Woods Hole Laboratory on 31 March. Also, brief summaries of special food habits projects that would augment ongoing studies were prepared and submitted for further consideration for funding and staffing.

The Pleuronectiformes 1969-72 food habits data base has been audited and corrected. The audit of the 1973-76 data base is also in progress. Bob Edwards and Ray Bowman have completed a draft of a paper entitled, "An Estimate of the Food Consumed by Continental Shelf Fishes in the Region between New Jersey and Nova Scotia." This report will be presented at a meeting in Atlanta, GA, in July. Rich Langton is working with Marv Grosslein and Mike Sissenwine on a paper for an ICES meeting to be held in Aberdeen, Scotland, this July.

Roger Theroux was instrumental in getting a computer tape copied and preparing the dictionary and other explanatory information of NEFC benthos data for the Middle Atlantic Bight area. This tape was submitted to VIMS for their use in preparing a report for MESA.

Apex Predator Investigation

A longlining cruise aboard the R/V Wieczno returned 10 April after being out 20 days. Three hundred fifty-one sharks (nine species) and 14 teleosts (five species) were taken on 13 longline sets from Cape Canaveral, FL, to Cape Hatteras, NC. Of the total catch, 285 were tagged, 67 were brought on deck, and 13 were identified but lost at the rail.

The fish brought on deck were examined for stomach contents and reproductive condition. Vertebrae were collected from 20 sharks (six species) for age and growth studies. In addition, eyes from 12 sandbar sharks (2 adults, 10 embryos) were frozen for electrophoretic determination of racial stock differences as reflected by the crystalline lens. Liver samples from pregnant sandbar and hammerhead sharks, along with representative embryos were frozen for later investigation of the crossover of PCB's from mother to embryo in utero.

An acoustic telemetry experiment with a female mako shark was conducted during the cruise with Frank Carey of WHOI. One sonic tag was placed externally in the back musculature and a second one internally in the stomach. The shark was then released and tracked for 105 hr over a course of 359 km. XBT traces were made approximately every 1.5 hr during the tracking. By comparing the water temperature of the pulsed signal to the XBT traces, it was possible to determine the fish's depth.

H. "Wes" Pratt and Charles Stillwell presented papers at the First Annual NEFC Research Meeting in Woods Hole entitled, "Studies on Reproduction in Sharks," and "Food Studies in Apex Predators," respectively.

Meetings, Talks, Visitors, Publicity

On 18 April Carolyn Griswold participated in a meeting of the BLM Biological Task Force in Washington, DC. Speakers had been invited to address the group on: (1) the Oil Spill Risk Analysis Model (OSRAM) used for prediction of oil spills resulting from OCS development; (2) the intergovernmental planning program for the leasing and transportation of OCS oil and gas; (3) the distribution and migration of marine mammals of the Atlantic seaboard; and (4) the marine fishery aspects of the Atlantic OCS. Development of study recommendations for the Atlantic OCS was discussed by task force members.

Red Wright, Steve Ramp, and Ron Schlitz attended the American Geophysical Society meetings in Miami Beach, where Steve Ramp and Red Wright gave papers on the current measurements and hydrographic studies in the Northeast Channel region. Steve Ramp's paper will be submitted for publication in Geophysical Research Letters. Discussions were held with Ron Trites of the Bedford Institute of Oceanography about the physical oceanography phase of the patch study scheduled for this fall, and Ron Schlitz visited both Eotech, Inc., and Marine Profiles, Inc., to make arrangements for equipment for the patch study. Ron Schlitz also visited Nova University to close out our current-meter arrangement there, and, earlier in the month, traveled to New York City to talk about long-range cooperative efforts with the US Coast Guard. Prospects are not too good at the present stage of funding and manpower.

Jack Green attended two meetings dealing with the status of food habits research in the Center and its future objectives.

On 3 and 4 April Ray Maurer attended the 8th Annual Automatic Imagery and Pattern Recognition Symposium hosted by the National Bureau of Standards in Gaithersburg, MD. Most papers presented dealt with developing software and algorithms for specific applications in industry, remote sensing, and the military.

On 8 April Jack Green met with scientists aboard the Argus to explain the use of the primary productivity on-deck incubator and general techniques for primary production.

Marv Grosslein participated in an S&S Committee meeting for the New England Fishery Management Council on 12 April at URI, and presented an outline of Marine Ecosystem Division's ADP needs at a Regional Data Management Committee meeting in Woods Hole on 18 April.

On 13 April, Donna Busch and Jack Green transferred primary productivity gear and miscellaneous supplies from R/V Verrill to R/V Argus which was anchored outside the 3-mi limit near Martha's Vineyard.

A seminar reviewing the basic principles and applications of image analysis was presented by John Peach from Bausch and Lomb, Inc., to the Plankton Ecology Investigation personnel at Narragansett. The 14 April session was attended by staff members and Drs. Jeffries and Poularikis from URI.

Ray Bowman was scheduled to take his Master's Degree qualifying exams on 26 April at Bridgewater State College.

Rich Langton, as chairman of the NEFC Food Habits Task Group, convened a meeting at Narragansett on 20 April. Representatives from Center investigations with interests in food habits were present and discussed ongoing research and priorities for future work.

Rich Langton presented a talk entitled, "Food Habits and Food Resource Partitioning by Northwest Atlantic Gadiform Fishes," at the First Annual NEFC Research Meeting held at Woods Hole from 24 to 26 April, and sponsored by IYABA.

On 27 April Donna Busch and Jack Green met with Drs. Vinogradova, Senin, and Segeiev, and Slava Sushin, scientists from the AtlantNIRO in Kaliningrad, USSR, to exchange data and discuss techniques of processing and analysis of samples collected aboard Argus during joint research cruises.

Manuscripts

Berrien, P. L. 1978. Eggs and larvae of Scomber scombrus and Scomber japonicus in continental shelf waters between Massachusetts and Florida. Fish. Bull., U.S., 76(1):95-117. (P)

Berrien, P. L., M. P. Fahay, A. W. Kendall, Jr., and W. G. Smith. 1978. Ichthyoplankton from the R/V Dolphin survey of continental shelf waters between Martha's Vineyard, Massachusetts and Cape Lookout, North Carolina, 1965-66. NMFS Northeast Fish. Ctr. Sandy Hook Lab. Tech. Ser. Rep. No. 15. 152 p. (P)

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MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

No report received. Report will be included in next month's issue.

