

NORTHEAST FISHERIES CENTER

NEWSLETTER

MARCH-APRIL 1983

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US DEPARTMENT OF COMMERCE
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"NORTHEAST FISHERIES CENTER NEWSLETTER"

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THE NORTHEAST MONITORING PROGRAM (NEMP): AN ASSESSMENT

by

Dr. John B. Pearce, Chief
Environmental Assessment Division

INTRODUCTION

The Second Annual Northeast Monitoring Program Workshop was recently concluded at Milford, Connecticut. The meeting was held during 22-24 February 1983, and provided an opportunity for principal investigators and contract research personnel to compare data and discuss the results of monitoring and research. An atmosphere was created in which all present could provide an overview of their previous year's work.

The contributions of the Northeast Fisheries Center, in general, and the Environmental Assessment Division, in particular, were numerous and far reaching. Clear evidence was presented, as noted below, that the general situation in the northeastern portions of the western Atlantic Ocean was becoming more critical with time. The sessions were divided up into three disciplinary sections which focused on water quality, sediment contaminant burdens, and indicator species health.

WATER QUALITY

Twelve papers were presented under the topic "Water Quality and Phytoplankton." The general concensus of the nutrient and phytoplankton presentations was that the coastal areas, particularly those associated with the Hudson-Raritan Bay complex, the Delaware Bay, and the Chesapeake Bay, had been, and continued to be, subject to eutrophication due to runoff of nutrient-rich materials from the river-estuarine systems involved (Figure 1). Particular attention was given to patterns of phytoplankton growth in relation to fishery abundance within the same regions and to the monitoring of those species of phytoplankton which are known to cause toxic "blooms." Because of growing interest in paralytic shellfish poisoning and the possible spread of the causative organism into the southern regions of New England, attention was given to a study of dinoflagellate resting cysts and their value in monitoring what might become a potentially dangerous situation. The session concluded with a discussion of remote sensing techniques as tools for both monitoring the environment and for the delineation of water management units based on water-mass boundaries visible on satellite imagery (Figure 2). Computer programs will soon be available which will allow investigators literally to "scan" through a year's worth of satellite images on a display device and "see" seasonal changes in chlorophyll patterns and temperature distribution over time. Such a system may bring to light processes and interrelationships which were not previously evident. Several papers also indicated the efficacy of remotely sensed images in following plumes from estuaries seaward and how they interactd with the dumpsites.

SEDIMENT QUALITY

An additional 12 papers were presented on the subject of sediment quality and benthos (Figures 3 and 4). An analysis of the physical and

chemical properties within the Northeast Region provided a statistical method through which changes in contaminant concentrations could be attributed to either normal geochemical processes or to increased pollutant loads (Figure 5).

The Environmental Assessment Division reported large decreases in the numbers of species (a variable usually inversely related to environmental stress) at many stations between summer and winter 1980. Only a few of the decreases could be attributed to seasonality. By summer 1981, numbers of species returned to typical values at almost all stations for which data were available. Amphipod densities at most stations were stable from 1979 to 1981. The decreases in species numbers in December 1980 are, therefore, not considered indicative of *continued* environmental degradation, apparently representing a greater natural variability than had been evident in the previous data.

Declines in species numbers did continue through July 1981 at four New York Bight stations: the Fire Island and Hudson Shelf Valley "control" areas, the sewage sludge dumpsite, and the deposition area. The last two stations, and the dredged material dumpsite, continued to contain the most altered benthic fauna of any NEMP sites as shown by cluster analysis and dominant species lists, as well as by low numbers of species and amphipods. At the Shelf Valley site, numbers of the pollution-sensitive amphipod, *Ampelisca agassizi*, dropped by 80 percent from summer 1980 through winter 1980 to summer 1981, paralleling the decline in species richness at that site (which had been considered the shoreward limit of *A. agassizi* dominance, and thus of uncontaminated conditions, in the Shelf Valley). Preliminary data indicated that another sensitive amphipod, *Rheporynius epistomus*, had become scarcer at the Fire Island site since the early 1970's, and more recently at the midshelf station off Delaware Bay. These trends could signal increasing degradation of the mid-Atlantic central shelf.

To ascertain the ecological importance of these findings, it must be determined whether: (1) these animals persist in macrofauna samples presently being analyzed, and (2) if similar trends are found in NEMP data on concentrations and/or sublethal effects of contaminants.

There was again high faunal similarity between the three stations from the mouth of Chesapeake Bay to 37 kilometers south of the Bay mouth, which were dominated by several of the same stress-tolerant polychaete species found near the New York Bight dumpsites. One year after disposal ceased at the Philadelphia dumpsite, the dumpsite stations had species numbers and composition similar to those at other midshelf stations. If densities of *A. agassizi* were indeed reduced by dumping, no recovery was evident as of December 1982. The analyses used did not reveal any other site to be obviously stressed by contaminants. Spatial patterns in numbers of species of amphipods were highly consistent with previous data.

Comparison of benthic macrofaunal biomass in the New York Bight Apex showed similar distribution patterns in 1973 and 1980, with highest values in and east of the Christiaensen Basin and northwest of the dredged material dumpsite, and lowest biomass generally in shallower sandy areas. Preliminary data indicate that the distribution of estimated secondary production closely follows that of biomass.

Heavy-metal analyses showed possible continued addition of these materials to areas such as Georges Bank, previously thought to be unimpacted by anthropogenic discharge. These trends were reinforced by papers presented under organism health as noted below.

In-situ studies were reported for several areas within NEMP's boundaries. Of particular interest in these presentations was the reported influx of grazing sea urchins which had depleted the kelp forests in one of the areas studied. This deforestation was documented by underwater photography. The potential impact of this reduction of large fixed marine algae was described as serious as there is some experimental and landing data which indicate that a reduction in kelp leads to a concurrent reduction in American lobster landings. The connection is believed to be that the macroalgae provides a nursery ground and refuge for the juvenile crustaceans. Further study in the geographic area concerning this apparent relationship is planned.

Within the same framework, statistical studies were presented which demonstrated the feasibility of describing areas using cluster analysis and MANOVA techniques. Within the New York Bight Apex, concentrations of various organic and inorganic pollutants were used successfully to delineate differences between the dredge material disposal site, the 12-mile sewage disposal site, an intermediate site between these two, and a relatively unimpacted area. This study provided evidence that pollutant levels from samples with a known origin can be used to characterize these areas within specific geographic limits. Knowing the parameters necessary to achieve a significant differentiation, such techniques can be used to describe impacts discovered in previously pristine locations (Figure 6).

INDICATOR SPECIES

By far, the majority of the papers presented treated the topics of contaminant burdens and indicator species health (Figure 7). Twenty papers were presented, making this section the largest of the three.

If there is any conclusion that could be drawn from these papers, the strongest was that contamination was a growing problem within the NEMP region and that there are numerous methods which may be used to demonstrate this point.

Beginning at the microscopic level, evidence was presented that the presence of *Clostridium perfringens*, fecal coliforms, and species of potentially pathogenic marine amoebae at the mouths of all major estuaries within the region, were clear indications of increased contaminant loadings in these areas. Since *Clostridium* spp. and *Acanthamoeba* spp. both form cysts (in the case of the latter, viable after 33 months of refrigeration), these two organisms represent a potential threat as they may be carried by currents into unpolluted areas and, if bacterial or other food sources are present, become environmentally active.

At the cellular level, immune responses, genetic anomalies, blood cell irregularities, and immunodeficiencies resulted from increased exposure to organic and inorganic contaminants in the environment. These, in turn, could lead to skeletal deformities and corneal erosion in fish among other problems. Both these conditions lead to decreased life expectancy and increased mortality within the species involved. Of particular interest within this series of papers was the first experimental infection of the winter flounder by *Gulgea stephani*. This series of observations led to the conclusion that this infection, previously reported only in live fish taken from the environment, could be fatal and was most prevalent in those areas heavily impacted by pollutant discharges (e.g., Raritan Bay).

In crustaceans, an increase in black gill disease and eroding of the carapace line in the Atlantic rock crab (*Cancer irroratus*) was reported.

These animals had been collected in areas of the New York Bight, the Philadelphia dumpsite, and off Georges Bank. The investigator reported elevated metal levels, especially cadmium, in crabs taken in the last area and concluded that, based on his study, there were no areas within the NEMP region which any longer could be considered "clean control" because of the apparent widespread distribution of heavy metals. This conclusion was supported by other evidence which noted elevated levels of polychlorinated biphenyls (PCB's) in other organisms from the same location.

All of these factors, and, in addition, increased concentrations of pollutants within the sediments, contribute to changes in behavior which were noted by several speakers. Two experiments in particular noted that burrowing rates for clams and the sand lance decreased with increased petroleum contamination of the sediments, and the fish spent more time in the water column than within the bottom materials. When animals which normally burrow in the muds are unable or unwilling to do so, they become more exposed to predation and, hence, become reduced in numbers. For a food species like the sand lance, this effect can be especially important. For a commercially exploited shellfish, the results can have an economic as well as ecological significance.

CONCLUSION

The Workshop, then, presented a compendium of results which, taken on an overall basis, showed that the indicators of health for the NEMP region revealed patterns of a consistent, if very gradual, decline. The spread of heavy metals and organic contaminants to areas throughout the region was evident in both the sediment quality and organism health sections, and the increased nutrient enrichment of coastal areas was a keynote of the water quality presentations.

In evaluating the results of the past NEMP efforts and future responsibilities, a cooperative effort is envisioned which will unify all of the existing data-base information into files which can be easily accessed and merged for statistical and other analytical purposes. In many cases, the overview of an ecological situation which can be provided by computer modeling or simulation can offer insights which might not come to light otherwise. In instances for which sufficient data now exist, a "normal" data set can be developed, into which anomalies can be injected to assess possible impacts of unusual biological situations or climatic events. A coordination of effort between mass-energy model builders and NEMP monitoring personnel could result in the widespread use of electronic assessment techniques. Of course, such efforts are expensive and do not eliminate the necessity for in-situ monitoring activities to continue.

Finally, special attention was given to the matter of developing risk assessments using these and future data. It is necessary to quantify the significance of contaminant loading in the physical environment and of measured biological effects.

The Second Annual Northeast Monitoring Program Workshop was a great improvement over the previous effort as noted by the speakers and observers. There is reason to believe that this event will continue to be scheduled on an annual basis and that, with time, the value of this meeting will increase as will the interaction between the participating individuals and agencies.

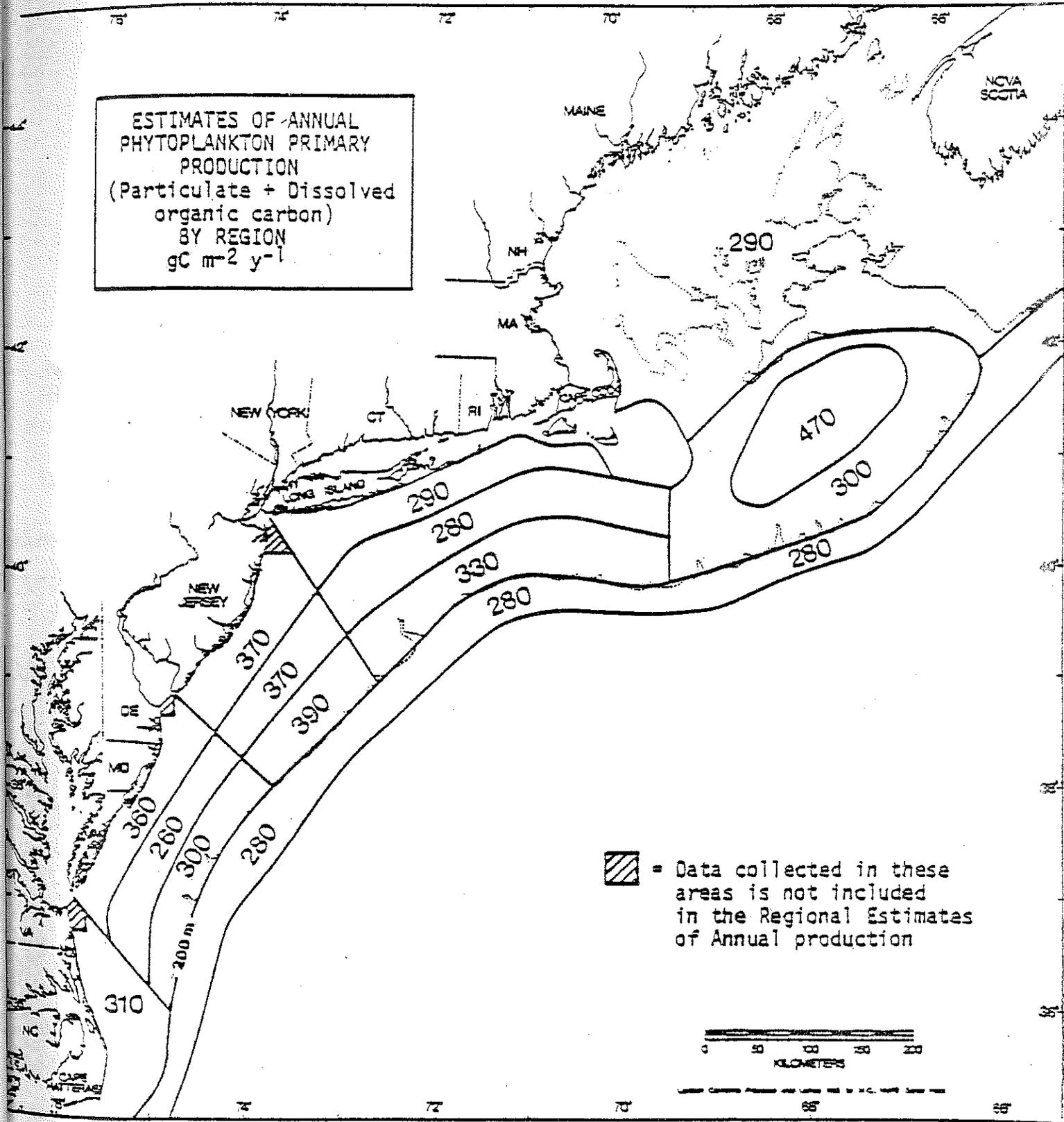


Figure 1. Estimates of annual phytoplankton production (particulate and dissolved organic carbon) by region, $gC\ m^{-2}\ y^{-1}$. Data collected from 1977 to 1980.

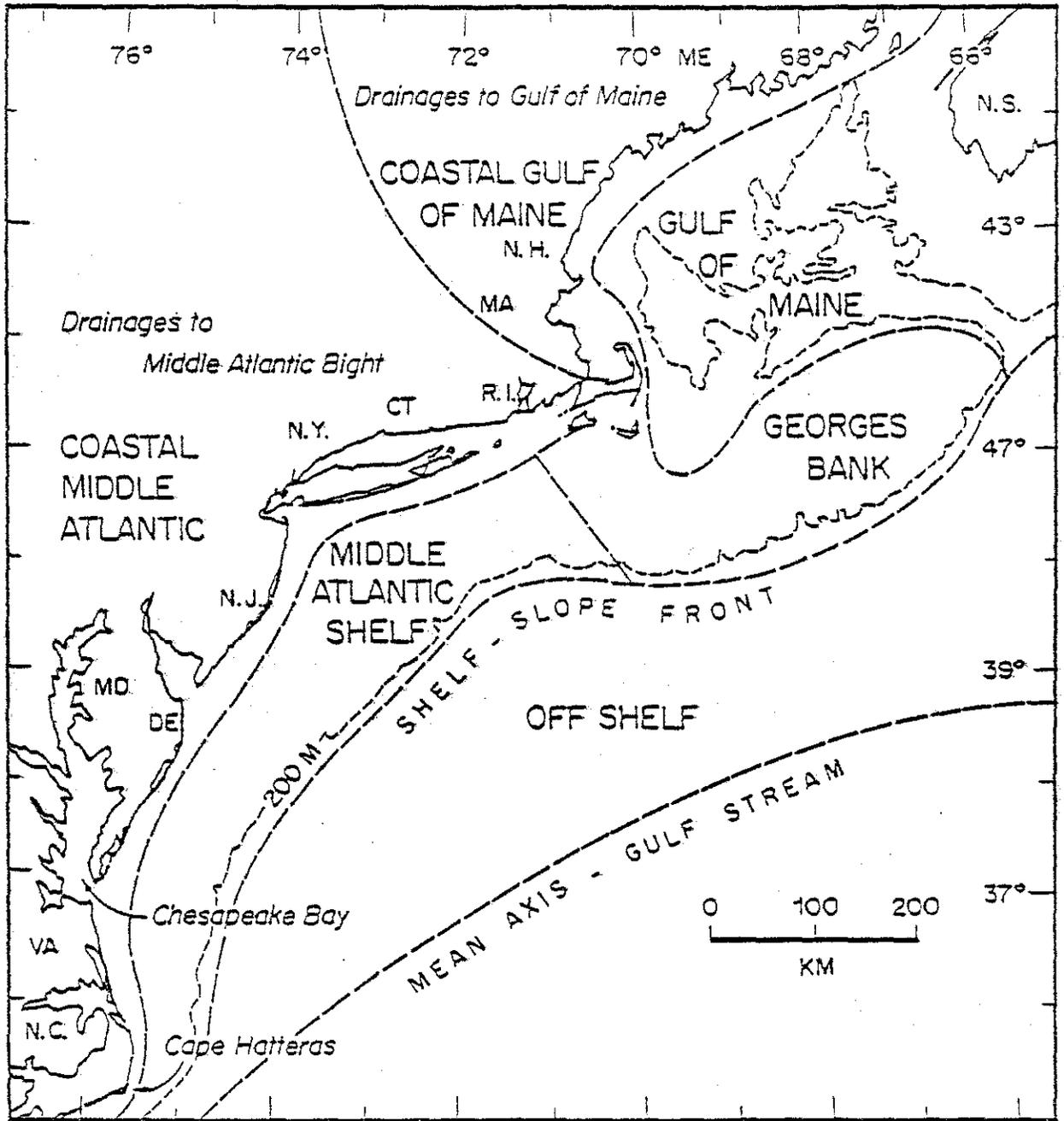


Figure 2. NOAA's Regional Action Plan (RAP) water management unit areas.