DIVISION OF ENVIRONMENTAL ASSESSMENT

Behavior of Marine Fishes and Invertebrates Investigation

Although red hake, Urophycis chuss, may use vision to feed, chemical detection is a primary sensory modality. A system has been developed for testing food detection by chemoreception and we are proceeding to establish detection thresholds for food extracts in this species. In connection with this, we are investigating motivation to feed, i.e., how long a latency exists between the last meal and the animal's renewed search for, or response to, food. Results should give us further insight into feeding habits and the important relationships that exist between these fish and the prey on which they feed.

Biological Oceanography of Stressed Environments Investigation

During April George Flimlin and Joe Ruave participated in the joint US-USSR research cruise aboard the Argus. Fifty-nine stations (432 depths) between Cape Hatteras and New York were sampled for chlorophyll, resulting in 864 samples being returned to the Sandy Hook Laboratory for netplankton and nannoplankton chlorophyll a and phaeopigment analyses. Samples from 70 stations (152 stations total) of the February-March cruise of the Delaware II were analyzed and total chlorophyll (netplankton and nannoplankton) for the surface was plotted and contoured for the area between Cape Hatteras and Long Island. The highest chlorophyll a concentrations occurred off the mouths of major estuaries (Hudson -- 15-mg Chl_a/m³, Delaware -- 11-mg Chl_a/m³, and Chesapeake -- 3-mg Chl_a/m³). Plotted and contoured surface total chlorophyll a data collected during the NOS Mt. Mitchell and Kelez cruises of November and December in the area east and north of Long Island show that chlorophyll a was generally low and uniform (about 1-mg Chl_a/m³) except for Georges Bank where values were slightly higher.

Nutrient analyses of water samples from the R/V Advance II and Albatross IV cruises are continuing with 286 samples analyzed this month. The remaining 280 samples will be analyzed very soon.

Installation of the exhaust and air intake for the ultraviolet irradiation system has begun.

A detailed sampling protocol and the equations for calculating nutrient concentration from strip-chart peak heights were listed and sent to the supplier of the data logger which we are purchasing. This will form the basis of the program for the data reduction. Because the data logger which our group is purchasing uses the computer language BASIC, Ruth Waldhauer has just completed a course using this language.

The second group of samples in the effects-of-storage experiment was analyzed, and the data will be correlated with the initial values.

Analysis of chemical data from the 1976 anoxic area off New Jersey was completed. Calculations from these chemical observations suggest that rates of anaerobic metabolism were comparable to aerobic rates.

A 6-wk course in survival Russian was completed by eight scientists from the Sandy Hook Laboratory.

Coastal Ecosystems Investigation

Much of our effort was devoted to organizing and beginning the first full-scale Ocean Pulse cruise, on which Frank Steimle is serving as Chief Scientist aboard the NOS vessel Researcher. The cruise departed Washington, DC, on 17 April and had occupied 20 stations between Cape Hatteras and Georges Bank by the end of April. Scientists from Ichthyoplankton, Comparative Pathobiology, Environmental Chemistry, Physiological Effects of Pollutant Stress, Aquacultural Genetics and Coastal Ecosystems Investigations are participating. Scientists collected benthic and water-column samples for analyses of various biota as well as contaminants in seawater and sediments. Extensive physiological measurements and pathobiological observations were made directly aboard the vessel while at the stations. The cruise has been successful in meeting its field objectives. A cruise debriefing is planned for Friday, 23 June, at the State University of New York (SUNY) at Stony Brook. At that time participants on the Researcher cruise will brief members of NEFC, as well as personnel from various academic institutions and federal agencies currently participating in, or interested in, Ocean Pulse.

A draft final report on the pre-oil exploration sediments, heavy metals, benthic macrofauna, and shellfish resources of the Baltimore Canyon Trough was sent to the Bureau of Land Management. Two more reports on New York Bight benthos were submitted to MESA. Data on the benthos of Long Island Sound were supplied to Project Oceanology, Avery Point, CT, which is compiling an overall species list and guide to the Sound's fauna. Data we collected during the first phase of a spoil disposal project at New London, CT, were provided to the group (Naval Underwater Systems Center) monitoring the second phase of disposal for comparative purposes. We continued work on distribution and abundance of New York Bight macrofauna for the MESA atlas and for a later, more comprehensive review of distributions and life histories. Work is also in progress on major manuscripts on benthic macrofauna populations of the bight, and on shellfish management.

Coastal Monitoring, Assessment, and Prediction Investigation

The Army Corps of Engineers and Naval Underwater Systems Center cosponsored a meeting at the Naval War College in Newport, RI, on 4 April to report on research being done under the Disposal Area Monitoring System (DAMOS) project of the Corps. Reports were given by several subproject leaders concerned with various site-specific studies in progress at selected estuaries in the New England - Middle Atlantic area. Several of the reports indicated relative inexperience in working in the estuarine environment and several comments that were critical of instrumentation, sampling, and procedures were voiced from the audience.

A report was received from Marvin Boussu of the Environmental Assessment Division at the Regional Office requesting review of a proposal from the Army Corps of Engineers to study the feasibility of establishing a single-pool hydroelectric facility at Eastport, ME. Unlike the joint US-Canadian Passamaquoddy

Project proposed earlier, it would be a US venture and would be constructed entirely on US soil and impound only waters in US territory. Comments were requested on the fish stocks in the vicinity that might be affected by the proposed structure, and for recommendations for studies relating to potential environmental impact that should be contemplated by the Corps.

On 7 April, we met with Tom Azarovitz and Arnold Howe, Project Leader of the Massachusetts Coastwide Fishery Resource Assessment Project, to review the status of the project prior to the start of the field program. Standardization of field procedures, data processing, and exchange of data between the two agencies were discussed and coordinated.

Environmental Chemistry Investigation

The first comprehensive Ocean Pulse cruise involving the NOAA Ship Researcher was participated in by the Investigation Chief, Mr. Richard Greig.

Several important changes in sampling protocols were made as a result of Mr. Greig being on the first leg of the Researcher cruise. Vincent Zdanowicz is on the second leg of this cruise which will end about 5 May.

Unfortunately, we have spent most of our FY 1978 budget allocation and thus the analysis of these samples collected on the Researcher will have to wait until we can obtain additional funding. We do have a proposal in to the Ocean Dumping program and if they fund us, we will be in a position to do some of the Researcher analyses as well.

Douglas Wenzloff presented a paper on metals in clams from the North Atlantic at a recent NEFC IYABA meeting. Apparently the work and presentation were well received.

Physiological Effects of Pollutant Stress Investigation

Physioecology

Studies were performed on the effects of time, temperature, and salinity, in pairs and in combination, on the toxicity of mercury to embryos of the American oyster, Crassostrea virginica. Observations were that: (1) toxicity was greatest just after fertilization, lessening as the embryos grew older; (2) there was no observable effect of temperature on mercury toxicity to the embryos immediately after fertilization, but the toxicity of mercury exposure 8 hr after fertilization decreased as temperature increased; and (3) immediately after fertilization, mercury toxicity increased with increasing salinity, but decreased 8 hr after fertilization.

Two metal-exposure experiments with surf clam, Spisula solidissima, embryos were performed this month. Arsenic and zinc studies have been completed, and further testing is needed for cadmium, copper, lead, mercury, nickel, and silver.

Work on larval oyster respiration is continuing. Further oxygen-uptake measurements with the larvae will be with ultramicrorespirometers, as the Gilson Differential Respirometer was found to be unsuitable for that purpose.

Physiological Effects and Biochemical Effects

Activity for these subtasks this month centered primarily on preparation for and participation in the Operational Test Phase cruise for Ocean Pulse on the NOAA Ship Researcher. Fred Thurberg, Edith Gould, and Lynne Hanson sailed on the

first leg, 17-24 April, covering the more southerly stations of the Mid-Atlantic and New York Bights. Tissue samples were taken from 146 animals, the majority of them sea scallops (Placopecten magellanicus), windowpanes (Scophthalmus aquosus) and rock crabs (Cancer irroratus) brought in by crab dredge or otter trawl. Representative plankton from each station, taken by neuston tows, was preserved as the beginning of a "census" collection. Some mysid shrimp, crangon shrimp, and a single glass eel were taken by epibenthic sled. Oxygen-uptake studies, hematological tests, and enzyme assays were performed on many tissues, and 262 samples were packaged and frozen for later examination in the laboratory. The consensus was that the cruise was even more successful than we had hoped, and that the NOS officers and crew of the Researcher were thoroughly competent, cooperative, hard working, and friendly. Apart from some winch problems, the ship lived up to its name, proving to be an excellent floating laboratory with the capacity for diverse sampling procedures. The first PEPS team reluctantly made way for the second PEPS team, who are working the second leg, 25 April-4 May out to Georges Bank and the Gulf of Maine. PEPS personnel aboard are Tony Calabrese and William Nelson (Physioecology), Margaret Dawson and Laure Devine (Physiology), and Jack Graikoski (Anaerobic Microbiology).

Meetings, Talks, Visitors, Publicity

On 1 April, Frank Steimle attended the New Jersey Academy of Science Annual Meeting, and presented a paper comparing bottom-oxygen concentrations in the New York Bight for 1976 and 1977.

Bob Reid and George Kelly attended a review of the New England Regional Disposal Area Monitoring Program recently initiated by the Army Corps of Engineers and Naval Underwater Systems Center, in Newport, RI, on 4 April.

Dr. John Pearce and Bob Reid sat on a panel to discuss fishing problems and prospects at the first Jersey Shore Fishing Conference on 5 April in Sea Bright,

On Thursday, 6 April, Mr. John Babinchak joined Dr. John Pearce in order to provide assistance to the developing Ocean Pulse program. On Friday, 7 April, they met with Dr. Allan Mitelka of the Interstate Sanitation Commission to discuss how the Ocean Pulse program could be of assistance to the Commission. It was indicated by Dr. Mitelka and Mr. Thomas Glenn, Director of the Commission, that they would have an interest in the program and that in some instances close cooperative efforts might be developed.

On Wednesday, 12 April, Mr. John Babinchak and Dr. John Pearce met in Woods Hole with Center personnel and congressional staff interested in the Ocean Pulse program.

Dr. Pearce and William Phoel met with Richard Cooper and academic staff from the University of New Hampshire and Southeastern Massachusetts University on 13 April to discuss the implementation of the Ocean Pulse program at Jeffreys and Cashes Ledge Ocean Pulse stations located in the Gulf of Maine. Extensive discussion was concerned with selection of key species and how to measure ecological parameters at the two Ocean Pulse stations. Also discussed was how diver and submersible operations can best be related to the objectives of the program.

On Wednesday, 19 April, Dr. Pearce gave a seminar to the Biology Club from Monmouth College, Long Branch, NJ, and to the Eatontown, NJ, Kiwanis Club. In both instances he discussed the environmental assessment activities ongoing within NEFC.

Mr. John Babinchak and Dr. John Pearce met with Drs. Laurie McHugh and Jerry Schubel of the State University of New York (SUNY) at Stony Brook on 24 April. They discussed the various ways that the Ocean Pulse program could interface with

activities ongoing at the SUNY Marine Science Center. The SUNY personnel were particularly interested in implementing Ocean Pulse activities in Long Island Sound.

Division of Environmental Assessment personnel attending the recent First Annual NEFC Research Meeting at Woods Hole were: Myra Cohn, Andy Draxler, Chris Evans, Ann Frame, John Mahoney, John MacInnes, Jay O'Reilly, Bill Phoel, Craig Robertson, Jim Thomas, and Doug Wenzloff. Ann Frame presented a poster describing a project by Tom Wilhelm and Frank Steimle to determine the feasibility of splitting benthic samples to reduce processing time. John MacInnes also presented a poster talk entitled "Response of the Embryos of the American Oyster, Crassostrea virginica, to Heavy Metals in Multifactorial Experiments." Other papers presented were: Doug Wenzloff, "Trace Metals in Clams of the Eastern United States;" Myra Cohn, "Phytoplankton Populations;" Andy Draxler, "Sulfide and Other Chemical Observations During the 1976 Dysaerobia in the New York Bight;" Chris Evans, "Phytoplankton Baseline Study from Cape Hatteras to Nova Scotia;" John Mahoney, "Phytoflagellate Blooms in the New York Bight;" Bill Phoel, "A Comparison of Seabed Oxygen Consumption Between Georges Bank and the New York Bight in Summer and Winter;" and Craig Robertson, "Water Column Respiration in the New York Bight and Georges Bank."