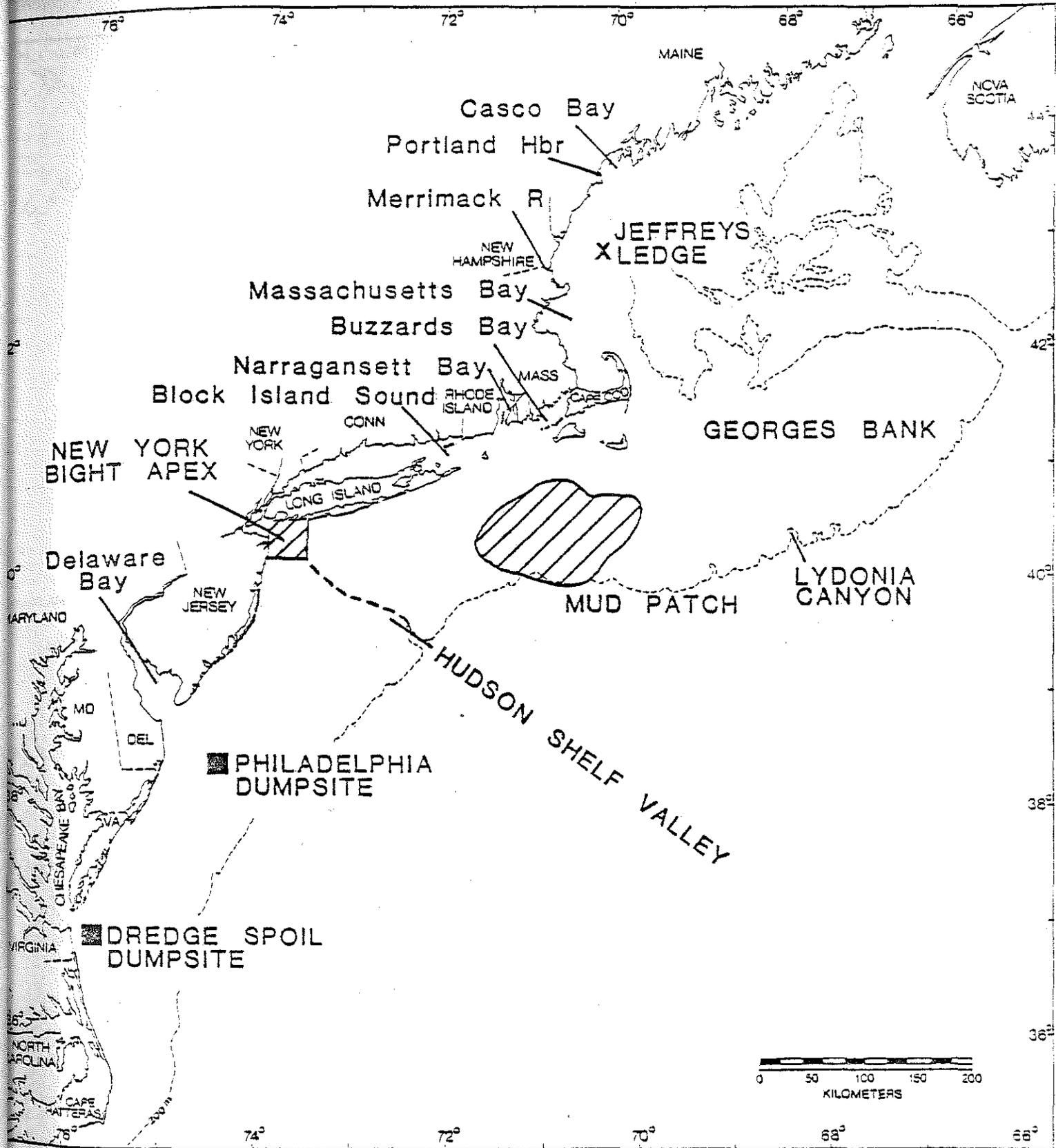


Figure 3. Location of specific areas discussed for sediment quality assessment.

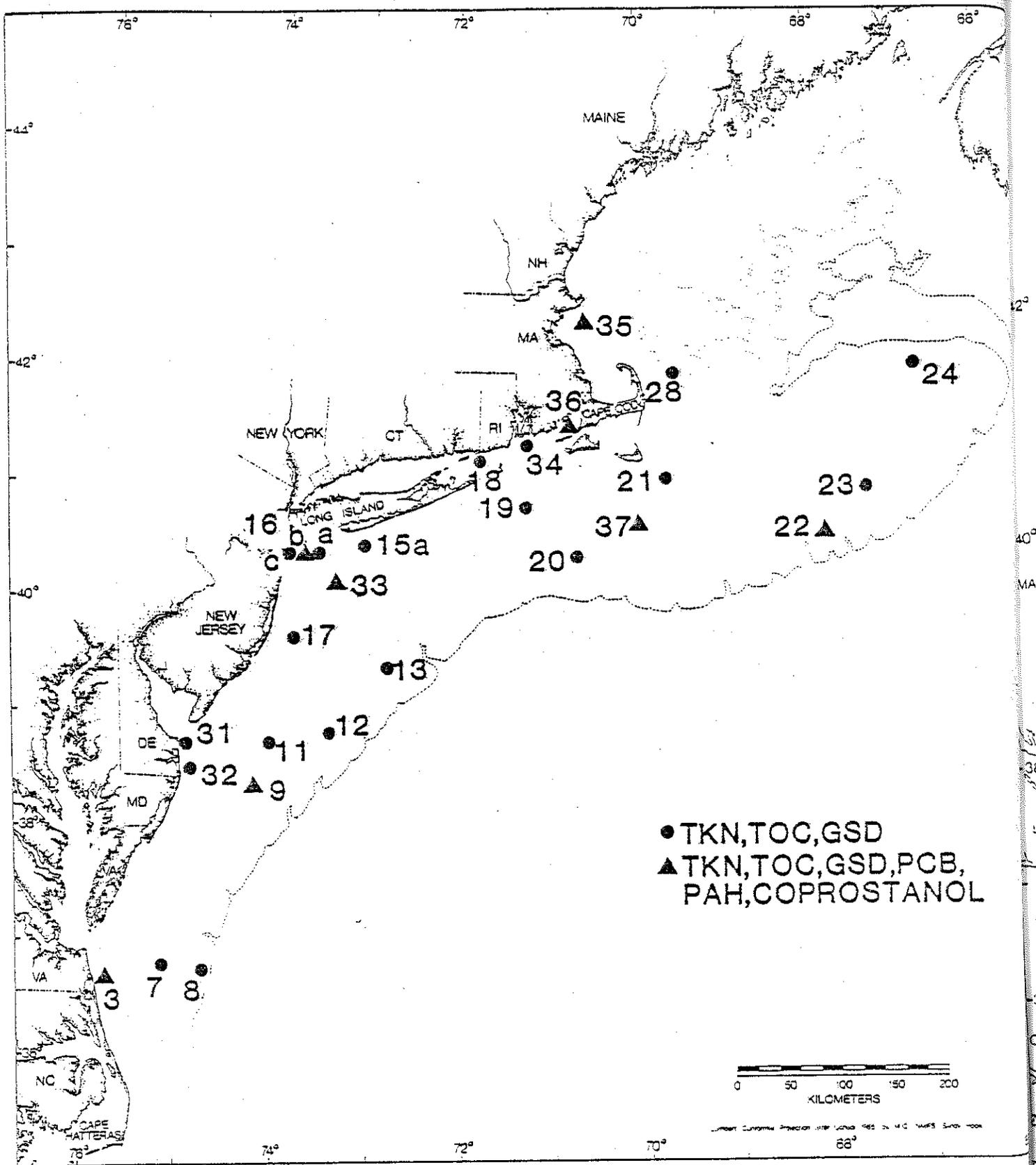


Figure 4. Sampling locations for sediment quality monitoring in 1981.

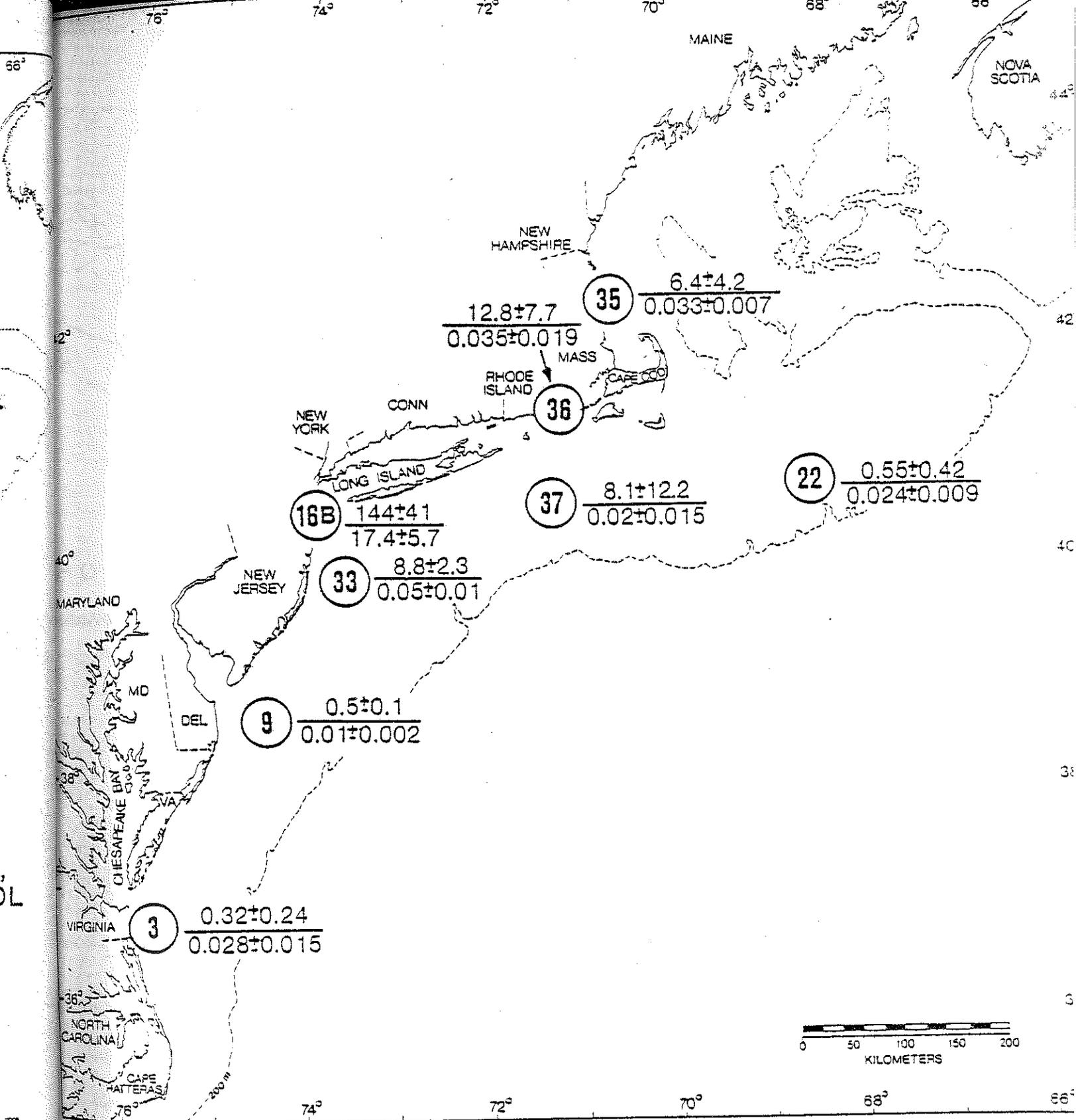


Figure 5. Sediment PCB (upper number --ppb) and coprostanol (lower number --ppm) levels with one standard deviation (means of five replicates) for 1981 sampling.

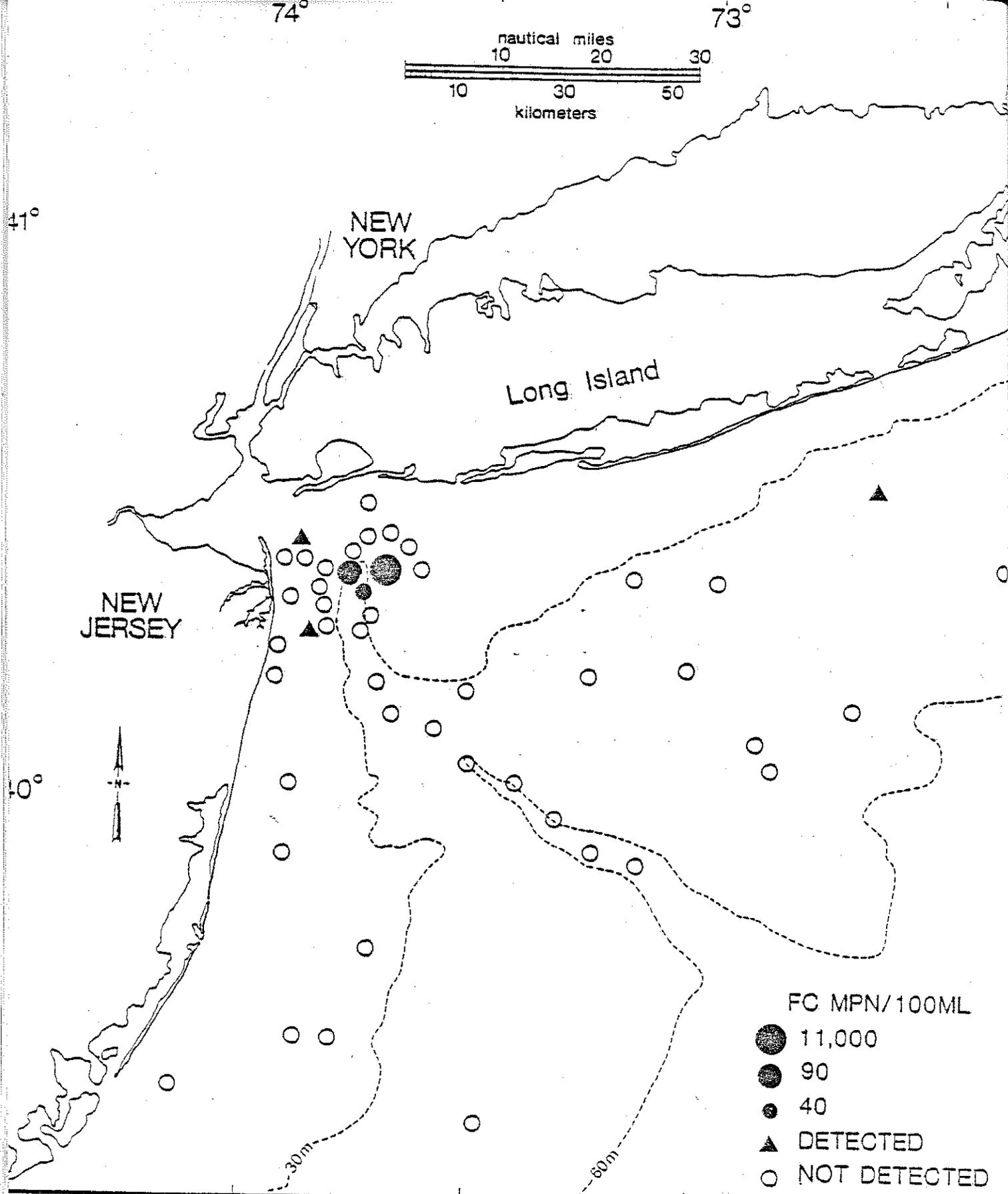


Figure 6. Fecal coliform (FC) levels in bottom sediments of the New York Bight during the summer of 1981.

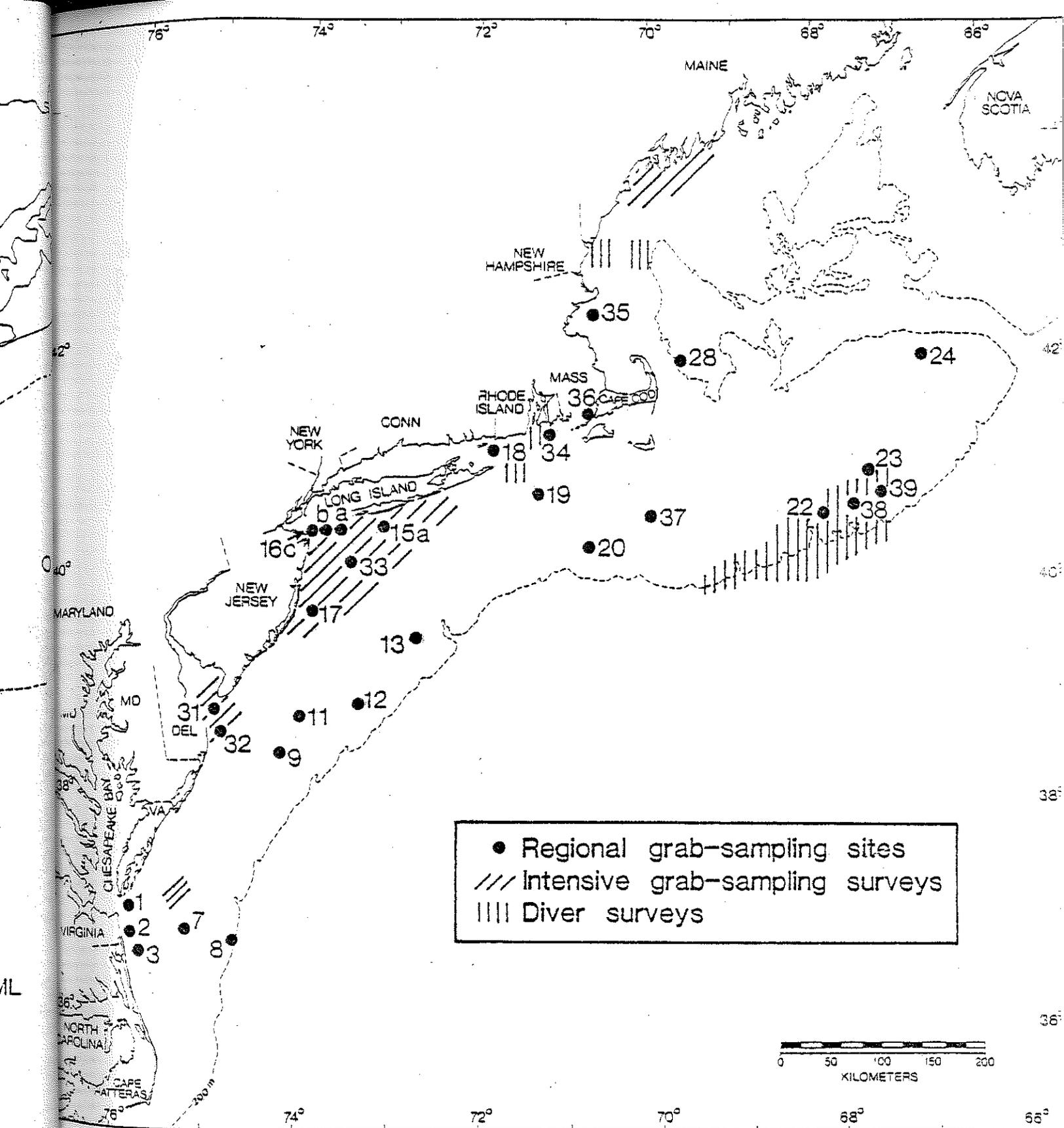


Figure 7. Sampling locations for benthic macrofauna.

RESOURCE ASSESSMENT DIVISION

submitted by

Dr. Bradford E. Brown, Chief

Editor's Note: The following writeup covers the November-December 1982 period, but was submitted too late to be included in the September 1982 - February 1983 issue. No writeup was submitted for March-April 1983.

RESEARCH ACTIVITIES

Administrative duties required the devotion of a considerable amount of Brad Brown's time during November and December. Brad met with Jim Taormina and the entire Resource Assessment Division to explain the detailed review of the Division's staffing and personnel classification system. During November, each of the Division's permanent staff was interviewed by personnel officers from the Regional Office and several individuals were also given detailed desk audits. The report of the personnel review was received in late December and is currently being studied by Brad. A committee was organized to oversee the merger of the fisheries library with the libraries from the other institutions into a joint Woods Hole scientific community library; Anne Lange is chairing the committee. With the acquisition of funds for a new addition or building at the Laboratory, Brad spent much time addressing the "space" issue with a committee made up of representative so the various components of the Laboratory and chaired by Dave Potter. Brad, Dick Hennemuth and Herb Stern also met with representative of the US General Services Administration and the regional contracting office concerning the construction in Woods Hole. Brad also met with the Laboratory Promotions Committee in November. Several promotions will be forthcoming as a result of the meeting. A hydroacoustics research proposal from the Draper Laboratory was worked on by Brad and Dick Hennemuth; and with Emory Anderson, potential uses of Polish vessels in a mackerel experiment in early 1983 were developed. Brad also worked with Ron Schultz and Vaughn Anthony to firm up the proposed contracting of the collection of Rhode Island commercial fishery statistics to the State of Rhode Island.