Dr. James Thomas met with Soviet scientists from the USSR Argus on 27 April to discuss cooperative phytoplankton research.

Clyde MacKenzie gave a paper, "Relation of Biological and Environmental Factors to Clam Management," at the Northeast Clam Industries - Management for the Future meeting in Hyannis, MA, on 27 and 28 April.

Bori Olla attended meetings of the Task Group on Feeding Habits at Woods Hole and Narragansett. Mr. Olla also presented seminars at Monmouth College and at the Zoology Department of Rutgers University.

Manuscripts

Greig, R. A., D. R. Wenzloff, C. L. MacKenzie, Jr., A. S. Merrill, and V. S. Zdanowicz. 1978. Trace metals in sea scallops, Placopecten magellanicus, from eastern United States. Bull. Env. Cont. & Toxic., p. 326-334. (P)

MacKenzie, C. Jr. How much has been learned about clam farming since Belding? Proc. Natl. Shellf. Assoc. (S)

Olla, B. L., A. L. Studholme, A. J. Bejda, C. Samet, and A. D. Martin. 1978. Effect of temperature on activity and social behavior of the adult tautog, Tautoga onitis, under laboratory conditions. Mar. Biol. 45:369-378. (P)

Thomas, J., J. O'Reilly, A. Draxler, J. Babinchak, C. Robertson, W. Phoel, R. Waldhauer, C. Evans, A. Matte, M. Cohn, M. Nitkowski, and S. Dudley. Biological processes in the water column and on the seabed during the anoxic episode in the New York Bight. NOAA Prof. Pap. (S)

AQUACULTURE DIVISION

Spawning and Rearing of Mollusks Investigation

Spawning results from bay scallops, Argopecten irradians, during the early spring have been interesting. Although scallops conditioned at 15°C produced the largest number of gametes, development of fertilized eggs from this group to the larval stage was much poorer than the results from gametes obtained from a group ripened at 20°C. Because all groups were spawned at 25°C, we feel that the greater ΔT experienced by the lower temperature group induced the release of many underdeveloped gametes.

We have been investigating the growth and algal consumption of laboratory-reared juvenile scallops in flowing seawater with naturally occurring food only. At chlorophyll a levels between 6 $\mu\text{g}/1/\text{ml}$ biomass/hr and 170 $\mu\text{g}/1/\text{ml}$ biomass/hr growth increased with increasing chlorophyll values. Apparently, even at the highest feeding level tested, more potential for growth exists.

We have carried out four successful spawnings of the surf clam, Spisula solidissima, this year. Our 2-yr-old brood stock of laboratory-reared clams has ripened more rapidly than naturally collected clams conditioned under identical conditions. The viability of the developing eggs has been greater with the laboratory-reared stock. A series of feeding experiments continues with the larvae from these spawnings. Further experiments have corroborated earlier work that suggests that the nutritional needs of 200- μ larvae are not met by the standard, 100,000 algal cells/ml of culture.

A new culture scheme for rearing surf clams is being tested. Metamorphosed clams are being raised in a 10- μ filtered-water system and supplementally fed. After clams have grown to 1 mm they are moved to 250- μ coarsely filtered seawater. The juvenile clams are contained in a plastic screen. Growth has been steady under these conditions.

Aquacultural Genetics Investigation

Selection Experiments and Heritability Studies in the Commercial American Oyster

Four crosses of the high line, two crosses of the control line, and two crosses of the low line in the mass selection experiment on the American oyster have now been made. Set has been collected from all three lines. A series of experiments comparing growth rates among the three lines is continuing. Modification of the experimental design has been made within these experiments in hopes of reducing some of the variation in the results. All 1976 and 1977 year-class animals have been moved to the outdoor rearing tanks. Data for heritability estimates on weight and size of American oysters at 1 yr of age are being collected.

Inbreeding and Outbreeding Experiments of the Commercial American Oyster

Breeding continued this month (since the beginning of March) of F_1 full sibs from six conditioned lines of the 1976 year class. Forty-six inbred and outbred control crosses have been made. Twenty-six of these were inbred and 20 were outcrosses between the lines. Results are generally consistent with previous efforts to obtain F_2 inbreds of the American oyster, Crassostrea virginica; that is, inbred larvae grow more slowly than the outbreds and usually do not survive to metamorphosis, all indicative of inbreeding depression. Larvae from a few of the inbred crosses are performing as well as those from the outcrosses, however.

Inbreeding lines are being evaluated for such factors as spawnability, fecundity, and, very importantly, survival and growth of progeny. Some differences (including sex ratio) have been observed already. For example, more than 20 animals have spawned from Line 41, and only three of these were females, while in Line 36, only six animals have spawned, and four of these were females. The average size of spawners from each line also is being determined. Preliminary cytogenetic examination revealed that in some of the inbred crosses there were increased frequencies of parthenogenesis and polyspermy over the usual. Much of the parthenogenesis was of the type whereby the female group fused with the second polar body.

Miscellaneous

R. Goldberg presented a paper, "The Evaluation of a Pumped Raceway System for Bivalve Aquaculture" at the First Annual NEFC Research Meeting at Woods Hole, MA.

R. Goldberg and E. Rhodes attended the Northeast Clam Management Workshop at Hyannis, MA.

Ellen Losee attended the First Annual NEFC Research Meeting and presented a paper entitled, "Selection for Growth in the Oyster, Crassostrea virginica."

S. Stiles discussed aquacultural genetics at a Center-sponsored workshop on Opportunities in Marine Science. Aspects of inbreeding and hybridization research on the American oyster were presented by S. Stiles at the First Annual NEFC Research Meeting held during 24-26 April.

Visitors

Visitors were Dr. Martin Billio of the European Mariculture Society, Lloyd Wilson of the University of Bridgeport, and representatives of the New York Cooperative Fisheries Research Unit at Cornell University.

PATHOBIOLOGY DIVISION

Comparative Pathobiology Investigation

Histopathologic examinations were conducted on soft shell clams, Mya arenaria, from Searsport, ME (oil spill area), mussels, Mytilus edulis, from California (oil seepage area), and duck clams, Macoma balthica, from Connecticut (heavy metal study). Lesions of the soft clams included acute inflammation, branchial hyperplasia, chlamydial parasites, and neoplasia. Lesions of the mussels included acute inflammation, metaplasia, and branchial erosion. No significant differences were noted among duck clams exposed to 20 and 100 ppb copper, and held as controls. Acute inflammation, ciliates, and gregarines were noted in many clams. Necrotic ciliates were present in clams exposed to copper. These protozoans apparently are sensitive to the copper concentrations employed.

Samples of duck clams were collected from the Tred Avon River in Maryland to determine the prevalence of neoplasms. Clams from Fox Hole continue to have neoplasms; however, no neoplasms were found in clams from Double Mills. Sediments and clam tissues from these sites have been frozen for mutagenic testing.

Twenty-six immature squid, Loligo sp., obtained from the February DWD 106 cruise, were examined histologically. The squid appeared normal with no significant histologic lesions. Six squid were infected with cestode larvae.

Essentially, all required photomicrographs for the monograph on the normal histology of the blue crab, Callinectes sapidus, have been prepared. Typing, in rough draft, of the body of the manuscript is complete, although some sections will require augmentation and revision based upon recently acquired information. Most of the bibliography yet must be typed. Research on blue crab viruses continues. Several tissues from a crab infected with a reolike virus (RLV) and a rhabdovirus have been examined with EM. Cells of the Y organ were almost uniformly infected with RLV but none of the ones examined contained rhabdovirus. Hemocytes in hemal spaces separated only by the basal lamina from Y organ cells were heavily infected with both RLV and rhabdovirus. As previously observed, cardiac muscle is not infected by either of the viruses. Hemocytes and hemopoietic tissue are the most heavily infected by both viruses. Only a few glial cells were lightly infected with either RLV or rhabdovirus in the areas examined. Neurosecretory cells did not appear to be infected.

Several necropses were conducted on large striped bass, Morone saxatilis, confiscated by the Maryland Marine Police. As yet no gross ovarian lesions have been noted in the post mortem examinations.

Considerable time was spent in preparing for and participating in the Ocean Pulse OTP cruise on the Researcher.

During the month the histology laboratory sectioned 858 blocks and stained 350 slides from a large variety of marine fishes, crustaceans, and mollusks.

Disease and Environmental Stress Investigation

Experiments involving striped bass larvae exposed to Cu^{++} were not completed as planned due to late spawning. These experiments were to be conducted at the Edonton, NC, National Fish Hatchery of the Fish and Wildlife Service.

All experiments on freeze-fracturing and etching of lymphocystis virus of winter flounder, Pseudopleuronectes americanus, have been completed. Preparations were made from fixed and unfixed tissues, some of which were treated with cryoprotective reagents. The replicas are being photographed in stereoscopic pairs at $+6^{\circ}$ and -6° of tilt so that their surfaces and internal structures can be determined.

A close inspection of all data from experiments on bacterial phagocytosis by winter flounder peritoneal cells revealed that: (1) granulocytes were capable of ingesting bacteria suspended in either sterile saline or tissue culture medium; (2) after 30 min granulocytes contained numerous bacteria, many of which were lysed; (3) the phagocytic granulocytes observed are morphologically identical to the "neutrophils" of the plaice (Pleuronectes platessa)--the plaice neutrophils reportedly are not phagocytic; and (4) the winter flounder granulocytes resemble the promyelocyte and myelocyte stages of mammalian neutrophils.

Three strains of amoebae from a fish hatchery in Bologna, Italy, have been studied to determine their correct identification. The amoebae were isolated from hatchery water, spleens of moribund fish, and "soft-eggs." Results of these studies are incomplete, but considerable progress has been made in culturing the amoebae in laboratory media.

Rock crabs, Cancer irroratus, collected near Ambrose Light (sewage sludge area) in March were predominately females in the paper-shell or post-molt condition. This finding is in marked contrast to earlier reports which proposed that adult females molted in late summer to early fall while males molted in winter. The molting activity of rock crabs may vary markedly along the Mid-Atlantic coast. These differences in the onset of molt must be considered when evaluating black gill disease of rock crabs.

The Long Island Sound striped bass pathogen was found to cause death in young striped bass at an intraperitoneal LD₅₀ of 40,600 bacterial cells. However, there appears to be a considerable genetic diversity in resistance in the fish population used (hatchery fish), since one fish in eight died with a dose of 1,000 cells and one fish in six survived a dose of 100,000 cells. If similar resistance patterns exist in natural populations, a disease condition could remain relatively limited. In fact, this may have occurred in the recent mortalities since healthy fish were caught in the vicinity of dead and dying fish.

Aquaculture: Control of Larval Disease Investigation

Data from ultraviolet-light (UV) experiments indicate that bacterial pathogens seeded in seawater can be killed by UV irradiation and that the seawater is then capable of supporting normal development of fertilized oyster eggs to the straight-hinge stage. UV studies on larval cultures reared to setting have been inconclusive, possibly because the adult oysters were spawned in non-UV-treated seawater. The oysters are now spawned in UV-treated seawater. Several total-plate-count tests were completed in attempts to optimize ozone dose and duration for the 300-gal quarantine system. A defective UV system was repaired, returned, and installed in series with the ozone disinfection stage. The complete system should be operational in about 3 wk.

Due to an improved technique for removing cells from crushed animals, motile, glass-attaching cells are now found in 2-day-old veliger oyster larvae (Crassostrea virginica). These cells are capable of phagocytosing bacteria by the third day of larval life. Hence the larvae appear to have a form of immune defense against pathogens even at this early stage. Previous reports that motile, glass-attaching cells are absent until day six and that phagocytosis does not occur until the third or fourth week are incorrect. Most of the larval animals upon which the erroneous observations were made did not live to the "setting" stage. Observations on other groups of fertilized eggs are continuing with the possibility that absence of phagocytosis in larvae may indicate a functionally deficient animal and predict failure to survive. Extracellular enzymes from oyster phagocytes have not been found in sufficient quantity to cause splitting of protein, lipid, or starch substrates embedded in gels. Because of evidence for phagocytic activity in very young cells, extracellular enzyme secretion becomes less important and more emphasis will be placed on identifying markers for intracellular activity.