Work continued on the preparation of materials for inclusion in the Georges Bank atlas to be published by the MIT Press. Brad Brown is preparing a chapter concerning the fishery resources in the Georges Bank region while Mike Sissenwine and Mike Fogarty, along with Marv Grosslein, are contributing a chapter on fisheries research in the region.

Mike Sissenwine also participated in the ongoing NEFC ecosystem modeling activities as well as in meetings discussing the continuing USA-Canada boundary dispute.

Emory Anderson completed the 1982 mackerel and, with Gordon Waring, butterflyfish assessments. Emory also worked with Steve Murawski in an analysis of northeast regional fisheries catch statistics in an attempt to group the data by species, area and gear to obtain possible management units for the Regional Director's Fishery Management Plan Priorities Committee. Emory also worked with Louise Dery on a draft report dealing with recent problems in mackerel age interpretations between the US and

Canada. Emory reviewed several other reports and draft assessment documents and provided advice and information on the hakes and mackerel to various federal offices as well as to commercial interests such as Joint Trawlers, Ltd., of Gloucester, Massachusetts, and Marine Development, Inc., of Boston.

Emory, along with many other members of the Division, prepared updated reviews of the status of all the species/stocks for which we are responsible for inclusion in the 1982 Status of the Stocks document which should be completed in early 1983.

Steve Clark, while attending the Northern Shrimp Technical Committee workshop in November assisted in the preparation of a report entitled, "Gulf of Maine Northern Shrimp Stock Status - 1982," which was submitted to the Northern Shrimp Section of the Atlantic States Marine Fisheries Commission.

Mike Fogarty began an examination of the effects of environmental influences on herring recruitment in the Gulf of Maine. He also provided analyses of the herring fishery for the Maine Department of Marine Resources for use in the development of their Regional Herring Management Plan. Mike also examined the usefulness of autoregressive moving average time series models for recruitment predictions.

Harold Foster and several others participated in the autumn bottom trawl survey which was completed on November 12.

Anne Lange, in addition to devoting a considerable amount of time to the Library Transition Committee worked on US catch and effort data, both historical and recent, for use in the US-Canada boundary dispute. Anne began an assessment of the *Loligo* squid based upon cohort structure and also worked with Marv Grosslein in reviewing a Woods Hole Oceanographic Institution-Sea Grant proposal for a squid marketing project. Anne also began organizing a foreign Fishery Observer training program to be held in January 1983.

Steve Murawski prepared an analysis of potential impacts of the Philadelphia dumpsite on commercial shellfish in the Middle Atlantic Bight requested by Bob Reid of the Sandy Hook Laboratory.

REPORTS

Anderson, E.D. 1982. Status of the Northwest Atlantic mackerel stock - 1982. NMFS, NEFC, Woods Hole Lab. Ref. No. 82-44, 45 p.

Murawski, S.A. and F.M. Serchuk. 1982. Assessment and current status of offshore surf clam, *Spisula solidissima*, populations off the Middle Atlantic coast of the United States - autumn 1982. NMFS, NEFC, Woods Hole Lab. Ref. No. 82-43.

Waring, G.T. and E.D. Anderson. 1982. Status of the Northwest Atlantic butterfish stock - 1982. NMFS, NEFC, Woods Hole Lab. Ref. No. 82-45, 20 p.

MISCELLANEOUS

Travel, Meetings, and Presentations

On November 3, Emory Anderson and Steve Murawski attended the Middle Atlantic Fishery Management Council's Scientific and Statistical Committee meeting in Philadelphia, Pennsylvania.

During November 3-5, Steve Clark attended the Northern Shrimp

Technical Committee Workshop in Gloucester, Massachusetts.

On November 6, Mike Sissenwine attended the New England Population Biologists meeting and presented a paper entitled, "Empirical examination of species interactions of fishery resources off the northeastern USA."

On November 17, Steve Clark attended a meeting of the Northern Shrimp Section of the Atlantic States Marine Fisheries Commission in Portsmouth, New Hampshire.

On November 19, John Boreman and Gordon Waring attended a meeting of Atlantic Fisheries Biologists in Newport Rhode Island, and John presented a talk entitled, "Status of Research and Management of Striped Bass in the Northeast."

On November 19-20, Steve Murawski attended the birth of Jill Diana Murawski at Falmouth, Massachusetts.

On November 24, Brad Brown and Tom Azarovitz met with Bill Watkins (Woods Hole Oceanographic Institution) to discuss his proposed research utilizing new developments in sonar to follow fish behavior.

On November 29, Steve Clark and Margaret McBride met with staff members of the Rhode Island Department of Environmental Mangement to discuss cooperative survey work planned of southern New England in January 1983.

During November 30 - December 10, Mike Sissenwine attended a meeting in Mathematical Ecology in Trieste, Italy, and presented a paper entitled, "The Multispecies Fisheries Problem: A Case Study of Georges Bank."

During December 1-3, Joan Palmer attended the 38th Annual Conference on Applied Statistics in Newark, New Jersey.

On December 7, Steve Clark and Mike Fogarty attended the Woods Hole Lab EEO Committee meeting.

On Decmeber 10, Emory Anderson and Steve Murawski met with Regional Office staff in Gloucester to review their Fishery Mangement Plan Priorities Committee data analysis and on December 14 both Emory and Steve attended the Regional Director's Fishery Mangement Plan Priorities Committee Meeting in Boston, Massachusetts.

Several members of the Division attended the Southern New England Chapter meeting of the American Fisheries Society in Warwick, Rhode Island, on December 15.

On December 15, Mike Fogarty, Anne Lange, Steve Murawski, and Mike Sissenwine attended a modeling workshop with Nick Bax of the NMFS, Northwest Fisheris Center, in Narragansett, Rhode Island.

During December 15-16, John Boreman attended the Hudson River Monitoring Program Workshop in Albany, New York.

On December 16, Brad Brown met with the Board of Directors in Milford, Connecticut, to discuss ways of effectively proceeding with the RAP process from a Division perspective.

On December 21 and 29, Mike Fogarty attended the New England Fishery Management Council's Lobster Oversight Committee meetings in Saugus, Massachusetts.

Seminars

On November 15, Bill Overholtz gave a seminar on his Ph.D. research at the University of Massachusetts, Amherst, entitled, "Longterm temporal perspectives for the demersal fish assemblages of Georges Bank with implications for management and modeling."

On December 6, Steve Clark gave a seminar entitled, "Current status

and future outlook for the New England groundfish resource," at the University of Massachusetts, Amherst.

On December 16, Margaret McBride reviewed the current yellowtail assessment with members of the Assessment Division at the Homeport conference room.

On December 20, Steve Murawski reviewed the current surf clam assessment at Homeport.

Visitors

A delegation from the People's Republic of China visited Woods Hole during 20-21 December and programs were presented for them at the Laboratory.

University Affairs

On November 30 - December 1, Brad Brown met with Dick Hennemuth and G.P. Patil of Pennsylvania State University to discuss cooperative programs in statistical ecology.

On December 15, Mike Sissenwine participated in a Ph.D. Comprehensive Exam of a Woods Hole Oceanographic Institution student.

On December 19, Mike Sissenwine and Mike Fogarty met with Dr. John Grates of the University of Rhode Island to discuss mutual research interests.

MARINE ECOSYSTEMS DIVISION

submitted by

Dr. Kenneth Sherman, Chief

ICHTHYOPLANKTON INVESTIGATION

The fourth and final leg of the early spring ichthyo-zooplankton survey is in progress. At the end of April *Albatross IV* was working in the Gulf of Maine to complete the combined trawl-plankton survey. With the exception of sand lance larvae, dense concentrations of fish larvae have not been encountered in the Mid-Atlantic, Southern New England, or Georges Bank subareas. A moderate catch of Atlantic cod larvae, along with some haddock and pollock, was made south of Cultivator Shoals on Georges Bank with cod the most abundant of the three species. Unidentified gadid eggs were abundant in samples from eastern Georges, the traditional spawning grounds of cod and haddock. Because of the poor spawning season for both cod and haddock last year, we are watching with interest this year's collections on Georges Bank for an indication of whether or not eggs and larvae will occur at abundance levels observed from 1977 through 1981. Our next survey, the third of this calendar year and the fifth of the fiscal year, begins on May 23 and continues through June 22.

Several members of the investigation are beginning work on contributions to the autumn International Council for the Exploration of the Sea Statutory Meeting. Peter Berrien is drafting a manuscript based on his recent assessment of the adult spawning biomass of silver hake. Myron Silverman is working on a paper describing the distribution, abundance and production of yellowtail flounder larvae off northeastern United States between 1977 and 1981, and Tom McKinney is working on a similar paper for offshore hake larvae. In addition, John Sibunka and Myron Silverman are putting together a summary of field work completed on Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) surveys from 1977 through 1982; Mike Fahay is working on two contributions for the E. H. Ahlstrom Symposium in August; and Wally Smith and Wally Morse are completing a paper with Ken Sherman on the spawning strategies of coastal fishes based on MARMAP results, and they are working on manuscripts describing the distribution and advection of cod and haddock larvae on Georges Bank.

LARVAL FISH DYNAMICS INVESTIGATION

Experimental Studies

A study of the temperature and salinity tolerance of sand lance embryos is nearing completion. The study incorporated a factorial design with salinities between 0 and 35⁰/oo and temperatures between 0° and 15°C. The maximum viable hatch occurred at salinities between 10 and 30⁰/oo. Larvae hatched successfully over the whole range of temperatures at all salinities except 0⁰/oo. Hatching times ranged from 20 days at 15°C to more than 113 days at 0°C.

Growth, survival, and biochemical composition of sand lance larvae reared at low larval densities (1 larva/liter) in large volume containers

(200 liters) was studied at 4 prey levels (2000, 100, 50, and 10 plankters/liter. Survival for the 4-week duration of the experiments ranged from 96 to 44%. Mean growth in dry weight ranged from 10 to 3% per day at temperatures between 6° and 8°C. A study of the point of irreversible starvation in larval sand lance is in progress. The point of no return at 8°C is between 17 and 19 days after hatching and appears to be considerably longer at 4°C. A study of proteolytic digestive enzyme activity in larval sand lance is also in progress.

Studies of the effects of contaminated sediments on growth, survival, and biochemical composition of marine fish larvae are continuing in cooperation with the Environmental Protection Agency (EPA) Environmental Research Laboratory at Narragansett, Rhode Island.

Both haddock and mackerel brood stock are being manipulated to induce spawning.

Population Processes

Final plans and preparations were made for the May Larval Dynamics Cruise. A pre-cruise meeting was held 21 April in Woods Hole attended by participants from the Narragansett Lab. This year we are hoping to sample larval haddock and their copepod prey within stratified waters along the southern edge of Georges Bank. No larvae were found during our May cruise in 1982 and conditions in May 1981 were well-mixed for the most part.

Greg Lough and company continued analysis of data from April-May 1981 larval haddock-cod cruises, as well as parts of the 1978 Larval Herring Patch Study. Station data from *Albatross IV* Cruise No. 78-13 and *Lady Hammond* Cruise No. 78-08 were entered on computer files and length-frequency summaries for larval herring were produced by George Bolz. Available zooplankton data from *Wieczno* Cruise No. 78-04 and *Albatross IV* Cruises No. 78-13, 78-14, and 78-15 were standardized and some plots were prepared by Roz Cohen. She completed sorting zooplankton from two Multiple Opening-Closing Net and Environmental Sensing System (MOCNESS) $\frac{1}{4}$ hauls made during the May 1981 cruise and, with the help of Peter Auditore, has been summarizing the larval haddock and cod gut data from these same two hauls. Peter Auditore continued gut processing of larval cod and haddock from the spring 1981 MOCNESS hauls, entering data on HP computer files, and editing gut data on the VAX system. Philip LeBlanc participated on the spring bottom trawl survey (28 March-8 April) and continued sorting ichthyoplankton from the MOCNESS-1-m hauls made during the April *Albatross IV* cruise (Cruise No. 81-03). Dave Potter was on TDY to Center Operations through 7 May but resumed most of his duties with the Investigation as of 18 April. Dave entered several small data sets from the spring 1981 cruises on the HP computer and developed plots. George Bolz removed otoliths from about 50 juvenile cod collected by the State of Massachusetts Division of Fisheries and prepared them for counting daily growth increments.

ECOSYSTEM DYNAMICS INVESTIGATION

Major efforts focused on drafting and revising papers on Georges Bank for the Book and US/Canada issues. Roger Theroux prepared a second revision of his chapter on benthos and added a section on zoogeography. Ed Cohen and Mary Grosslein completed a first draft of the chapter on total ecosystem productivity and Mary finished the first draft of his part of the

chapter on fishery research and ecology. Ed also contributed to the chapter on zooplankton.

Mike Pennington continued work on statistical analysis of MARMAP ichthyoplankton data and also on procedures for estimating daily rations for fish. Wendell Hahm continued work on sensitivity analyses with the model GEORGE.

Roger, Marv, and Ed provided support for the US/Canada issue via literature search, data listings and plots, and editing and drafting of materials for the documentation on ecological boundaries.

Feeding Ecology

Ray Bowman, Bill Michaels, and Tom Morris participated in two cruises (*Wieczno* 83-01, and *Albatross IV* 83-02) where fish stomachs were preserved or examined. Preparations were made for a third cruise on *Gloria Michelle* to one of the BLM benthic monitoring sites but the trip had to be cancelled due to weather. First drafts of several documents were completed including food habits of spiny dogfish (Bowman) and weakfish (Michaels) and a comprehensive data report on the food of 17 species of fish for the 1973-1976 data series.

PLANKTON ECOLOGY INVESTIGATION

Jack Green completed a draft of a report on the distribution of zooplankton in the potential impact area of Deepwater Dumpsite 106. He completed a manuscript for publication on zooplankton coherence in abundance and distribution over the last 70 years in the Northwest Atlantic with Ken Sherman, Julien Goulet, and Leonard Ejsymont, and has been preparing for a presentation at American Society of Limnologists and Oceanographers '83 of the results of zooplankton pump sampling.

Joe Kane has completed revisions of his study of larval fish feeding and has been preparing for a poster to be presented at the summer American Society of Limnologists and Oceanographers meeting.

Donna Busch prepared a briefing for the Narragansett Laboratory Director for a satellite oceanography meeting in Washington 22-23 March. She also reviewed several documents and manuscripts for the laboratory director, colleagues, and professional journals, and prepared chlorophyll sampling gear for the Larval Dynamics cruise aboard *Albatross IV* in May. Jackie Anderson and Pat Michalik will participate on the cruise to sample chlorophyll a .

From 7-9 March Carolyn Griswold visited the Harbor Branch Foundation (HBF) where plans for the upcoming Johnson/Sea Link cruise was discussed by the three users--NOAA/NMFS, UBN and HBF. On 28 March she met with Elijah Swift to discuss the possibility of using the Bugwatcher system to analyze in situ movements of organisms seen and videotaped from the submersible.

During April Carolyn Griswold prepared comments on the 106 Deep Water Dumpsite Characterization study for Ken Sherman. She also prepared a report on a NOAA/NMFS alternative for North Atlantic lease sale dealing with deletion of tracts within the 60 m isobath on Georges Bank. She prepared a proposal for a cooperative research program entitled "Net-fouling Organisms in the Gulf of Maine--Natural History and Practical Considerations." Cooperators other than NEFC include the State of Maine, Bigelow Laboratory, University of New Hampshire, and the State of

Massachusetts. She was interviewed on the slime problem by *Soundings* and results of that interview came out in the May issue.

From 25 April-6 May, Carolyn Griswold participated in a groundfish/ichthyoplankton survey on the R/V *Albatross IV* in the Gulf of Maine.

Image Analysis

Information on development of the Automated Plankton Processing System was provided to two groups from Canada: Dr. Tony Koslow (Dalhousie University) and Hardy Associates, LTD., Dartmouth, Nova Scotia.

On 19 and 20 April, Luther Bivins and John Pijanowski (Office of Technology and Engineering, NOAA), and two contractors from Strauss Photo-Technical Services and Gemini Electronics visited the Narragansett Laboratory. Zoltan Kocsis (Strauss Photo-Technical) delivered the 4" x 5" and 70 mm silhouette cameras designed specifically for the Automated Plankton system. These cameras use a Kodak ortho film, fine-line developer, and high output strobe to produce a uniform, high-density background required for digital image processing. The design permits usage in daylight and can be taken on shipboard to photograph "live" samples. Acceptance tests are being performed on image quality and consistency. The 70 mm camera incorporates an automatic film advance and uses cassettes which carry 35' film lengths. A Pako film processor on loan from the Woods Hole Laboratory is being adapted to rapidly process large amounts of film. A project review meeting was held on 20 April with Luther Bivins, John Pijanowski, Perry Jeffries (University of Rhode Island), Alec Poularikas (University of Rhode Island), Mark Berman and Ken Sherman at the Narragansett Laboratory.

Mark Berman is perfecting image processing software and preparing a paper for presentation at the American Society of Limnologists and Oceanographers meeting this June in New Foundland. Mark has also prepared a cooperative proposal between US and Japan on the application of image processing to fisheries research.

Joe Kane and Pat Michalik began summarizing microzooplankton data from pump and bottle samples taken on *Albatross* 81-05. This information will define the small scale variability in the major components of the prey field, which may significantly impact larval survival.

Jerry Prezioso continued to summarize the length frequency information on Antarctic krill from the First International BIOMASS Experiment in the Antarctic.

Biostatistics

Thomas Plichta analyzed zooplankton displacement volumes (1977-81) along 5 standard MARMAP transects for a report by Jack Green on zooplankton advection from Georges Bank.

1 March, Len Bass (EPA and University of Rhode Island) reviewed data base progress by the System Support Group at the Narragansett Laboratory.

2 March, Julien Goulet visited Sandy Hook for automated data processing discussions with the Ichthyoplankton Investigation.

5 April, Julien Goulet met with Peggy Lamoureux, Barry Thompson (University of Rhode Island Graduate School of Oceanography) and Bob Cannon concerning a revised phone system for the Narragansett Laboratory.

12-13 April, Julien Goulet attended a training session (New Technologies: Impacts on People and Organizations).
18 and 28 April, Julien Goulet visited Woods Hole for an A-76 committee meetings.

FISHERY OCEANOGRAPHY INVESTIGATION

During March and April the Fisheries Oceanography Investigation made significant progress in the processing and analysis for a number of data sets. The hydrographic data from the Nantucket Shoals Flux Line experiment was submitted for publication as a NOAA Technical Memorandum. The analysis of the current meter data from the flux line was continued by Steve Ramp. An abstract on the measured fluxes was submitted to the spring American Geophysical Union meeting. Ron Schlitz and Ben Marshall continued processing the conductivity-temperature-depth data from the Warm Core Ring project. David Mountain and Paul Jessen began a volumetric analysis of the bottom waters of the Gulf of Maine using the MARMAP hydrographic data. Catherine Jewell began a study of the relation between hydrography and the presence of *Benthoosema glaciale* in MARMAP samples. The *Benthoosema* appears well correlated with the presence of slope water on the outer parts of the shelf in spring.

On 11 March, Steve Ramp, Ronald Schlitz, and David Mountain met with other investigators in the Nantucket Shoals Flux Line experiment to discuss the writing of manuscripts.

On 27 April, David Mountain met with Mona Smith of NOAA/NEDRESS concerning including the MARMAP hydrographic data in the NEDRESS data referral service.

APEX PREDATORS INVESTIGATION

Seventeen sharks were recaptured during March and April: 3 blue sharks, 3 sandbar sharks, 5 makos, 1 each of tiger, dusky, lemon, silky, scalloped hammerhead, and Atlantic sharpnose. One blue shark was at liberty for 23 months and travelled 1,634 mi from southwest of the Cape Verde Islands to off the coast of Portugal. The shark was tagged by the Polish vessel *Wieczno* and recaptured by a Spanish longliner.

A tag was returned after 44 months from a sandbar shark that had travelled from Long Island, New York, to Cape Canaveral, Florida. Another sandbar travelled 871 mi in 6 mo from off Montauk, New York, to the coast of central Florida. One mako was at liberty for almost two years. Three of the recaptured makos were taken by the same commercial fisherman. One recaptured mako was originally double tagged but only one tag was on the fish at recapture. The tiger shark (at liberty for only 4 days) was re-released with the tag still in place. This shark travelled 6 mi in four days.

The dusky travelled 351 mi in 8 mo from Long Island, New York, to Cape Lookout, North Carolina. After eleven months at liberty, a lemon shark had been recaptured 8 mi northwest of the tagging location. The scalloped hammerhead was found dead on the beach five months after tagging. It had travelled 542 mi from Cape Hatteras, North Carolina, to South Vero Beach, Florida. An Atlantic sharpnose travelled from St. Lucie, Florida, to Charleston, South Carolina, in 3 mo for a distance of 261 mi.

Jack Casey and Wes Pratt analyzed 20 years of white shark information from our records and the literature for a preliminary report on

distribution of the white shark in the Western North Atlantic. Information covers areal distribution by season, sex, and temperature.

Wes Pratt worked up a preliminary estimate of age for 48 white sharks using vertebral ring counts. A limited review of length-frequency information supports these initial estimates.

During March and April, John Hoey continued work on several manuscripts. Comments were obtained from several staff members on the swordfish manuscript and a revision was completed at the end of March. Work continued on the manuscript on the distribution and abundance of sharks on the Western North Atlantic. A great deal of time was spent producing seasonal maps which portrayed areas of peak abundance for 9 species of sharks. A draft of this paper should be ready for in-house review by the end of May. Jack Casey completed review of the recreational shark catch paper and his comments are being incorporated into the last draft.

In March, during Cruise 83-02 on board the R/V *Wieczno*, stomachs from 96 sharks and 26 teleosts were examined for food studies. Stomachs from 10 (77%) of 13 blue sharks sampled from a cold eddy approximately 224 km east of Cape Hatteras, North Carolina, contained remains of lancetfish (*Alepisaurus* sp.) and a variety of squid species amounting to 46% and 38% by frequency of occurrence, respectively. This was the first time such a high percentage of lancetfish was observed in blue shark stomachs and may have resulted from a concentrating effect of this mesopelagic species by the cold eddy.

Sixty-nine percent of the stomachs of sharks captured off Cape Hatteras were empty. Those with food contained small amounts of cephalopods (predominantly *Illex* sp.) and a variety of fish species in advanced stages of digestion. Scalloped hammerheads were the most abundant shark in this area and had fed on squid, goosefish, and small scombrids, possibly skipjack tuna. Blue sharks contained cephalopod remains only. There was no evidence of lancetfish remains in these stomachs. Yellowfin and blackfin tuna had fed on amphipods, euphausiids, small squid, and juveniles of fish species usually associated with flotsam.

Chuck Stillwell prepared a "spotlight" article of the "Apex Predator Investigation" to be included in the June issue of the NEFC bimonthly newsletter.

Chuck Stillwell and Nancy Kohler started revising a ms on the food and feeding habits of the swordfish in the Northwest Atlantic.

Chuck Stillwell prepared a slide presentation to be given at the eighth "Our World-Underwater" conference to be held in Chicago on 6-8 May. He will be one of the speakers sponsored by Sea Grant and NMFS.

PUBLICATIONS

Wright, W. Redwood. Nantucket Shoals flux experiment, I. Hydrography. NOAA NMFS NEFC Tech. Mem. series (S).

Colton, J. B., Jr., and J. L. Anderson. Residual drift and residence times of Georges Bank surface waters with reference to the distribution, transport and survival of larval fishes. MARMAP Contribution MED/NEFC 82-10. NOAA NMFS NEFC Tech. Mem. series (S).

Sherman, K., J. R. Green, J. R. Goulet, and L. Ejsymont. Zooplankton coherence in a large Northwest Atlantic ecosystem. MARMAP Contribution MED/NEFC 82-68. Science (S).

Sherman, K., W. G. Smith, J. R. Green, J. R. Goulet, E. Cohen, and L. Ejsymont. Zooplankton of the northeast shelf including Georges Bank and adjacent waters. In G. Backus (ed.) The ecology of Georges Bank. MIT Press. MARMAP Contribution MED/NEFC 83-09. (S).

REPORTS

Griswold, C. A. Net-fouling organisms in the Gulf of Maine: Natural history and practical considerations. A Cooperative Research Program. MARMAP Contribution MED/NEFC 83-19.

Nickerson, S., and D. Mountain. Surface and bottom temperature and bottom salinity distributions on the continental shelf, Cape Hatteras to Cape Sable from MARMAP cruises, 1977-1982. NEFC Lab. Ref. Doc. 83-11.

MISCELLANEOUS

Travel, Meetings, and Presentations

10 March, Donna Busch attended a meeting of the North Atlantic Technical Working Group in Hyannis, Massachusetts.

22-23 March, Ken Sherman attended a meeting in Washington, D. C., on Satellite Oceanography.

9 April, John Hoey gave a talk to the Connecticut Marine Fisheries forum on different longline fisheries operating off the east coast of the US.

Mike Fahay travelled to the Southeast Fisheries Center (SEFC), Miami, to attend a Steering Committee meeting for the E. H. Ahlstrom Symposium which will be held in San Diego in August.

28 March, Tom Halavik, Donna Busch, Jack Green, Tony Bocelle, and Dick Broderick met at the Narragansett Laboratory to discuss remaining construction problems associated with the laboratory solar project.

18 April, a follow-up solar meeting was held to discuss resolutions to problems with the greenhouse and solar collectors. Steve Strong (Solar Designs), Jack Green, Donna Busch, Ray Maurer, Peggy Lamoureux, Louise Andsager, and Tom Halavik attended.

Seminars

23 March, Wes Pratt gave a slide-talk, at the Narragansett Laboratory, on Honduran coral reef fishes from the island of Roatan.

Kenneth Sherman convened a meeting of the Division principals 3-4 May to discuss the current status of Investigations and review the overall focus on ecosystem studies for FY'84.

Visitors

1 March, Dr. Marko Branica (Director, Institut "Ruder Boskovic", Zagreb, Yugoslavia) visited the Narragansett Laboratory.

16 April, Jack Edmunds (Applied Science) visited Ken Sherman.

28 April, Dr. Arnold Gordon (Columbia University) visited the Narragansett Laboratory regarding joint work with the National Science Foundation studies on the Antarctic ice edge.

University Affairs

1 March, Len Bass (EPA and University of Rhode Island) reviewed data base progress by the System Support Group at the Narragansett Laboratory.

7 March, Roger Theroux met with Margaret Carter (University of Pennsylvania, Ph.D. candidate) to provide additional data on the Scaphopoda material she is using for her research and to discuss progress to date.

16 March, Donna Busch and representatives from Atlantic Environmental Group (AEG) attended a Synoptic Oceanography Research Team meeting at the Remote Sensing Laboratory, University of Rhode Island.

15 April, Ken Sherman presented a briefing with EPA scientists to scientists at University of Rhode Island on ocean dumping.

15 April, Roger Theroux consulted with Edward Belt (Amherst-Smith-Mount Holyoke Colleges Marine Consortium) requesting advice and loan of bottom sampling gear suitable for use from a sailing vessel for a demonstration cruise out of Newport in May. Upon Roger's recommendation the Woods Hole Laboratory agreed to provide a Digby dredge.

20 April, A project review meeting was held with Luther Bivins and John Pijanowski (NOAA), Perry Jeffries (University of Rhode Island), Alex Poularikas (University of Rhode Island) and Ken Sherman at the Narragansett Laboratory.

26 April, Ken Sherman presented a lecture to students at the University of Rhode Island Bay Campus as his portion of a series of lectures in a course on marine ecosystems.

Public Affairs

2 March, Julien Goulet and Jack Green judged a junior high science fair at Msgr. Clarke School, Wakefield, Rhode Island.

28 March, Leon Caron (Bigelow Laboratory) requested and received information on bivalve biomass on Georges Bank for a grant proposal.

Personnel

3 March, Dave Potter's TDY to Center Operations was extended for a period not to exceed 90 days (5/7/83).

Janel Mosley, Clerk-Typist, joined the Support Services Section in April--welcome aboard! We said goodbye to Elizabeth Aviles-Rogers who accepted a position with the Army Corps of Engineers.

The Narragansett Administrative Unit welcomed aboard David McCutcheon in March. He is our new Maintenance Worker.

Administration said goodbye and best of luck to Joyce Denecour, Clerk-Typist, who left because her temporary appointment had expired.

Alan Ryan has been assigned to the Narragansett Laboratory for a two-year period to work with Ken Sherman on Antarctic studies.

Alice DeNofa attended an Office of Personnel Management training course, "Seminar for Executive Secretaries 1983," from 16-18 March 1983.

In April, Ray Maurer began a course on Video Production at Rhode Island College.

EEO Activities

Tom Halavik attended a Department of Commerce EEO meeting in Washington, D.C.

10 March, Roz Cohen attended a Federal Women's Program meeting in Woods Hole.

RESOURCE UTILIZATION DIVISION

submitted by

Joseph J. Licciardello, Acting Chief

FISHERIES CHEMISTRY INVESTIGATION

Product Quality Chemistry

Plans are underway for a new Association of Official Analytical Chemists (AOAC) collaborative study of the Agarose Gel Isoelectric Focusing Method for Species Identification. The first collaborative study of this method showed that the accuracy of the method was not good enough for AOAC acceptance. The method is being completely revised to incorporate performance standards. All AOAC species identification methods must now include comparison of known and unknown samples analyzed simultaneously. The inclusion of performance standards will allow more flexibility in methodology and greater accuracy in identification. During the past month, four laboratory personnel participated in a small scale, in-house collaborative study in which each individual was asked to identify several unknown samples by comparing their protein patterns with patterns from authenticated species. All samples were analyzed on the same gel. Each of the four collaborators was allowed to select the type of agarose and brand and range of carrier ampholyte that he or she favored. All unknown samples were correctly identified. As soon as the AOAC approves the experimental protocol, samples will be sent out to our network of collaborators.

Plans have been made to investigate further the relative shelf-life-extending effects of cobalt-60 irradiation and a 5% potassium sorbate dip on cod. One day postmortem cod will be filleted and divided into two batches. One batch will receive a 45 second dip in 5% K sorbate solution; the other will not be dipped. These fillets will be sealed in Saran packages, and half of the fillets in each of the above two batches will be exposed to 200 Krads of irradiation. This same treatment will be repeated with 7-8 day postmortem cod. The quality of these fillets stored on ice will be monitored periodically by microbiological and chemical testing, sensory evaluation, and Torrymeter measurements. The unavailability of cod has delayed the start of this study.

Monthly monitoring of water samples from rivers, lakes, reservoirs, etc. of the Cape Ann area for the acid rain study continues. This promises to be a unique program of widespread volunteer involvement covering the entire state of Massachusetts. We are one of 70 analytical laboratories which have offered assistance. Latest report is that the program seems to be working reasonably smooth.

We have been unable to identify for the Enforcement Division a specified species in pills even after reacting the ground pills with cyanogen bromide in formic acid. Lisa Marshall, a one-week student intern from Bates College, is using another procedure on the pills.

All the samples from a year long storage study of canned red crabmeat have been analyzed. The data are being collated and analyzed statistically.

Unknown samples from a collaborative study for the determination of tocopherol have been analyzed. The collaborative study was conducted by

FDA for use on the gas chromatograph. We asked to run the samples by high pressure liquid chromatography as a check on our new method. Results will not be available until the collaborative study is over. Recovery experiments show great variability using the present extraction procedure. A new extraction method will have to be investigated.

Evaluation of fresh fish for certain edibility characteristics by the trained flavor and texture panels is continuing. Current data indicates that, in general, insignificant changes occur in edibility characteristics between fresh fish (1 day old) and fish held on ice for 7 days. Species characterized are selected according to seasonal availability, and each species will be evaluated a minimum of three times.

Product Safety

Analysis of PCB's in Mackerel Samples

Samples of muscle, kidney, head kidney, and ovaries collected by Dr. Longwell's group of the Milford Laboratory were worked up and analyzed by gas chromatography utilizing an electron capture detector of Ni⁶³. The chromatograms were interpreted and concentrations reported.

Marine Sediment PCB Reference Materials

The samples included a coastal sediment sample collected in the Laurentian Channel midway between Nova Scotia and Newfoundland (Eastern Canada) and two sediments collected from Nova Scotian harbors. This set of samples provided a range of PCB levels from below 2 parts per billion to 112 parts per billion. These three reference materials were analyzed by EPA's official method for the analysis of PCB's in sediments. Results obtained were compared against reported results from the National Research Council of Canada.

Adoption of a Simplified Rapid Method to Determine Chlorinated Pesticides and PCB's in Fish Tissue

This procedure allows up to 80% reduction in reagents, reduces analytical time up to 50% and requires less laboratory space than official procedures. The rapid method is a modification of the original Food and Drug Administration procedure. Blanks, spiked blanks, and muscle samples were analyzed by the rapid procedure and the AOAC procedure. Accuracy, precision, and recoveries of each procedure were compared.

Rapid Extraction of Organochlorine Pesticides and PAH's from Animal Tissue

The rapid extraction is based on a sample preparation device that operates on the efficient and rapid technique of solid phase extraction using a specially designed vacuum manifold that processes disposal extraction columns. These columns selectively isolate compounds from solutions. Solvents and samples are aspirated through the column via a vacuum manifold and eluants are collected in tubes positioned in a removable rack placed inside the manifold. Collected eluants are used directly and analyzed by gas chromatography or high-performance liquid chromatography. A C₁₈ column was used to isolate PCB's and polynuclear aromatic hydrocarbons (PAH's). Samples of eel muscle, spiked blanks, and blanks were analyzed using this sample preparation technique. This technique could be used for a rapid screening method of organochlorine

pesticides and PAH's in fish tissues with additional research on utilizing the proper selective phase and elution solvents.

Evaluation of Branson Sonicator for Efficient Extraction of Contaminants

The Branson apparatus utilizes a sonication horn cell to completely disrupt the tissue cell. This shearing effect affords maximum extraction efficiency. The apparatus was tested against muscle tissue to evaluate extraction efficiency of PCB's. Rosette cells were ordered to minimize foaming during the pulsating step.

Preparation of Internal Standard Material for PCB's and PAH's

Since a tissue reference material containing traces of organic contaminants is extremely difficult to obtain, it was necessary to develop our own. This reference material will provide a continuing measurement of the performance capability of each analyst. Each person can be constantly aware of his strengths and weaknesses, and corrective steps can be undertaken when necessary before serious problems occur and erroneous data are reported out of the laboratory. A dozen replications of the analysis of the reference sample will be made up by each of the chemists. From these data, the percentage relative standard deviation will be calculated and used in construction of control curves. The chart will provide graphic assessment of accuracy and precision and instant detection of erroneous data. It also will have long term value for the shelf evaluation of analytical output by staff personnel. Another significant value of the charts is that of providing a laboratory administrator with a rapid assessment of the continuing analytical capabilities of the staff chemists as related to the output of valid analytical data. For this purpose cod liver oil was spiked with Aroclor 1016 and 1254 and six polynuclear aromatic hydrocarbons. After thorough mixing for 24 hours, the oil was weighed into vials and stored at -20°F until ready for use.

Preparation of New Batch of Aroclor Standards

A new batch of PCB standards and p,p'-DDE were prepared. Concentrations of 1 ppm, 0.5 ppm, and 0.1 ppm were prepared for mixed Aroclors and Aroclor 1254, 1242, and 1260. For p,p'-DDE concentrations of 50, 10, and 5 picograms per microliter were prepared. The standards were chromatographed to check relative retention times and detector response.

Internal Standard for Analysis of PAH's

1,2-Benzofluorene was found to be readily separable from the 16 priority pollutant PAH's by high-performance liquid chromatography. Four experiments were run by the Grimmer and Bohnke method to demonstrate the appropriateness of 1,2-Benzofluorene as an internal standard.

GC/MS Confirmation of Casco Bay Sediments

Three extracts were displaced into hexane using C₁₈ Bond elute columns for positive confirmation of the presence of PAH's in sediment samples collected from Casco Bay. Suspected PAH's found during past analyses were positively confirmed by GC/MS.

FISHERIES TECHNOLOGY AND ENGINEERING INVESTIGATION

Product Standards and Specifications

The Washington Office is supporting a petition to the U.S. Department of Agriculture to allow the use of minced fish (now known as "minced fish meat") in their regulations governing the composition of meat products such as frankfurters and sausages. In support of this petition, we have revised a draft U.S. Standard Minced Fish Meat and sent it to the Washington Office.

The preparation of a Final Rule Making document of the Proposed U.S. General Standards for Grades of Shrimp to be published in the *Federal Register* is underway. A grading survey is being conducted to test the new score point deductions to be used in the revised draft. Following the completion of the grading survey, a new draft will be prepared.

A proposed draft U.S. Standards for Grades of Fresh or Frozen Fish Steaks and its instructions have been revised and sent to the Washington Office.

A proposed draft U.S. Standards for Grades of Frozen Lobster and a preamble for publication in the *Federal Register* are in the Washington Office. With our help, the U.S. Army Natick Laboratory has issued a Purchase Description for spiny lobster.

A proposed draft U.S. Standards for Grades of Frozen Fish Portions and Fish Sticks is being revised.

Three revised proposed drafts U.S. Standards for Grades of Frozen Fish Blocks have been sent to the Washington Office for review and comments by about 25 organizations. Instructions for using this draft and a sampling guide (covering species and country of origin) were also prepared.

An initial proposed draft U.S. Standards for Grades of Fresh or Frozen Raw Clams is being prepared.

Processing and Preservation

Sorbate Preservation

Experimental work was completed on (1) dipping codfish fillets into 2.5 and 5.0 percent potassium sorbate solutions and determining the iced shelf life, and (2) storing whole eviscerated codfish in seawater containing 0.5 percent potassium sorbate for two days and determining the iced shelf life.

The results showed that the 2.5 percent potassium sorbate dipped fillets had a statistically significant increase in shelf life over the nontreated control samples. Those fillets dipped in 5.0 percent potassium sorbate showed only a slight increase over the samples dipped in the 2.5 percent solution. The whole eviscerated fish stored in potassium sorbate seawater had a slightly longer but no significant difference in shelf life than the nontreated iced control samples.

A rough draft of the experimental work has been completed and is under review.

Arrangements have been made with a local fishing vessel for an experiment in which freshly caught, whole eviscerated codfish are dipped in 5 percent potassium sorbate prior to icing. Shelf life determination will be done on the fish and the fillets cut from them.

Blue Crab

Experimental work on the pasteurization of blue crabmeat in flexible pouches has been completed. The first draft of a paper on this work has been completed.

Frozen Fish

With the reconditioning of the frozen fish storage rooms, the experiment to determine the frozen storage stability at -10° , 0° , and $+10^{\circ}$ F of fish fillets cut from ripped and gutted fish after being held in ice for 0, 5, and 10 days will begin shortly. Fresh haddock fillets have been ordered for this storage experiment and as soon as the fish arrives, the experiment will begin.