Meetings, Talks, Visitors, Publicity

Dr. Rosenfield traveled to Woods Hole, MA, during 11-13 April to discuss the Ocean Pulse Program.

The First Annual Northeast Fisheries Center Research Meeting was held at Woods Hole, MA, during 24-26 April. Dr. Rosenfield attended the meeting. Dr. Bodammer was the Coordinator and presented a paper. Others from the Pathobiology Division who presented papers were Ms. Sharon MacLean, Mrs. Jane Wade, Ms. Carolyn Brown, Mr. Fred Kern, Mr. Austin Farley, Dr. Thomas Sawyer, and Mr. John Ziskowski. Dr. Rosenfield attended a meeting of the Promotion Committee on 27 April at Woods Hole.

Dr. Murchelano discussed programmatic matters with Drs. Blogoslawski and Robohm and Ms. Brown at Milford on 11 April and with Messrs. Ziskowski and LeBaron at Sandy Hook on 12 April.

Mr. Farley met with Mr. Yeariton and Dr. Brown at Narragansett, RI, to confer on cooperative work on Mya neoplasia.

Dr. Robohm attended the Northeast Shellfish Sanitation meeting at Centereach Long Island, during 12-13 April.

Mrs. Emily Ortt was given the Governor's Award for Handicapped Marylander of the Year, and a Personal Achievement Award at a luncheon in Baltimore, MD, on 19 April. She was selected over contestants from 23 Maryland counties.

Mr. Morris Ellison participated on the first leg of the Researcher cruise during 17-24 April. Mr. Martin Newman is participating on the second leg of the cruise.

The Oxford Laboratory welcomes Ms. Sandra (Sandy) Cassanelli from Worcester, MA, and Mr. Michael (Mike) Crosby from Falls Church, VA. Both are temporary biological laboratory technicians; Sandy is working with ROMP and Mike is working on molluscan pathology.

Visitors to the Oxford Laboratory were Mr. E. Spencer Garrett, NMFS, Pascagoula, MS; Mr. Byoung Seo Min, National Fisheries Research and Development Agency, Pusan, Korea; Mr. E. H. Hollis, Maryland Department of Natural Resources, Annapolis, MD; Mr. Haskell Tubiash, Maryland Department of Health and Mental Hygiene, Baltimore, MD; Mr. J. G. Snellenburg and Kirsten, Tina, and Brenda Snell and Jean McGonegal, all from Southold, NY. A group of scientists from Virginia Institute of Marine Science visited the Laboratory on 20 April.

Manuscripts

Blogoslowski, W. J., and M. E. Stewart. 1978. Paralytic shellfish poison in Spisula solidissima: anatomical location and ozone detoxification. Mar. Biol. 45:261-264. (P)

Blogoslowski, W. J., and C. Brown. Use of ozone for crustacean disease prevention: a brief review. Proceedings of the 2nd Biennial Crustacean Health Workshop, Galveston, Texas. (A)

Blogoslowski, W. J., M. E. Stewart, and E. W. Rhodes. Bacterial disinfection in shellfish hatchery disease control. Proceedings of 1978 World Mariculture Society. (S)

Brown, C. Evidence of a toxic effect on bivalve embryos by a red pseudomonad. Presented on 24 April 1978 at the 1st Annual NEFC Research Meeting, Woods Hole, MA.

RESOURCE UTILIZATION DIVISION

Resources Development and Improvement Investigations

Sampling and Harvesting Gear Development

The beam trawl is completed and is now aboard the cooperating vessel awaiting trials. The Rorqual is berthed at the State Fish Pier and is being scraped and painted. Work has been initiated on redesigning and refurbishing the Center's Shellfish Sampling Hydraulic Dredging System. A new dredge is being designed incorporating a submersible pump. The constant tension winch is being redesigned to simplify operation, and a number of dredge performance monitoring systems are

under development. Examples of the experimental lobster pot have been constructed and will be loaned for test fishing. Assistance was lent to the Woods Hole Laboratory by providing a person for a sea sampling trip aboard the Gloucester offshore fishing vessel Captain Scrod.

Processing Engineering

Several different devices were tested and evaluated in the course of investigating various concepts for the mechanical processing of squid. The devices, method of testing, and results have been documented in a compendium along with tables of test data and comments on the reliability of the method. The purpose of the compendium is to make our findings and conclusions available to anyone who is interested in building a squid processing machine so they will have some idea of the problems and parameters they may encounter if they follow a method that we have tested.

The Whiting Processing Machine has been loaned to Channel Fish Co. for a production run. The machine has been installed and will be put into operation when the plant is opened.

Species Identification

The unknown sample (February report) has been positively identified as king crab. This month saw a definite breakthrough in the resolution of bands. A collaborative study could probably be started next month in preparation for the method's acceptance as an AOAC official method.

Storage Study of *Mytilus edulis*

March samples were stored at -25°C for use as control taste-test samples to alleviate the problems encountered this winter when no fresh controls were available for comparison with frozen samples. No work has started on the micro Kjeldahl, as all the reagents have not yet arrived.

Reformed Crab Meat

A 9-mo frozen storage study on steamed red crab lumps was completed. The results are being analyzed and put into proper order to be incorporated in a report on crab meat reformed with alginates.

Squid

Two lots of thawed *Illex illecebrosus* were skinned on the Jensen fish fillet skinner to add to previous data on skin removal from squid by machine. A technical report on the comparison of manual versus machine skinning of squid is in progress.

Guaranteed Quality Program

Laboratory personnel and USDC Inspectors are still being screened as to their acuity in relating the odors of fresh fish to their 32°F storage-age. Although not enough data have been generated to select a panel of six or so, we have started to look into the effects of packaging on the 32°F storage life of fresh fish.

Comments have been received from economist reviewers of our report on the Guaranteed Quality Program. The draft of the final report is now being typed.

New Product Development

After installing and checking out our heading and gutting machine in the commercial fish processing plant, we found that one of the motors was inoperable. A new one has been ordered and will be installed shortly. The most optimistic date for the trial run is in mid- to late May, depending upon how rapidly the new plant is finished.