Colorimetric Analysis

The Hunter L colorimeter has been repaired and will be used to determine the color of the fish in the edibility study. A protocol for determining color is being worked out cooperatively with the U.S. Army Natick Research and Development Laboratory and the Seattle Technological Laboratory. With the aid of the new Robot Coupe food processor, the finely ground fish sample will be placed into a petri dish and its reflectance read on the Hunter L colorimeter. Various fish cooking techniques are being tried to determine their differences on the colorimeter.

Engineering

Performance Plan Ratings on employees were completed, and new performance plans prepared for the coming year.

A new freezer warehouse and associated refrigeration equipment, including heat gain and total refrigeration load, was designed and calculations completed for a Maine processor.

Freezer Room #4 was completely outfitted with a new compressor, receiver-condenser, hold back valves, and associated piping. It is back in service and being used as part of a new frozen fish study.

Facilities

Various maintenance functions have been performed and contracts monitored such as a new roof top fan from Room #09, sealing of a drain to eliminate the bad odor in the stockroom. The old hot water heater was disconnected and the new one put in service in the boiler room. A contract to upgrade plumbing is continuing with new water pipes in labs 8, 9, 10, 17, 20, and 21.

NMFS/URI Cooperative Fisheries Engineering Unit

The Microlog data acquisition system has been installed aboard the R/V *Λωοθία θιψηνωσε* and is functioning properly with two channels activated, one for main engine fuel consumption and another for vessel speed. Details are being ironed out for an improved data output.

The Indikar thrust meter has been installed on the propeller shaft and will be tested before May 1, 1983.

The Lourance X-15 microprocessor controlled sounder has been received and put into operation by Marcia Hallisey, a University of Rhode Island graduate student, who is working with us on an acoustic net mensuration system for use in the Two Tank.

Improvements to the R/V *Gloria Michelle* continued with the conversion of the aft fuel tank into a storage space. This effort will free the fish hold space such that it can be reinstated as a working fish hold for experimentation and improve laboratory space. A new air system has been installed that includes a much needed remote PTO control for the main winch. Other work included new hatches in the deck, new Lexan pilot house windows, navigational equipment repairs, and electrical system updates.

A new series of inclining tests have been conducted on board the R/V *Gloria Michelle* by the Ocean Engineering Department's graduate students yielding improved results.

Al Blott, Vern Nulk, John Kenney, Jack Moakley, and Bob Van Twuyver received Certificates of Recognition for their efforts in obtaining and preparing the R/V *Gloria Michelle* for use by Center Program activities.

R/V *Gloria Michelle* cruises during the period were:

Cruise No.	Title	Area
GM 83-06	Experimental Scallop Dredge Trails and Observations	Block Island Sound
GM 83-07	MERL Diurnal Sampling	Narragansett Bay
GM 83-08	MERL Diurnal Sampling	Narragansett Bay

PUBLICATIONS

- King, F.J. 1983. Procedure for cooking seafood products. Accepted for publication in the May 1983 issue of *J. Assoc. Off. Anal. Chem.*
- Krzynowek, J., K. Wiggin, and P. Donahue. 1983. Sterol and fatty acid content in three groups of surf clams (*Spisula solidissima*): Wild clams (60 and 120 mm size) and cultured clams (60 mm size). *Comp. Biochem. Physiol.* 74B(2):289.
- Licciardello, J.J., E.M. Ravesi, R.C. Lundstrom, K.A. Wilhelm, F.F. Correia, and M.G. Allsup. 1982. Time-temperature tolerance and physical-chemical quality tests for frozen red hake. *J. Food Quality* 5:215-234.
- Lundstrom, R.C. F.F. Correia, and K.A. Wilhelm. 1982. Dimethylamine production in fresh red hake (*Urophycis chuss*): The effect of packaging material oxygen permeability and cellular damage. *J. Food Biochem.* 6:229-241.

MISCELLANEOUS

Travel, Meetings, and Presentations

Judith Krzynowek and Kurt Wilhelm have been traveling to Woods Hole for converting the laboratory's data processing to a different computer.

Joe Licciardello presented a seminar on seafood quality in Boston.

Joe Licciardello participated in a meeting on utilization of dogfish waste sponsored by Maine Department Marine Resources at Boothbay Harbor.

Joe Mendelsohn attended "Seafood '83" held in Boston, Massachusetts. This exposition was to display fishery products for prospective buyers and show that high quality fishery products are available. Most of the products on display were from foreign processors.

Perry Lane attended and participated in the following: a joint meeting of the New England Marine Advisory Council (NEMAC) Executive Committee and the New England Sea Grant Directors at the Massachusetts Institute of Technology (MIT) to review NEMAC-SG interaction; a meeting of the NEMAC Board of Directors at MIT; a meeting of the New England Fisheries Management Council in Danvers; the seminar "Dollars and Sense of Seafood Quality" in New Bedford, Portland, and Gloucester as well as a 3-day workshop on Quality and Sanitation for plant foremen held in Danvers; the Pt. Judith, Rhode Island, Fishermen's Forum; and a meeting of the Northeast Shellfish Sanitation Association in New Haven, Connecticut.

Bob Learson gave a presentation on fish quality in Boston, April 5 and was the guest speaker at the University of Massachusetts Food Engineering Department Seminar in Amherst, Massachusetts, April 8.

Bob Learson represented the Center at the National Fisheries Institute Annual Convention in New Orleans, April 20-23. He participated in a seminar on the NMFS Fishery Utilization Research Programs.

The third meeting of the Technical Working Group on the Draft Standards for Grades of Frozen Fish Blocks was held at the Gloucester Laboratory on April 27. Fifteen members of the industry attended. John Ryan, Fred King, Bob Learson, and Perry Lane represented the laboratory.

The first meeting of the Technical Working Group on the Draft Standards for Grades of Fish Steaks was held April 28. Six industry members participated in reviewing the draft standard. John Ryan, Fred King, and Bob Learson represented the laboratory.

March 2, Al Blott attended a meeting of the Northern Shrimp Technical Committee to discuss participation in the shrimp survey and further gear development this fall.

March 5, Al Blott and Vern Nulk attended the Rhode Island Fishermen's Forum in Pt. Judith.

March 11, Al Blott attended a meeting of the Rhode Island State Planning Committee to discuss the needs of the Rhode Island fishing industry.

March 14-15, Al Blott sailed aboard the R/V *Delaware II* to participate in the shakedown of midwater fishing gear.

April 9-13, Al Blott and 10 other representatives of the U.S. Fishing industry sailed aboard the Polish training/fishing vessel *Admiral Archeszewski* to observe mackerel fishing operations.

April 14, Al Blott attended a seminar at the University of Massachusetts at Boston on Marine Fisheries and priorities of the University of Massachusetts.

April 22, Al Blott presented a paper on the Isaacs-Kidd Midwater Trawl net to the New England Estuarine Research Society in Portland, Maine.

April 22, Al Blott attended the Gloucester Fish Expo in Gloucester, Massachusetts.

April 28, Al Blott left for Denmark to attend the International Council for the Exploration of the Sea meeting and participate in the proceedings of the working groups on the Engineering of Fishing Gear and Reaction of Fish to Fishing Gear.

Visitors

Laurie Sauda and a class of 10 students from Essex Agricultural and Technical Institute for a tour of the laboratory and a discussion of our activities.

University Affairs

Lisa Marshall, a student at Bates College, spent a week at the laboratory working on a project under Judy Krzynowek's supervision.

Glenna Kopphen, from Cornell University Extension Service, visited the laboratory for two days researching collected reprints of cholesterol and lipid literature.

Students from the Food Science Department of Essex Agricultural and Technical Institute spent a day at the laboratory preparing seafood samples for their upcoming annual open house.

Public Affairs

Ian Dore, author, visited the laboratory in search of information on species identification by isoelectric focusing.

Mr. Hardy visited the laboratory in search of nutritional information on seaweed.

Technical assistance was provided to the following:

Compared isoelectric focusing patterns of several shrimp, lobster, and fish species for Mr. Ian Dore, Osprey Books, Huntington, New York.

Identified frozen fish fillets in two samples as being Ocean Perch (*Sebastes marinus*) using agarose gel isoelectric focusing. The analysis was conducted for veterinary activities, U.S. Army MEDDAC, Ft. Knox, Kentucky.

Gas chromatographic determination of volatile amines in seafoods to Dr. E.S. Windham, Veterinary Laboratory Services, Department pathology, Ft. Sam Houston, Texas.

Nutritional value of lobsters to TAB magazine, Cambridge, Massachusetts.

Nutritional information on chowder clams, monkfish, and various shellfish to several people.

Information on fresh, frozen, and canned shelf lives of seafoods to Old Salt Seafoods, Easton, Maryland.

Information on methods of extending shelf life of fish to Tom Hill, Massachusetts Institute of Technology.

Information on crab processing to Turko shipyard, Finland.

Visual aids in seafood preparation to Attleboro, Massachusetts Vocational High School.

Effect of freezing and frozen storage on bacterial survival to H. Maynard, National Seafoods.

Information on rigor in fish to Dana Staples, The Nordic Group.

A number of S-K proposals were reviewed and evaluated at the request of the Washington Office.

Joe Licciardello reviewed two scientific manuscripts, one for the Journal of Food Science and the other for Marine Fisheries Review.

Perry Lane worked with Susan Faria, Massachusetts Division of Marine Fisheries, to prepare a list of Massachusetts fishermen, processors, and academic groups for use by Ken Gall at New York Sea Grant in conducting a survey on technological needs of the seafood industry.

Perry Lane worked with Carmine Gorga and Joe Slavin to prepare a record of seafood seminars in New Bedford, Portland and Gloucester, and a workshop for plant foremen.

Perry Lane and Joe Mendelsohn visited Aslanis Fish Company in Boston to observe plant operations and processing methods.

Provided information in the following areas: marketing eels; smoked squid; notched cutting board; histamine analysis; sanitation and quality control; eels; rigor mortis on pollock; preparing and marketing salted fish; processing fish in retort pouches; salting and drying cod; yields and recoveries of fish flesh in the salting process; purifying clams; information on refrigerated seawater and chilled seawater; insulated containers; and distribution of seafoods.

Personnel

We welcome aboard John Hurd who will be assuming the laboratory janitorial duties.

Everett Burke retired in March and Tom Connors retired in April.

Training

Bob Learson attended a Department of Commerce Management Training Seminar during March 8-10 in Washington, D.C.

EEO Activities

On 17 March, Barbara Jobe and J. Perry Lane attended an adjunct meeting of the Gloucester Laboratory and Regional Office EEO Committees at the State Fish Pier in Gloucester.

During the last part of March, Judith Krzynowek, Federal Women's Program Representative, collected and forwarded questionnaires for the Sexual Harassment survey being conducted by Carolyn Brown, Federal Women's Program Coordinator.

On 29-31 March, Barbara Jobe attended the EEO/AAP Conference Workshop in Washington, D.C.

On 14 April, Angela Grace and Barbara Jobe attended the Regional Office EEO Committee meeting.

AQUACULTURE DIVISION

submitted by

Dr. James E. Hanks, Chief

AQUACULTURAL GENETICS INVESTIGATION

Oyster Breeding

The second selected generation of oysters in a bi-directional selection experiment for growth have been conditioned for spawning the next selected generation. All these oysters are being measured so that response to the last generation's can be calculated. Also conditioned for spawning is the second generation of sib-crossed oysters. These will undergo another generation of brother-sister matings, and lines maintained for breeding and fundamental studies. Inbred lines can be expected to have fewer lethal recessive genes which contribute to mortality in gynogenesis. Some will be used in efforts to combine polyploidy with species hybridization. The aim of this is to produce triploid oysters, with two sets of American oyster chromosomes and one set of Japanese chromosomes. Ordinary Japanese x American oyster hybrids, which are of interest for hatchery culture, invariably die before setting. Emphasis is being placed on manipulation of the first meiotic division instead of the second as in finfish, an option readily available in shellfish, but not in finfish because of the meiotic stages at which the eggs are spawned in the two groups. To this end, the effects of high pressure treatment on the unfertilized egg are being explored.

Mutation and the Environment

In the last bi-monthly narrative, it was reported that winter flounder caught in the New York Bight Apex and in Long Island Sound were found to have a higher mutation frequency in their erythropoiesis than flounder caught in the rest of the coastal Mid-Atlantic, in the offshore Atlantic, on Georges Bank or in the Gulf of Maine. In the absence of any evidence that this is attributable to natural effects, pollution burdens in the Bight Apex and Long Island Sound are implicated. Further data analyses of micronuclear counts (the basis of the assay) have now been conducted exploring the likelihood that the differences observed could be attributable to influence of age, growth, or maturation on natural mutation rates. The initial findings were based on 224 fish from four general water masses and 12 locations within the general water masses.

Data on age of the fish from scale readings were available for a subset of about 75 fish from seven stations in the Coastal Mid-Atlantic, Georges Bank and the Gulf of Maine. State of maturation was known for roughly half of all fish analyzed, from 15 stations in all four general water masses. Information on weight, length, and sex was available on just about every fish sampled. Age of fish did not differ significantly between water sources, but maturation did. There was no significant statistical correlation between mutation frequency and age. Multiple regression analysis showed no significant relationship of mutation (micronuclear) incidence with the following: weight, length, sex and maturation.

Maturation though was more closely related than the other factors. Analyses of the subset of data with maturation data again revealed that, as in the complete data set, fish in the New York Bight Apex and Long Island Sound had significantly higher mutation frequencies than flounder sampled elsewhere in this study.

The likelihood does not seem great then that any explanation for the higher counts in the Bight Apex and Long Island Sound will be found in natural factors as they might influence spontaneous mutation. However, this possibly should be re-examined as larger data sets become available on these fish.

A good portion of all 400 head kidney samples from the Atlantic mackerel sampled in spring of '82 have now been scored for micronuclear (mutation) incidence in their immature erythrocytes. Most of these fish were captured near the edge of the Continental Shelf and are being used to assess more thoroughly natural influences on mutation. Atlantic mackerel are presently being sampled in the New York Bight Apex, and this will provide the basis for a comparison of frequencies in contaminated and relatively clean areas.

Some effort is being expended on the development of rapid mutation assay for shellfish resources.

Cooperation with Other Government Agencies and with Private Industry

The background paper, "Cytogenetic perspectives in petroleum hydrocarbon studies", A. Longwell prepared for the National Academy of Sciences Updated Report on Petroleum in the Marine Environment was provided on request to M. Varela, Office of Radiation Projects, EPA, Washington, D. C.

Two private environmental consulting firms were provided with reprints and other information.

ASPECTS OF NUTRITIONAL REQUIREMENTS OF MOLLUSKS

Open Tank Cultures

In response to increased laboratory demand for algal suspensions to feed adult mollusks, two open tank mixed-algal-species cultures (ca 500 liters) have been started. Growth of algae in an enriched reconstituted seawater medium has been rapid and dependable, and background populations of bacteria, mycelia, and protozoans have remained minimal. The unusual and extreme stability of these open cultures has permitted us to maintain a semi-continuous culture regime in which 100 liters of media are added to each tank two or three times each week to replace harvested culture. Total tank culture harvested during the period of this report was 1,950 liters at a mean packed cell volume of .013 ml packed cells/10ml cell suspension. Investigators utilizing this food source were Spawning and Rearing of Mollusks, Aquacultural Genetics, and Physioecology.

Algal Culture Experiments

Since measuring differences in the protein content of certain algal species cultured in our standard enriched natural seawater medium (E) and in a reduced-nutrient formulation (X_1), we have been investigating the influence of each of the medium components upon the growth as well as

proximate composition of several algal species. In the recent experiments, the iron chelate component, NaFe Sequestrene, was tested in various concentrations with the flagellate *Dunaliella euechlora*. No differences in growth of this alga were observed over the range of concentrations tested, nor were there any differences in cellular protein. Samples are being held for analysis of total carbohydrate and total lipid.

Development of analytical capabilities in our laboratory has continued with a procedure for measuring total carbohydrate in algal cells. A modification of a phenol-sulfuric acid method was tested for 20 algal species that have been used as food sources in previous oyster feeding studies. Results were consistent and dependable. Whereas small batch cultures of algae were used for these preliminary measurements, semi-continuous carboy cultures of each algal species will be assayed when available.

We have also been investigating analytical procedures for total lipids and have begun testing one possible procedure.

SPAWNING AND REARING OF MOLLUSKS INVESTIGATION

To determine the feasibility of utilizing heated seawater to enhance the growth of bivalves during mid-winter phytoplankton blooms, we have begun several experiments. Different numbers of surf clams were maintained at constant flow rates and at either elevated (15°C) or ambient seawater temperatures. Growth in ambient seawater began only after the temperature had risen to 10°C. Clams at 15°C have grown rapidly from February to the present. Every three weeks, the 15°C experiment was restarted with new clams of the initial size. Data collected include ambient phytoplankton levels, phytoplankton consumed, and changes in length and biomass as related to food availability and temperature. These data provide the basis for models of carrying capacity, production, and economics in systems that utilize heated seawater.

We have continued to experiment with shellfish larval growth and food consumption rates at various algal concentrations. This work has been extended to include bay scallop, hard clam, and American oyster larvae. Results to date indicate rapid growth at low to medium food concentrations (10,000 to 25,000 cells/ml), but greatest apparent food consumption at medium to high levels (25,000 to 100,000 cells/ml). This contradiction will be explored in future tests.

PUBLICATIONS

- Longwell, A. 1983. Update of aquaculture genetics (and related) programs recently completed or ongoing in the U.S. ICES, Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.
- Longwell, A. 1983. Population genetic studies on aquatic species recently or presently being supported of the U.S. Departments of Commerce (NOAA), Interior or Agriculture. ICES, Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.
- Longwell, A. 1983. Prospects for chromosome and molecular techniques in population studies of marine resource species - theory, background, and application. ICES Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.

- Longwell, A. and Choromanski, J. 1983. Bibliography of gynogenesis and polyploidy, 1978-1983. ICES, Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.
- Longwell, A. And Choromanski, J. 1983. Bibliography on biochemical studies of the genetic structure of aquatic resource populations - theory, techniques, results, 1978-1983. ICES, Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.
- Longwell, A. And Choromanski, J. 1983. Bibliography on chromosome banding techniques and their application to fish, and population studies, 1978-1983. ICES, Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.
- Longwell, A. and Choromanski, J. 1983. Bibliography on DNA restriction endonucleases, and DNA hybridization as a means of discerning phylogenetic and population differences, 1978-1983. ICES, Genetics Working Group paper for April 27-29 meeting, Lowestoft, U.K.

A completed manuscript titled "Cycles in Relative Growth of Juvenile Oysters, *Crassostrea virginica* (Gmelin)" by Ravenna Ukeles, Gary HJ. Wikfors, and Joseph W. Twarog, Jr. was completed and submitted for publication to the journal, Marine Biology Letters.

MISCELLANEOUS

Travel, Meetings, and Presentation

A. Longwell attended a meeting of the International Council for the Exploration of the Sea Working Group on Genetics, of the Mariculture Committee in Lowestoft, United Kingdom, April 27-29, made two presentations and participated in discussions on gynogenesis and ployploidy in aquaculture.

March 25-27. Ed Rhodes attended the Benthic Ecology Meetings held at the Florida Institute of Technology, Melbourne, Florida.

April 9. Ed Rhodes and Ron Goldberg attended the Connecticut Fisheries Forum at Avery Point, Connecticut, and presented talks about mariculture potential in Long Island Sound.

April 21-23. Ed Rhodes attended the New England Estuarine Society meeting in Portland, Maine.

April 28. Ron Goldberg attended the Maine Softshell Clam Conference in Boothbay Harbor, Maine.

Visitors

Dr. R. W. Alden III of Applied Marine Research Laboratory, Norfolk, Virginia visited the genetics laboratory in April to learn procedures for the application of the micronucleus test to field sampled resource fish.