Product Quality, Safety, and Standards Investigations

Product Quality

A study was conducted to determine the accuracy and reliability of the Torrymeter for measuring freshness of iced Atlantic cod. The Torrymeter is a hand-held instrument which measures the dielectric properties when its electrodes are in contact with the skin of fish, and this parameter is reputed by the manufacturer to correlate with quality. This study revealed that a lower meter reading resulted if the fish had been bruised or previously frozen, or if the measurement was performed on the side of the iced fish stored facing down as compared to the side facing up.

In an experiment in which the fish were stored with the dorsal side up, the following results were indicated: There was no significant difference in meter reading due to size of fish of similar post-mortem age, but there was a difference in reading at various positions along the lateral line. Readings taken along the dorsal region were usually lower than the corresponding reading along the lateral line. There was no difference in the readings taken at similar positions on both sides of the fish. There was a high degree of linear correlation ($r = 0.99$) between log meter reading and cooked flavor score, and also between log meter reading and trimethylamine content, a chemical index of freshness. Preliminary results indicated a lower meter reading for skinless fillets compared to skin-on fillets.

This study will be continued with iced, skinless Atlantic cod fillets and, also, with other species of fish. It is premature at this time to arrive at a conclusion regarding the usefulness of this instrument.

Product Safety

Workup of cold-smoked salmon samples is continuing. A new gas liquid chromatography column has been conditioned. GC conditions for the separation of 14 volatile N-nitrosamines as well as Sigma 10 parameters have been established. An automatic digital valve sequence programmer has been installed into the Perkin-Elmer 910 gas chromatograph. Analysis of cold salmon extracts by gas liquid chromatography has been completed on some of the worked-up samples. The output of the liquid chromatography step in the multidetection method has been doubled by modifying the configuration of one of the hoods. A new water bath with its own thermostat and circulating pump was made to accommodate the extra output. Some extracts were taken to the Thermo Electron Corporation for nitrosamine analysis by GC-TEA. GC-MS work of spiked whitefish extracts is continuing.

Product Standardization

A Codex Draft Code of Practice for breaded/battered products was sent to processors for review. Gloucester Laboratory personnel reviewed a Codex Draft Code of Practice for smoked fish.

A representative from the US Army Natick Research and Development Command visited the Gloucester Laboratory to resolve specific comments on the requirements for breaded oysters in the Federal Specification for Oysters, Raw, Shucked.

A USDC Inspector started working with the standardization unit on a study of cook-drip methodology and objective measurement of bone in fillets and fish blocks.

Comments received at an Inspection Conference on the revised General Fillet Standards for Grades indicated some confusion over the meaning of "U.S. Grade C" and "Substandard." Definitions for these classifications were rewritten and sent to the Washington, DC, office.

One of the quality requirements for graded fish sticks and portions is the amount of shrinkage after cooking. USDC Inspectors have encountered problems with this requirement when grading fish sticks and portions made from some species not in general use at the time their Inspector's Instructions were originally written. Accordingly, this section was rewritten in four Inspector's Instructions for fish sticks and portions and sent to the Washington, DC, office.

To increase the use of species of fish other than Atlantic cod, haddock, redfish, and yellowtail flounder, John Ryan has arranged for inclusion of pollock fillets and silver hake blocks on the agenda of the next meeting of the Armed Forces Product Evaluation Committee to be held on 9 and 10 May at the US Army Natick Research and Development Command.

Technical Assistance, Visitors, Meetings, Training

Technical Assistance

We have arranged to supply the US Army Natick Laboratory with smoked whitefish; and have arranged with a New Bedford firm to supply the College Park Laboratory with winter flounders.

Assistance was given to Mr. Ernie Viera of Essex Agricultural School and his class of food nutritionists in the preparation of mussels for consumption at the school's annual open house.

Steven Powell of Harris Yacht in Portsmouth, NH (fishing vessel deck equipment), and Walter Kalil, Jr., a boat owner in Newburyport, MA (net reels), received technical assistance.

We arranged to provide crab specimens to the Gloucester Story Museum.

We also provided material for fisheries display to George Soderberg of the Gloucester OEDC.

We responded to inquiries on the following: distinction of commercially important hakes imported from South America; American versus European anglerfishes; rarity of occurrence of golden-colored haddock; thawing methods of frozen whole fish; underutilized species of fish of Massachusetts waters; how to determine whether lobsters were alive or dead before cooking; food values of fish flesh; most practical methods of shipping live lobsters; formulas for artificial seawater; significance of nematodes in fish flesh; packaging materials for shipping live lobsters and crabs; use of special paper pressware for cooking in microwave ovens;

identification of wolffish (Anarhichas denticulatis) not ever known to have been recorded from the Gulf of Maine; smoking preservation of silver hake; statistics on local silver hake catch; rapid salting of fish; flavor additives to fish products; mariculture using power plant effluents; names of clam processors; chemical contaminants in clams; information on swordfish and sharks; red crab; squid; general information on fisheries and the fishing industry for the US Army Corps of Engineers; aquaculture; fishing gear; abnormal conditions in Dover sole; fishing vessel safety; desalination; availability of salespersons to work for a seafood broker; technology of preparing a canned clam meat product; establishing a facility in this area to prepare dried squid for export; reestablishing company records of a seafood broker whose records were destroyed in a fire; what, if any, requirements exist for allowable breakage of softshell clams as a result of interstate transport; existence of standardized methodology for determination of drip fluid (drained weight) in fish fillets and fish blocks; products which might be made commercially from minced fish; methods of longlining to a local fisherman; interpretation of USDC sampling plan for a producer; explanation of inspection techniques for redfish fillets being bought by the military.

Visitors

Mr. Eric Tholix, Extraco Co. (Sweden), and Messrs. Ackert, Iamoto, and Hansson of the Gorton Group, visited to discuss use of chemical additives for stabilizing texture of minced fish.

Meetings

Several members of the Gloucester Laboratory attended the First Annual NEFC Research Meeting sponsored by IYABA at Woods Hole.

Judi Krzynowek attended "Electrophoresis '78" hosted by Dr. Nicholas Catsimpoilas at MIT, Cambridge, MA.

Fred King participated in a workshop meeting, 24 April, at the US Army National Research and Development Command with representatives of the Food Sciences Laboratories. The topic was determination of market names for hake and hake-like species.

Fred King spoke on "Food Technologists' Role in Seafood Research" to students at the Waterbury Branch of the University of Connecticut on 27 April.

Fred King participated in a conference during 28-31 March sponsored by the Seafood Quality and Inspection Division in St. Petersburg, FL.

Joe Mendelsohn gave a talk on a special phase of the deboning of fish at a meeting in Riverhead, Long Island, sponsored by the New York Sea Grant Extension Program.

Don Gadbois attended and participated at an executive smoked fish committee meeting in Chicago, IL, on 13 April.

Perry Lane attended and participated in meetings of the New England Marine Advisory Service working group on communications in Boston; the New England Fisheries Steering Committee in New Bedford; the New England Fisheries Development Task Force in Gloucester; and an evening discussion on Limited Entry in Gloucester.

Louis Ronsivalli and Perry Lane met with members of the New England Fisheries Steering Committee to discuss the Guaranteed Quality Program.

Manuscripts

Ronsivalli, L. J., C. Gorga, J. D. Kaylor, and J. H. Carver. 1978. A concept for assuring the quality of seafoods to consumers. Mar. Fish. Rev. (S)

Bakal, A., P. Garber, and J. M. Mendelsohn. 1978. Ocean quahog rivals surf clam domain, wins quality objectives. Food Product Development. (S)

Ryan, J. J. 1978. Cod, elements of food technology. AVI Publishing Co., Inc. pp. 385-386. (P)

Ryan, J. J. 1978. Preparation of fish fillet blocks. Mar. Fish. Rev. 40(1):5-12. (P)

NATIONAL SYSTEMATICS LABORATORY

Benthic Fishes

Work continued on a report on a collection of ophidioid fishes trawled by Soviet vessels off West Africa.

Pelagic Fishes

Work continued on the description of a new species of Spanish mackerel from Australia and New Guinea. Research continued on halfbeaks.

Shrimps

Research continued on postlarval Penaeus and a revision of the genus Penaeopsis.

Other Crustaceans

Work continued on a guide to the temperate-water decapods of the US east coast.

Meetings, Talks, Visitors, Publicity

Dr. Collette presented a seminar on Spanish mackerels at the Virginia Institute of Marine Science. Drs. Collette and Cohen each participated in a different Ph.D. oral examination at VIMS. Collette finished teaching a one-term course in ichthyology at George Washington University. Visitors during the month included Dr. Dirk Nolf of the University of Gent, Belgium, who spent 2 wk studying otoliths; Dr. Butler of the Huntsman Marine Laboratory in New Brunswick; and two scientists from the People's Republic of China.

Manuscripts

Collette, B. B., and N. Parin. Four new species of halfbeaks (Hemiramphidae) from the Indo-West Pacific. Proc. Biol. Soc. Wash. (S)

Collette, B. B., J. L. Russo, and L. A. Zavala-Camin. 1978. Scomberomorus brasiliensis, a new species of Spanish mackerel from the western Atlantic. Fish. Bull., U.S., 76:273-280. (P)

ATLANTIC ENVIRONMENTAL GROUP

Ocean Monitoring and Climatology Task Group

A one-page report updating the location and configuration of warm-core Gulf Stream eddies adjacent to the continental shelf in the Middle Atlantic Bight was submitted for publication in the May Atlantic Notice to Fishermen, and also was released to a mailing list of interested individuals at the same time. This report points out that once again during April no warm-core eddies were observed. In addition, the offshore movement of the shelf water front which began in March continued in April, placing the front 150 km or more seaward from its normal position in the northern Middle Atlantic Bight. It isn't known at this time what relationship, if any, there is between the absence of eddies and the excursion of the front.

During April the cooperative Ship of Opportunity Program obtained nine XBT transects, two in the Gulf of Maine, three across the southern New England shelf along the 71°W meridian, two across the shelf and slope off New York, one off Cape Hatteras, and one in the Gulf of Mexico. To preserve the Portland, ME, to Yarmouth, NS, transect, it was necessary to transfer an XBT system from the M/V Marine Cruiser to the M/V Marine Evangeline in the latter half of April.

Ocean Dumping Task Group

Cruise SC509-MI-78 aboard the OSS Mt. Mitchell was conducted during 5-14 April from Norfolk, VA, in support of the NOS/NOAA Ocean Dumping Studies Program. This cruise investigated the dispersion of 300,000 gal of dyed industrial waste from the duPont facility at Grasselli, NJ, using a high frequency acoustic system and fluorometers sensitive to the dye tracer. Physical measurements included X and water-sampling hydrographic casts to 1000 m. These data will be used to interpret the dispersion experiment and the associated biological and chemical sampling.

Preparations have been initiated for the 11-17 June cruise effort aboard the R/V Kelez. These have included a purchase of 1,000 lb of Rhodamine WT dye and sampling equipment to obtain uncontaminated zooplankton samples for trace metal analysis. A Plessey STD system will be submitted to Woods Hole Laboratory for checkout and possible repairs.

A revised version of the report covering the July 1977 cruise and dispersion experiment (Albatross IV Cruise No. AL 77-05) will be submitted to the Program Office shortly. Data analysis from the January 1978 and April 1978 cruises is continuing and will be reported.

Meetings, Talks, Visitors, Publicity

Jim Bisagni participated in a cruise aboard the OSS Mt. Mitchell from Norfolk, VA, in support of the NOS/NOAA Ocean Dumping Studies Program during 5-14 April.

John Gunn attended the American Geophysical Union spring meeting in Miami, FL, during 17-24 April and presented a paper on the "Baroclinic Currents and Advection of Water Masses Along the Antilles Arc."

Reed Armstrong traveled to Galveston, TX, to conduct hydrographic studies and to attend a meeting of the Source Evaluation Board, Buccaneer Field Studies, during 24 April - 5 May.

Mert Ingham attended a meeting of the Promotion Review Committee at Woods Hole on 27 April.

Manuscripts

Chamberlin, J. L. 1978. Passage of a Gulf Stream warm-core eddy recorded by the vertical temperature array on a NOAA buoy. Gulfstream (NOAA) 3(12):6-7. (P)

Cook, S. K. 1978. Expendable bathythermograph observations from the NMFS/MARAD Ship of Opportunity Program for 1975. NOAA Tech. Rep. NMFS-SSRF. (A)