Mr. William Cuthbert of Mulberry Farm Bivalve Aquaculture, Guilford, Connecticut, visited our Laboratory on several occasions to obtain information and advice on producing algal food cultures.

March 10. Bob Bachand, Norwalk, Connecticut.

March 11. Albert Mimo, Old Saybrook, Connecticut.

March 17. Tom Robinson, Niantic, Connecticut.

March 31. Fred Wishner, New York Aquarium

March 30. Prof. Hubbard, Economics Department, Quinnipiac College, his wife, and their guest from Kenya, Ms. Obiora.

University Affairs

The background paper, "Cytogenetic perspectives in petroleum hydrocarbon studies", prepared by A. Longwell, 1981, for the National Academy Updated Report on Petroleum in the Marine Environment was sent on request to Dr. D.R. Dixon of the Institute for Marine Environmental Research, Plymouth, United Kingdom.

Data on micronuclear (mutation) incidence in the mature and immature erythrocytes of approximately 600 fish, along with ancillary information on the fish, (Atlantic mackerel and winter flounder) were turned over to Prof. F. Anscombe, Statistics Department, Yale University, for use in a graduate technical work project. Background information and reprints on the subject matter were also provided the graduate student.

On March 1 and 11 Ed Rhodes Participated in Steve Tettelbach's comprehensive examinations as a doctoral committee member, University of Connecticut.

In March Ron Godberg spoke with Dr. Robert Malouf at the State University of New York at Stony Brook regarding growth experiment of bivalves in turbid waters. Arrangements were made for the Milford Laboratory to provide seed clams.

On March 10 the Investigation provided oyster larvae to Bob Bachond, Fairfield University.

On March 10 Ed Rhodes discussed a PhD. thesis with Mary Gibbons, State University of New York.

On March 10 the Investigation provided European oysters to Dr. Hartman, Yale University.

On March 14 Ed Rhodes discussed shellfish seed availability with Steve Molanowski, University of Connecticut

On March 22 Ed Rhodes discussed shellfish larval feeding with Lowell Fritz, Rutgers University.

On March 31 Ed Rhodes discussed aspects of marine pollution with Mark Begly, Northeastern University

On April 15 Ron Goldberg spoke to a class from Suffolk Community College about molluskan aquaculture.

On April 30 Ed Rhodes gave an aquaculture program tour to a Marine Science class from Fairfield University.

Public Affairs

Dean Perry set up a display and talked to students at a Career Expo, Platt High School, Meriden, Connecticut, April 13.

Axenic starter cultures were provided to Dr. John Blake, Battel's Laboratories: receipt of cultures in excellent condition was acknowledged.

Information on culture techniques and algal growth media was requested by and sent to the Centro Nacional Patagonico of Argentina.

Dr. Ukeles reviewed two manuscripts submitted for publication in Marine Ecology-Progress Series at the request of the editor, Dr. O. Kinne.

On March 2 Ed Rhodes provided information on hatchery maturation of clams to the Shinnecock Tribal Oyster Project, Southampton, New York.

On March 29 the Investigation provided fertilized oyster eggs to Energy Resources, Cambridge, Massachusetts.

On April 15 Ron Goldberg spoke with Richard Hannington from the town of Babylon, Long Island, New York about cooperative experiments involving suspension culture of bivalves.

EEO Activities

On March 29 Ron Goldberg attended the NMFS EEO Leadership Conference in Washington, D.C.

PATHOBIOLOGY DIVISION

submitted by

Dr. Aaron Rosenfield, Chief

FISH PATHOLOGY INVESTIGATION

Since 1979 lesion-bearing tissue from bottom fishes samples for age and growth and predator/prey studies on seasonal bottom fish survey cruises have been sectioned and appropriately stained for microscopic examination. To date, 350 tissue blocks have been sectioned, stained, and examined; collation of the microscopic observations has been completed and photomicrographs of specific lesions have been prepared. The findings from this initial study of marine fish health are being prepared for publication.

Gadoid fishes examined on survey cruises included cod (107), haddock (36), silver hake (32), red hake (28), white hake (26), and pollack (11). Pleuronectid fishes examined included winter flounder (40), yellowtail flounder (33), and American plaice (9). Tissues containing gross lesions included gill (93), gut (57), integument (53), liver (41), muscle (33), spleen (32), and heart (19). In gadoids more lesions were noted in cod (121) than haddock (36), silver hake (30), red hake (28), or white hake (26). In pleuronectids more lesions were noted in winter flounder (40) than yellowtail flounder (33) or American plaice (9).

Gill lesions were caused by microsporidans, parasitic copepods, and a yet unidentified oocytelike cell. Gut lesions almost always were caused by encysted larval cestodes and/or nematodes or microsporidans. Integumental lesions consisted of lymphocystis, ulcers, and several hyperplastic/papillary epithelial lesions. Liver lesions usually were associated with encysted larval cestodes and/or nematodes. Lesions of muscle were caused by larval trematodes, microsporidans, and parasitic copepods. Heart and spleen lesions only were seen in cod and consisted of granulomatous inflammation in response to microsporidan infection.

Work on immunochemical staining of virus in fish cells is progressing. Both infectious pancreatic necrosis virus and infectious hematopoietic necrosis viruses have been successfully demonstrated in cell cultures using an Avidin-Biotin-Peroxidase technique with AEC (3-amino 9-ethyl carbazol) as a substrate. DAB (3,3 diaminobenzidine tetrahydrochloride) is currently being tested to provide a second color reaction with might be useful in examining material in which more than one type of virus is present.

Experiments planned for the coming months will use the technique to visualize virus present in paraffin sections of fish tissues and to test for the presence of antibody in the sera of wild fish. The greatest problem encountered to date has been determining the optimum fixation for materials to be stained using this technique. Contrary to most published information, best results have been achieved using formalin vapor as a fixative. The recommended mercuric chloride-based fixative (Susa, formal-sublimate) have been less successful. Another problem has been determining the proper concentration of 1° Ab to be used. These have ranged from a 10⁻² dilution of infectious hematopoietic necrosis antiserum to 10⁻⁸ or 10⁻⁹ dilution for infectious pancreatic necrosis antiserum.

Further studies of skeletal anomalies await the arrival of a summer temporary aide to prepare X-ray films of fish collected during fall and winter surveys. Several collections of *Menidia* were also frozen to determine if they may have some utility as an indicator species.

The Northwest Atlantic mackerel parasite data were reviewed and plans were made to add to the data base in 1983, concentrating on young-of-the-year fish. Data received from the Pathobiology group in Szczecin, Poland, also were reviewed. Some revisions in our data log sheets have been made based on our first year's experience.

The results of the mackerel studies will be entered on a computer data base beginning this summer in preparation for analysis in early 1984.

Ultrastructure studies conducted on yellowtail flounder blood samples, from fish with abnormal nuclei in routine blood smears, have demonstrated that the inclusions frequently observed in light microscope preparations are composed of compactly organized heterochromatic material. The dense chromatin was observed in marginated masses of varying size. It was pinched off from the nucleus and formed inclusion bodies that resemble those observed in viral erythrocytic necrosis (VEN). Presently, it is not known whether this condition is a result of a hemolytic condition related to disease, or step in the normal sequence of erythrocyte maturation leading to typical cell death. In preparation for electron microscopy studies of *Eimeria* sp. in mackerel liver, light microscopic evaluations of routinely prepared tissues are in progress. Various stages of the parasite, principally oocysts, were found in 100% of the tissues examined. The infections appeared to range from light to heavy. Paired samples for ultrastructure will now be processed in order that a more thorough examination of parasite development and taxonomy can be made.

Through the courtesy of Dr. Greg Lough, arrangements have been made for the collection of cod and haddock larvae from Georges Bank. These larvae will be sectioned together with some taken for DNA/RNA measurements by Dr. Larry Buckley at the Narragansett Laboratory.

Data on the occurrence of *Haematraetidum scombri* and gill parasites in winter-caught Atlantic mackerel from the continental shelf have been received from ZSIOP in Poland. Preliminary examination of the data shows that 23.5% (112/477) of the mackerel sampled were infected with *H. scombri* in the peripheral blood. This prevalence of infection is consistent with that found previously in the spring migrating population. Of the 112 infected fish, 91% (102/112) had fewer than 1% of the erythrocytes infected. Only 8% (9/112) had 1-3% of erythrocytes infected and one (0.9%) infected fish had greater than 4% infected erythrocytes.

Examination of preserved heads from 290 mackerel showed high prevalences of a monogenetic trematode, *Kuhnia scombri* (54.2%), and cysts of uncertain origin (CUO) (90.3%). No copepods or leeches were noted. Infestations by *Kuhnia* primarily were light; 36% (106/290) of mackerel examined had 1-4 monogenes, whereas 1.7% (5/290) of the fish had infestations of 11-16 monogenes. Some fish monogenes are known to be blood-sucking parasites and preliminary studies on *Kuhnia* suggest that it may also feed on the blood of its host. Statistical analysis of infection data will be used to assess the relationship of this monogene in the transmission of the blood parasite *Haematraetidum*.

Infections with CUO in the mackerel examined ranged from 1 cyst to 364 cysts per fish with most of the fish (128/290 = 44.2%) have 1-10 cysts. CUO occurs as small white cysts in the gill lamellae of several species of fish (e.g., cod, haddock, red hake, silver hake). Histologic and electron

microscopic (Morrison, pers. commun.) examinations of these cysts have not as yet revealed their identity.

COMPARATIVE INVERTEBRATE PATHOLOGY INVESTIGATION

Collections of mussels were obtained from Quoddy Head, Maine, Portland, Maine, outer Cape Cod, and Boston Harbor. Samples of mussels, oysters, and soft clams were obtained from New Bedford Harbor and are being processed. Neoplastic cells from clams from New Bedford are being processed for electron microscopy.

Farley and Kern participated in a mortality survey of the Choptank River system in early April. Eight oyster bars were examined for the occurrence of mortalities, salinity, and temperature. Salinities ranged from 13 ‰ to 15 ‰ and temperatures from 10-12.8°C. Mortality levels were generally high (36-60%) from the mouth of the Tred Avon west to Cooks Point in the Choptank and low up the Tred Avon River and east of the Tred Avon up the Choptank River. New mortality was 8% at the Tred Avon Lighthouse and 23% at Todds Point in the Choptank.

A sample of oysters from Texas that were being shucked at Tilgham Island were collected and are being processed. This practice is potentially threatening to local oyster populations because of the possibility of introducing exotic pests and diseases from shell plantings, etc.

Critical evaluation of electron micrographs from Denman Island *Crassostrea gigas* revealed virus-like particles in the cytoplasm of microcells. A draft manuscript was completed on this microcell disease in oysters.

The final diagnostic report on Tasmanian seed oysters was provided to the State of Washington prior to their introduction into that state's waters. These oysters had been held in Mad River Slough, California, for two months after their introduction from Tasmania. No significant parasites or pathologies were observed in any of the samples examined.

Dr. Johnson spent the reporting period gathering material for, and writing, a review paper on viral diseases of marine invertebrates, to be published in *Helgolander Meeresuntersuch.* The paper will form a basis for an oral presentation to be given at a symposium on diseases of marine animals, to be held in Helgoland, September 1983.

The histology unit prepared over 1,600 sections of oyster, mussel, clam, crab, and fish tissues for microscopic examination by resident pathologists.

MICROBIAL ECOLOGY AND PARASITOLOGY INVESTIGATION

Rock crabs, *Cancer irroratus*, were collected in March from the "Mudhole," a station located in the Hudson Shelf Valley slightly seaward from the New York Bight sludge disposal sites. The collection was timed to coincide with a season in which recently molted crabs from Sandy Hook Bay and other inshore environments were beginning an annual springtime migration to deeper waters. Among the collection of 143 crabs, 124 (86%) were late postmolt shells and the incidence of gill blackening was less than 1%. Gross observational data on gill blackening supported previous conclusions that such discoloration is minimal during and after molting activity. In contrast to the March 1983 results, gill blackening was noted in 20% of the crabs collected in May 1982, and in 30% collected in

November 1982. The incidence of gill blackening has been consistently higher at the "Mudhole" than at any of our previous sampling areas. Results from studies at the station enable us to conclude that one of the principal causes of gill blackening in the Bight Apex is the accumulation of black mud and silt between adjacent gill lamellae. The role of blackened sediment on rock crab condition was supported by the observation that carapace blackening occurred in 79% of crabs collected in November 1982, crabs which also showed an incidence of 30% for gill blackening. The value of gill blackening as a monitoring and research tool for crustacean health has been shown in similar studies at the Philadelphia-Camden disposal site. While the dumpsite was active, blackening was noted in up to 10% of the crabs examined; however, since dumping ceased in November 1980 we have not noted blackening in any of the crabs examined.

Sediment samples were collected by members of the Department of Microbiology, University of Maryland, in March 1983. The sediments were taken from eight stations near a sewage outfall at Ocean City, Maryland, and studied for human enteric bacteria and sewage associated amoebae (*Acanthamoeba*). One station yielded amoebae from 4/6 culture plates and a second station yielded them from 2/6 plates. Two strains of amoebae tentatively identified as pathogens are being tested for their ability to grow at mammalian body temperatures. The study was conducted to further test our hypothesis that *Acanthamoeba* is routinely isolated from sewage associated sediments, and the pathogenic species are recoverable more often from contaminated sediments than from clean sediments.

A very limited study on winter flounder has been initiated in cooperation with Dr. Fred Thurberg, Milford Laboratory. The study has been designed to conduct histopathological studies on gills from same fish that are used for blood studies at Milford. The first sample of approximately 33 fish from Ocean Pulse station #13 showed that 10 of them (30%) had Feulgen-positive fine-grained lesions between the gill lamellae. Among a second collection of 17 fish from the "Mudhole," 2 (12%) had similar lesions. We gratefully acknowledge Dr. Robert Murchelano, Oxford Laboratory, for looking at the slides and suggesting that the condition grossly resembled "epitheliocystis" as seen in other freshwater and marine fish species. The slides also were examined by Drs. John Harshbarger and Clyde Dawe who expressed a similar opinion. Until the lesions are examined with the electron microscope to establish the characteristics of the causative organisms, we are using the term "epitheliocystis-like" lesions in gills of the winter flounder. Further studies are planned to see if there are seasonal, geographical, and size-class differences in the incidence of the disease. Findings on gill conditions in winter flounder will be discussed periodically with Dr. Thurberg to determine whether there are any statistical correlations between gill pathology and blood characteristics in the fish.

DISEASES OF LARVAL MOLLUSKS INVESTIGATION

Staff members of the Milford Pathobiology Division visited the recently completed Mulberry Farms clam *Mercenaria mercenaria* hatchery in Guilford, Connecticut. Water samples were taken at six different points (river water, greenhouse intake, pool #3, head tank, head tank 1 -UV treated, and discharge water) to determine the total concentrations of natural bacterial flora and *Vibrio* presence. Total plate counts for the six samples averaged 10^4 CFU/ml except the UV water (10^3 CFU/ml) and the head

tank (10^6 CFU/ml plus 10^2 *Vibrio*). A report was sent to the Mulberry Farms manager including recommendations to reduce *Vibrio* presence in the head tank.

Nineteen suspect pathogens isolated from natural shellfish beds last year have been challenged to replicate experimental larval mortality. After months of storage, they have become less virulent causing little or no mortality. To revive pathogenicity these organisms were challenged at 5.0×10^8 CFU/ml with oyster larvae. They were then recovered from the challenge and will be rechallenged to observe significant mortality. Of these 19 isolates, 12 have been checked in an extensive series of biochemical tests to determine species. It appears that 10 are absolutely not identical but 2 show that they could be related. A complete antibiotic sensitivity test will be completed on all these isolated in the next reporting period.

During this bi-monthly period two trips to Bayview, Milford, were made on 16 March and 12 April in a cooperative study with the State of Connecticut Aquaculture Division. Sediment, water, and clams were collected and total plate, coliform, and *Vibrio* counts were completed.

Edwin Rhodes of the Life History Investigation received two samples from the Leslie Salt Co., San Francisco, California. We were asked to plate these on three different NaCl plates with concentrations of 10%, 15%, and 20%. One sample grew much better on all three salt plates than did the other, which only grew on the 10% (3.50×10^1); no growth on TCBS. One sample also grew on TCBS (no changes in salt-media preparation) and all colonies were sucrose positive. Biochemical media with elevated salt concentrations are being prepared to identify bacterial genus. Results will be reported in a future narrative.

On 8 and 29 April, Pathobiology staff collected water and sediment samples from Palmer Cove, Noank, Connecticut, to monitor the presence of *Gonyaulax* cysts. Few cysts were found.

Additional bioassay work was done with four clam samples received from John Hurst of the Department of Health in Maine. Two of the four (Higgins Beach and Sagadahoc Bay) were tested for PSP toxin. All four samples will be filtered and tested again in the near future.

One of the major problems affecting *in vitro* studies of the cellular defense system in mollusks is that of cell adherence to test-tube surfaces. Reliability of phagocytosis experiments using cell suspensions is seriously compromised because of this problem. Using our newly developed lytic-fluorometric method for counting cells, we have examined a number of materials for effectiveness in circumventing the attachment of oyster and scallop cells. These include teflon, polyethylene, glass, paraffin-coated glass, and agarose-coated glass as well as all of the foregoing incubated with cells in seawater containing 0.01% agarose. The latter, while helpful in preventing cell attachment, caused some cell lysis. Paraffin and agarose surfaces gave the best results. However, 5-18% of the cells attached even to these materials; attachment increased when tubes were rotated for 60 min as in phagocytosis experiments. Further work to improve these results is in progress.

Reagents used in enzyme-linked immunoassays for identification of bacteria and serum antibodies were titered and tested for specificity. Unwanted cross-reactivity of bacteria with both laboratory-prepared and commercially-prepared reagents was observed. Attempts are being made to eliminate cross-reactivity by absorption with appropriate bacteria.

previous experiments revealed that a specific toxin-producing *Vibrio* sp. did not produce the toxin while growing in a minimal broth medium. If the bacterium, however, was removed from this medium, it again became pathogenic. Earlier experiments gave some indication that the purine, i.e., hypoxanthine, present in the minimal medium inhibited toxin production. Further experiments conducted, however, showed that the addition of hypoxanthine to oyster larval cultures had no effect on the virulence of the *Vibrio* sp. Similar experiments are now being conducted using the amino acid asparagine and a combination of hypoxanthine and asparagine. Media are being prepared so that the nutritional requirements for toxin production in the *Vibrio* sp. can be ascertained.

Data collected during February and March from daily seawater sampling suggested that the averaged bacterial load in seawater increased slightly as it left the Milford Harbor and flowed to one of the individual lab rooms in the Milford Laboratory. Using estuarine agar plates, bacterial counts of seawater taken from Milford Harbor average 2.3×10^4 CFU/ml, while seawater collected in the lab average 2.4×10^4 CFU/ml. These results are contrary to what was found during January and February when counts decreased from 4.4×10^4 CFU/ml in the harbor to 2.0×10^4 CFU/ml in the lab. Agar digesters were more frequently found on harbor seawater sample plates than on lab seawater sample plates during the last 2 months.

PUBLICATIONS

- Bodammer, J.E.; MacLean, S.A. Ultrastructural observations on the haemoparasite, *Haematraetidium scomberi*, in the Atlantic mackerel. J. Fish. Dis. (S)
- Brown, C. Nutritional requirements for a pathogenic *Vibrio* sp. (Abstract). J. Shellfish Res. (S)
- Daggett, P.-M.; Sawyer, T.K.; Nerad, T.A. Distribution and possible interrelationships of pathogenic and nonpathogenic *Acanthamoeba* from aquatic environments. Microb. Ecol. 8: 371-386; 1982. (P)
- Howard, D.W.; Smith, C.S. Histopathologic procedures employed by the Northeast Fisheries Center Oxford Laboratory. NOAA Tech. Memo. NMFS-F/NEC. (S)
- Kern, F.G.; Farley, C.A. A brief history of MSX disease in the American oyster. Tidewater Fish. News 16: 3; 1983. (P)
- Lewis, E.J.; Sawyer, T.K.; Casey, J.; Wesche, A. Frequency distribution of free-living limax amoebae in a natural fresh- to salt-water estuarine system. 2nd Int. Conf. Biol. Pathogen. Small Free-Living Amoebae. U.S. Public Health Service, Centers for Disease Control, p. 135; 1982. (P)
- McAllister, P.E.; Newman, M.W.; Sauber, J.H.; Owens, W.J. Isolation of infectious pancreatic necrosis (IPN) virus from southern flounder, *Paralichthys lethostigma*. Bull. Europ. Assoc. Fish Pathol.
- Robohm, R.A.; Rose, W.E. A novel lytic-fluorometric method to count molluscan phagocytes in monolayers or suspensions. (Abstract). Int. Soc. Develop. Comp. Immunol. (S)
- Sawyer, T.K. Shared cyst characters and their potential for the incorrect identification of species of *Acanthamoeba*. (Abstract). 2nd Int. Conf. Biol. Pathogen. Small Free-Living Amoebae. U.S. Public Health Service, Centers for Disease Control, p. 89; 1982. (P)

MISCELLANEOUS

Travel, Meetings, and Presentations

On 28 February, Milford Pathobiology visited the Mulberry Farms clam hatchery in Guilford, Connecticut. A tour was given by Biff Cuthbert and Jim Pepper through the new *Mercenaria* hatchery.

Dr. Rosenfield, Mr. Farley, Mr. Kern, and Dr. Blogoslawski (Milford) attended the Shellfish Transport Conference at Woods Hole on 9-11 March.

Dr. Brown (Milford) participated in the IR-4/Food and Drug Administration Workshop for Minor Use of New Animal Drugs on 14-16 March in Rockville, Maryland.

Dr. Rosenfield and Dr. Sindermann (Sandy Hook) visited the Office of Resource Utilization in Washington, D.C. on 15 March to discuss the proposed National Shellfish Improvement Plan.

Dr. Rosenfield visited the Atlantic States Marine Fisheries Commission in Washington, D.C. on 16 March to update the executive director on State-Federal problems related to shellfish transports.

Mr. Kern attended the Center Incentive Awards Committee meeting at Woods Hole on 16-18 March.

During 17-24 March, Dr. Sawyer conferred with Dr. Stewart Bamforth, Tulane University, New Orleans, Louisiana, concerning manuscript preparation, presented a seminar on pathogenic protozoans, and collected sediment samples for culture.

Dr. Murchelano attended a joint U.S./Canada workshop on fish stock assessment in Halifax, Nova Scotia, 22-24 March.

On 25 March, Dr. Rosenfield, Dr. Sindermann, and Mr. Ben Drucker (Washington Office) met at Oxford to discuss and plan for a symposium on diseases of aquatic animals.

John Ziskowski participated on Part II (28 March-8 April) of the spring 1983 bottom fish survey on the *Albatross IV*.

Mr. Kern and Mr. Farley participated in a mortality workshop at Rutgers University in Bivalve, New Jersey, 28-30 March.

On 30 March, Dr. Blogoslawski attended a Sea Grant review at Avery Point, Groton, Connecticut.

Dr. Sawyer conferred with Dr. Ruddell at the Hampton Institute and with Dr. Perkins at the Virginia Institute of Marine Science on 1-2 April.

Pathobiology, NMFS Regional Office, and Maryland Department of Natural Resources staff members met at Oxford on 4 April to discuss problems related to Chesapeake Bay oysters and possible economic effects of MSX on the oyster fishery. Disaster funding was also discussed in terms of oyster mortalities.

Dr. Blogoslawski attended a Sigma Xi meeting at Quinnipiac College, Hamden, Connecticut.

Dr. Murchelano attended a University of Maryland Sea Grant Advisory Committee meeting at College Park on 5 April.

Dr. Rosenfield, Ms. MacLean, and Dr. Brown (Milford) attended the PMAC meeting in Woods Hole on 6 April.

Dr. Blogoslawski attended a NESSA meeting in New Haven, Connecticut on 7-8 April and gave a report on Federal activities.

On April 9, Dr. Blogoslawski attended the Connecticut meeting of the Fisherman's Forum at Avery Point, Groton, Connecticut and presented a talk on "Worldwide Shellfish Depuration."

Dr. Murchelano and Ms. MacLean participated on Part III (Georges Bank) of the spring 1983 bottom fish survey on the *Albatross IV* from 11-22 April.

Mr. Kern and Dr. Robohm (Milford) attended the 2nd Annual Northeast Monitoring Program Workshop at Sandy Hook, N.J. on 19-21 April.

On 20 April, Mr. Farley presented a talk on "Historical Aspects of Oyster Mortality and Diseases Worldwide, and Past and Current Status of MSX in Maryland" to the Oyster Growers Association in Salisbury, Maryland.

Mr. Farley attended a meeting at the Department of Natural Resources in Annapolis on 21 April to assess mortalities and histopathology methods used in Maryland studies and disease management procedures.

Lisa Tettelbach (Milford) attended the Spring NEERS meeting in Portland, Maine, 22-23 April.

Mr. Newman performed studies on infectious pancreatic necrosis virus during the reporting period at the National Fish Health Research Laboratory in Leetown, West Virginia.

Mr. Farley conferred with Dr. Reinisch on 26-28 April concerning approaches to studying the clam neoplasm in New England.

Dr. Sawyer participated in the 2nd International Symposium on Responses of Marine Organisms to Pollutants in Woods Hole on 28-29 April.

Visitors

Biff Cuthbert of Mulberry Farms visited with Dr. Blogoslawski on 16 March to collect *Mercenaria* spawners, and on 18 March, to discuss disinfection.

On 27 April, Dr. Francisco Ruano, from the National Institute for the Investigation of Fisheries in Portugal, visited the Milford Pathobiology Division.

Pat Staley, University of Connecticut Marine Advisory Service, visited and toured the Milford facility on 29 April.

Visitors to the Oxford Laboratory during the reporting period were: Charles Frisbie, Maryland Tidewater Administration, Annapolis, Maryland; Dr. Joseph Osterman, Walter Reed Army Institute of Research, Washington, D.C.; Henry Patterson, Environmental Protection Agency, Duluth, Minnesota; Time Cole, Joyce Meritt, and Naomi Massey, Center for Environmental and Estuarine Studies, Cambridge, Maryland; Ben Drucker, NMFS, Washington, D.C.; and members of the Current Events Club, Easton, Maryland.

University Affairs

On 11 April, Protul Skrikant, a master's candidate from the University of Bridgeport, discussed a joint project with Milford Pathobiology.

Phil Platcow, a Quinnipiac College student, discussed his class project with Dr. Blogoslawski on 23 April.

On 26 April, Dr. Blogoslawski visited with Dr. Julius Kuck at Fairfield University to discuss joint research.

Public Affairs

Dr. Johnson reviewed a grant proposal for the National Science Foundation.

Fourteen specific reprint requests for Milford Pathobiology publications were filled during March and April.

Dr. Brown talked to a group of students from Suffolk County Community College on 15 April.

Students and faculty of the Marine Technology Program, Suffolk County Community College, visited the Milford Laboratory on 15 April. Dr. Robohm described current work in immunology conducted at the laboratory.

Personnel

LaTina Cornish attended a shorthand refresher course in Philadelphia, Pennsylvania during the week of 18 April.

Phyllis Johnson and Ceil Smith received their 20-yr pins in a brief ceremony at the Oxford Laboratory.

EEO Activities

A film entitled "Workplace Hustle" was shown at the Oxford Laboratory on 28 March.

Dr. Murchelano, Ms. MacLean, and Dr. Brown (Milford) attended the NMFS EEO/AAP Planning Conference in Washington, D.C. on 29-30 March.

A Center questionnaire on sexual harassment was completed by Oxford staff members and forwarded to the Center Federal Women's Program Coordinator on 4 April.

NATIONAL SYSTEMATICS LABORATORY

submitted by

Dr. Bruce B. Collette, Director

SYSTEMATICS OF FISHES

Revised drafts of manuscripts for the Scombroidei and Beloniformes for the Ahlstrom Memorial Symposium on Ontogeny and Systematics of fishes to be held this August in San Diego. Made final revisions to a manuscript on the interrelationships of Spanish mackerels (*Scomberomorus*) to be published in the third volume of *Advances in Cladistics*. Proofread page proof for the paper on host-parasite relationships of scombrid copepods that will appear *Fishery Bulletin*. Made extensive additions and revisions of the catalogue of Scombridae of the world to appear in a *Food and Agriculture Organization World Catalogue*.

Found characters distinguishing two species of double-lined mackerels (*Grammatoreynus*) in the Indo-West Pacific: the wide-spread "scad mackerel" and the "sharck mackerel" which appears to be restricted to northern Australia. Began writing a manuscript on the genus.

Finished a manuscript describing two new species of coral toadfish from the western North Atlantic.

SYSTEMATICS OF CRUSTACEANS

Continued preparation of a monograph on the eastern Pacific "rock shrimps," (genus *Sicyonia*): revised description of the species, prepared a key to the species, wrote the introduction, and made observations on the characters and distribution of the genus.

Completed first draft of key to genera and species of lobsters in U.S. trade, based on tails only. Photographed in color the tails of 6 species of spiny lobsters received from Pinellas Seafood Co., St. Petersburg, Florida.

Continued research on mud shrimps of the eastern Pacific.

Made further conversions on files of the manuscript for the book "Shrimps, lobsters and crabs of the United States, Maine to Florida," for the Smithsonian Press, and sent entire set of discs to press.

Drafted a key to the genera of king crabs *Lithodida* for internal use in the Laboratory and the museum.

SCIENTIFIC SERVICES

Identifications were made of: a collection of shrimps from Mazatlan, Mexico for Michel E. Hendrickx (Instituto de Ciencias del Mar y Limnología, Estacion Mazatlan, Universidad Nacional Autónoma de México); 11 lots of *Sicyonia* from the Mexican Pacific for Luisa Nora Mazin; Norway lobsters in photo from Iceland for National Geographic Society; 12 lots of xanthid and cancriid crabs for Wendy Elcome Harris (Normandeau Assoc. Inc., Piscataquah Lab., Portsmouth, New Hampshire), 3 lots of raninid, majid and parthenopid crabs for D. Barr, (Bureau of Land Management project, Smithsonian Institution); 20 lots of decapod crustaceans from canyons and continental slope from off Long Island to off Chesapeake Bay for D. T. Logan (Lamont-Do

herty Geological Laboratory, Columbia University); lobsters photographed at Tuamotu for National Geographic Society; xanthid crab from cave in the Bahamas for C.W. Hart (US National Museum); and 2 lots of species of halfbeaks for Gordon Howes (British Museum).

Information was provided on: the common names of commercial shrimps of South America for the Organization of American States (OAS); easy to recognize features for the identification of commercial shrimps from Argentina to William Rudd (Meridan Products, Los Angeles, California); marine mollusks from California to Eduardo Nealler Zuniga (Pontificia Universidad Catolica de Chile, Santiago, Chile); bibliography of *Sicyonia* shrimps from the Mexican Pacific, to Luisa Nora Mazin (Univerdidad Nacional Autonoma de Mexico, Mexico, D.F.); references to decapod crustaceans from the eastern Mediterranean for Dr. R. J. Reimold (Metcalf and Eddy, Boston, MA); needs for maintenance of lobsters in live tanks at restaurants for Wendy Smith (Humane Society of the U.S., Washington, D.C.); references on burrowing by the stone crab, *Menippe mercenaria* for R. W. Frey (Univ. of Georgia, Athens); scombrid fishes of Southwest Africa for M. P. Olivar (Instituto Investigaciones, Barcelona); and common names (3 requests) of fishes for the Food and Drug Administration.

Curatorial assistance was provided to the Smithsonian Institution by loaning paratypes of a species of ophidioid fish to one Japanese researcher and providing information on the types of a species of deepwater sea robin *Peristedion* to another. Several lots of lithodids and other large crabs were identified for the Division of Crustaceans to facilitate the planned move of this material to the Smithsonian's new Museum Support Center in Silver Hill, Maryland.

Six research proposals were reviewed for the National Science Foundation, four for Biological Research Resources, and one each for Population Biology and Biological Oceanography.

PUBLICATIONS

- Collette, B.B. Two new species of coral toadfishes, genus *Sanopus*, from Yucatan, Mexico and Belize. Proc. Biol. Soc. Washington. (S)
- Williams, A.B., and C.L. Van Dover. A new species of *Munidopsis* from submarine thermal vents of the East Pacific Rise at 21°N (Anomura: Galatheidae) Proc. Biol. Soc. Washington. (S)

MISCELLANEOUS

Travel, Meetings, and Presentations

Ruth Gibbons spent two weeks (April 4-15) at the laboratory of Dr. Albert C. Smith (Veterans Administration Medical Center, Gainesville, Florida) working on a cooperative electrophoretic study of the proteins of the eye lens nucleus of species of Spanish mackerels.

Following the PMAC meeting in Woods Hole on April 5-6, Dr. Collette briefly visited the Marine Science and Maritime Study Center of Northeastern University in Nahant.

Dr. Williams attended a special session of contributed papers on "Origins and Distributions of Caribbean-Gulf of Mexico Crustacean Fauna," co-sponsored by the Association's annual meeting at Lafayette, Louisiana, April 13-15. Dr. Williams attended a meeting of the Atlantic Estuarine Research Society at Cape May, New Jersey, April 28-29.

Visitors

Dr. Canet was visited by Dr. Dennis T. Logan (Lamont-Doherty Geological Observatory, Columbia University) to discuss distribution of penaeoid shrimps in deep waters off the coast of New York and New Jersey.

Dr. Collette was visited by Dr. G. David Johnson (South Carolina Wildlife and Marine Resources Department) to discuss percoid and scombroid phylogeny for the Ahlstrom Symposium; Dr. Dean Parsons (NMFS, Office of Resource Investigations) to discuss squid research; Dr. James C. Tyler (National Science Foundation) to discuss relationships of the louvar; Dr. M. Patricia Morse (Northeastern University) to discuss teaching at the Marine Science and Maritime Studies Center in Nahant; Dr. Daniel M. Cohen (Los Angeles County Museum of Natural History) to discuss the Ahlstrom Symposium; Drs. Frank A. Talbot and William N. Eschmeyer (California Academy of Sciences, San Francisco) to discuss ichthyological research; and Dr. Sarah W. Richards (Little Harbor Laboratory, Inc., Guilford, Conn.) to discuss taxonomic problems in *Ammodytes*.

Dr. Williams was visited by Won Kim (Florida State University, Tallahassee) to discuss decapods of the Panama region, particularly xanthid crabs.

University Affairs

On March 11, Dr. Collette participated, as co-director of research, in the final examination for the Ph.D. degree of former Systematics Laboratory employee Joseph L. Russo at the Georges Washington University. Mr. Russo successfully defended his dissertation "Interrelationships of the gempylid fishes." This research is an integral part of the overall research program of the Systematics Laboratory on scombroid fishes.

Scientific Society Affairs

A new society, the American Association for Zoological Nomenclature, has been formed to support the work of the International Commission on Zoological Nomenclature. Several organization meetings were held in March and April. Dr. Collette was elected as a member of the governing Council. Other members of the Council are employed by other agencies that rely on nomenclature in their research and service work - the U.S. Fish Wildlife Service; the Parasitology and Systematic Entomology laboratories of the U.S. Department of Agriculture; the National Museum of Natural History; and the Geological Survey.

Dr. Collette participated in a meeting of the Council of the Biological Society of Washington as past-president of the society.

ATLANTIC ENVIRONMENTAL GROUP

submitted by

Dr. Merton C. Ingham, Director

OCEAN MONITORING AND CLIMATOLOGY TASK

The cooperative Ship of Opportunity Program obtained thirteen expendable bathythermograph (XBT) transects and four continuous plankton recorder (CPR) transects in March-April: four XBT and two CPR transects in the Gulf of Maine, three XBT transects off southern New England, three XBT and two CPR transects across the shelf and slope off New York, and three XBT transects across the Gulf of Mexico.

The announcement on the next two pages of eddy conditions in the Georges Bank-Middle Atlantic Bight area were sent to Commander, Atlantic Area, US Coast Guard, for publication in the April and May 1983 issues of the *Atlantic Notice to Fishermen*.

Warm Winter Water on Southwestern Georges Bank

Sea surface temperatures transmitted from a meteorological data buoy (NOAA buoy 44003) on southwestern Georges Bank (40.8°N, 68.5°W) portrayed two unusual events during this past fall and winter (November-March). Time series plots (Fig. 1) of daily water temperature, sensed by a hull thermistor about 1 m beneath the surface, during the fall-winter period of 1982-83 quite clearly show two periods of warmer-than-usual surface water. The first, a short-period event lasting about 15 days, began on 3-5 November with an abrupt rise in temperature from about 13°C to 18°C. The second event was of longer duration, lasting from December through March, and was marked by the persistence of surface water temperatures which were warmer than those in 1981-82 by as much as 4°C (January). The 1982-83 winter sea surface temperature also were warmer than those of 1979-80 and 1980-81 (about 2°C and 5°C, respectively, in January).

Analysis of Advanced Very High Resolution Radiometer (AVHRR) imagery from the NOAA 7 satellite indicates that the abrupt warming of SST's observed at buoy 44003 in November 1982 was the result of an intrusion of warm slope water from the south into Great South Channel and onto the southwestern corner of Georges Bank. The slope water intrusion seemed to be associated with the anticyclonic circulation of a warm core Gulf Stream ring (82-H) that moved relatively quickly along the southern flank of Georges Bank during November. Intrusion of warm water onto the bank started to develop on about 3 November and rapidly expanded into a large tongue, encompassing a 900-square-mile (3,100 km²) area. Satellite imagery shows the intrusion persisting until about 8 November (Fig. 2), after which prevailing cloud cover prevented viewing of the area.

Similar abrupt warming about the same time was apparent in sea surface temperature records from buoy 44008, located in about 60 m of water at the southeastern corner of Nantucket Shoals (40.5°N, 69.4°W), with temperatures rising from 13.1°C on 2 November to 16.7°C by 4 November.

The warmer sea surface temperatures at buoy 44003 during December 1982 through March 1983 apparently were a result of the relatively warm winter that was experienced across New England in 1982-83. Daily average air

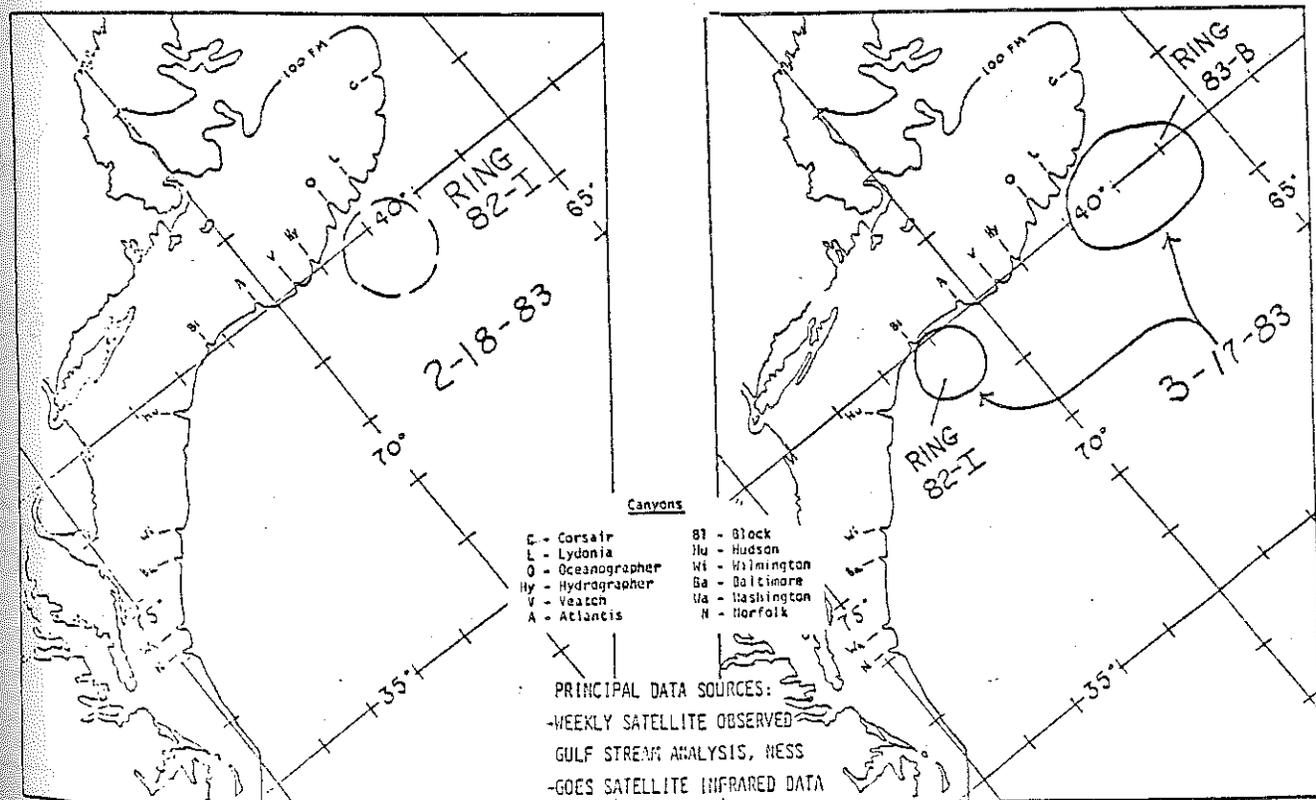
GULF STREAM RING LOCATIONS

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

Ring 82-I travelled westward along the edge of the continental shelf 259 km (140 nm) to a position centered at 39.5°N, 71.0°W, south of Block Canyon. Ring 83-B, a relatively new ring, travelled west-southwest 185 km (100 nm) to a position centered at 39.8°N, 66.8°W, southeast of Lydonia Canyon.

During the next thirty days, ring 82-I can be expected to travel in a south westerly direction along the edge of the continental shelf to a position centered southeast of Wilmington Canyon. Ring 82-B can be expected to travel west-southwest to a position centered south-southeast of Hydrographer Canyon.

Fishermen are requested to report unusual conditions or catches occurring in the vicinity of these rings to the Director, Atlantic Environmental Group, National Marine Fisheries Service, RR 7, South Ferry Road, Narragansett, Rhode Island 02882, by mail. Updates on ring positions and general information on Gulf Stream rings may be obtained by calling the Atlantic Environmental Group (401-789-9326).



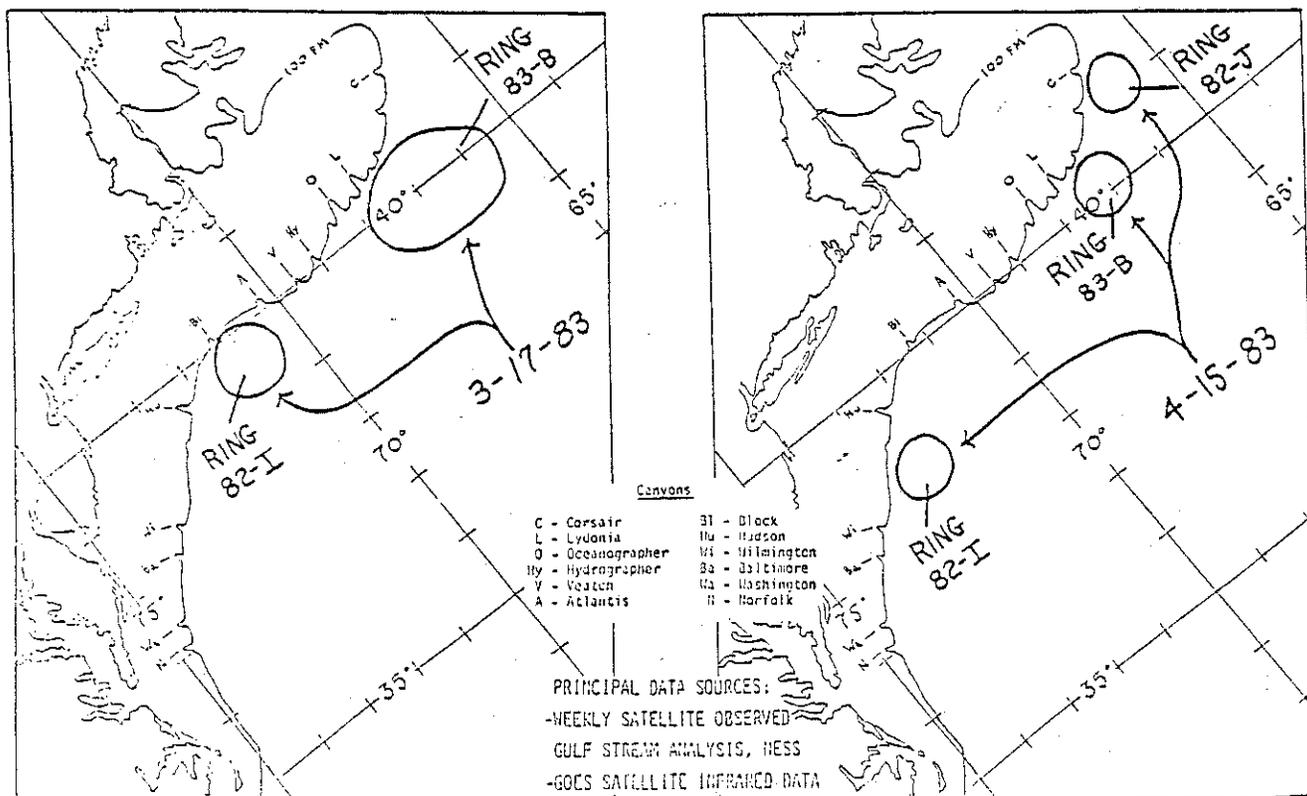
GULF STREAM EDDY LOCATIONS

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

Ring 82-I travelled southwestward 167 km (90 nm) to a position centered at 38.8°N, 72.4°W. Ring 83-B, reduced drastically in surface area, travelled northwest 56 km (30 nm) to a position centered at 40.2°N, 67.1°W, southeast of Lydonia Canyon. Ring 82-J, a relatively old ring but new to this analysis, travelled in a southwesterly direction 148 km (80 nm) to a position centered at 40.1°N, 65.9°W, southeast of Corsair Canyon.

During the next thirty days, ring 82-I can be expected to travel along the edge of the continental shelf to a position centered east of Washington Canyon. Ring 83-I can be expected to move in a west-southwest direction and may approach Hydrographic Canyon. Ring 82-J can be expected to move southwestward along the edge of Georges Bank and may approach Lydonia Canyon.

Fisherman 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).



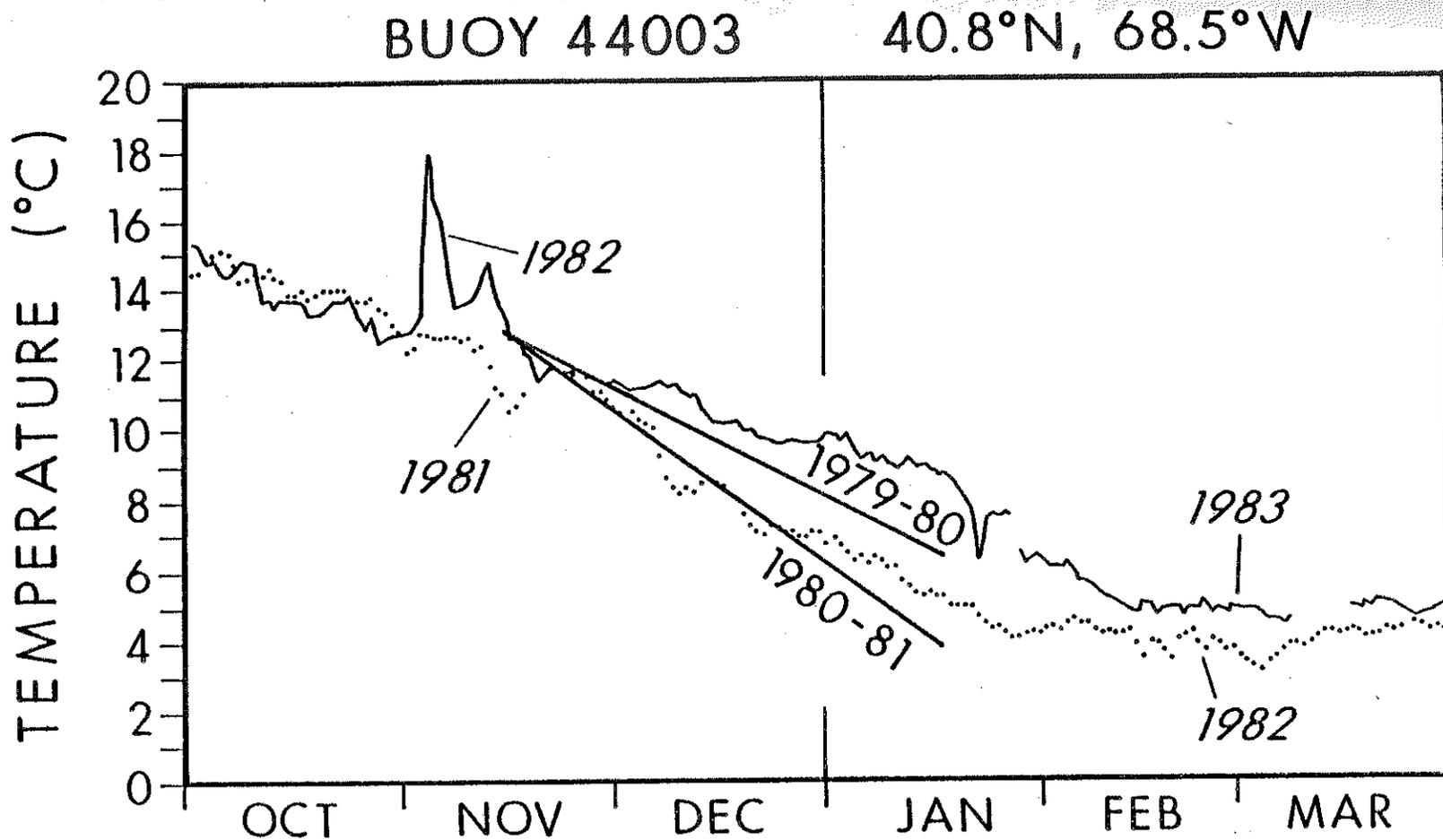


Figure 1. Sea surface temperature recorded by the hull thermistor in NOAA meteorological buoy 44003 during October-March 1982-83 (solid line) and 1981-82 (dotted line). Trend lines from buoy data for November-January 1979-80 and 1980-81 are shown as straight lines for comparison.

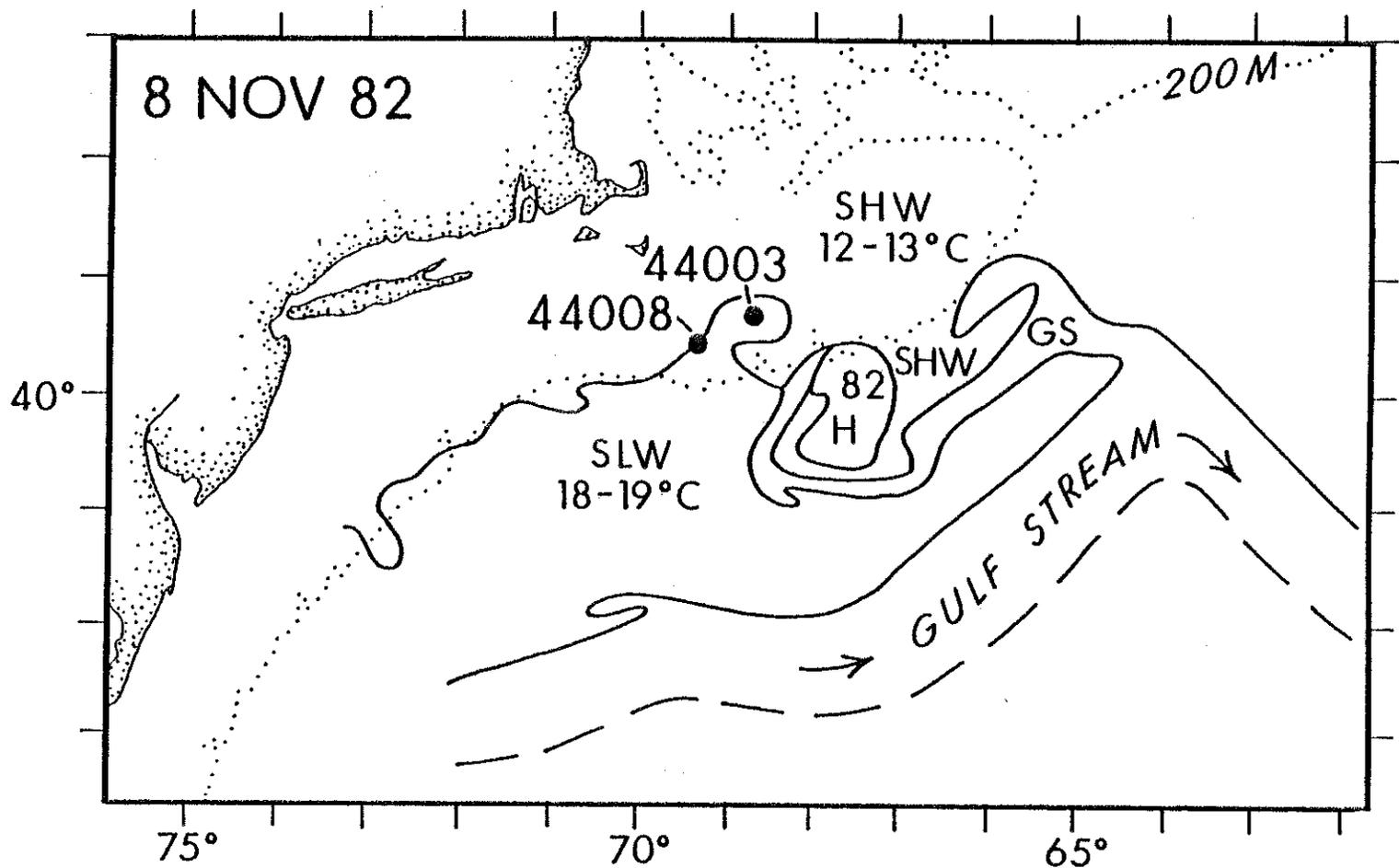


Figure 2. Map of surface thermal features in the area south of Georges Bank on 8 November 1982 derived from infrared imagery from the NOAA 7 satellite. The locations of two meteorological buoys, 44003 and 44008, are shown. Temperature ranges, shown (12-13°C for shelf water and 18-19°C for slope water) were obtained from ship reports of surface temperature.

temperatures from Providence, Rhode Island weather station records were about 4°C and 6°C warmer in December 1982 and January 1983, respectively, than in 1981-82. The resultant cooling rate of surface water (approximately 0.05°C per day) was the lowest in four winters of records from buoy 4003.

For further information, contact Peter Celone or Carol Price of AEG.

PUBLICATIONS

- Armstrong, R.S. Variation in the shelf water front position in 1982 from Georges Bank to Cape Romain. *Annls. biol. Copenh.* 39. (S)
- Armstrong, R.S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. *Annls. biol. Copenh.* 38. (A)
- Celone, P.J., and C.A. Price. Anticyclonic warm core gulf stream rings off the northeastern United States during 1982. *Annls. biol. Copenh.* 39. (S)
- Crist, R.W., and R.S. Armstrong. Bottom temperatures on the continental shelf and slope south of New England during 1982. *Annls. biol. Copenh.* 39. (S)
- Crist, R.W., and J.L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1980. *Annls. biol. Copenh.* 37. (P)
- Cook, S.K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1982. *Annls. biol. Copenh.* 39. (S)
- Fitzgerald, J.L., and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1981. *Annls. biol. Copenh.* 38. (A)
- Fitzgerald, J.L., and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1980. *Annls. biol. Copenh.* 37. (P)
- Hilland, J.E. Variation in the shelf water front position in 1980 from Georges Bank to Cape Romain. *Annls. biol. Copenh.* 37. (P)
- Hughes, M.M., S.K. Cook. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1981. *Annls. biol. Copenh.* 38. (A)
- Hughes, M.M., S.K. Cook. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey, in 1980. *Annls. biol. Copenh.* 37. (P)
- Ingham, M.C., and D.R. McLain. Sea surface temperatures in the northwestern Atlantic in 1982. *Annls. biol. Copenh.* 39. (S)
- Ingham, M.C. Weather conditions and trends in the Maine-Virginia coastal and offshore area during 1970-79. *Proc. Northwest Atlantic Fisheries Organization (NAFO) annual meeting, Halifax, Nova Scotia, Sept. 13-16, 1981.* (P)
- Ingham, M.C., and D.R. McLain. Sea surface temperatures in the northwestern Atlantic in 1980. *Annls. biol. Copenh.* 37. (P)
- Jossi, J.W., D.E. Smith, and G.A. White. Continuous plankton records: Massachusetts to Cape Sable, N.S., and New York to the Gulf Stream, 1982. *Annls. biol. Copenh.* 39. (S)
- Jossi, J.W., D.E. Smith, and G.A. White. Continuous plankton records: The sampling program of the U.S. National Marine Fisheries Service. *Annls. biol. Copenh.* 38. (A)

- Jossi, J.W., and R.R. Marak. MARMAP Plankton Survey Manual. NOAA Tech. Memo (NMFS-F/NEC). (A)
- McLain, D.R., and M.C. Ingham. Sea surface temperatures in the northwestern Atlantic in 1981. *Annls. biol. Copenh.* 38. (A)
- Murray, T., S. LeDuc, and M. Ingham. Impact of climatic factors on early life stages of Atlantic mackerel, *Scomber scombrus* L.: An application of meteorological data to a fishery problem. *J. Applied Meterology.* (P)

MISCELLANEOUS

Travel, Meetings and Presentations

On March 3, and again on April 5, Grayson Wood traveled to Newtown, Massachusetts to confer with Sea Data Corporation personnel and to review progress in the development of a new data acquisition system for the undulating oceanographic recorder.

Steve Cook visited with the training representative of the Merchant Marine Academy and personnel from Moore-McCormack in New York on March 16. The following day, he met with a representative from the M/V *Oleander*.

On April 4 and 5, Mert Ingham attended the NEFC PMAC Meeting which was held in Woods Hole, Massachusetts.

Peter Celone boarded the M/V *Oleander* on April 15 to participate in a cruise to Hamilton, Bermuda, to collect environmental data and plankton. He returned to Narragansett on April 19.

Mert Ingham was in Sandy Hook, New Jersey during April 18-21, participating in the Northeast Monitoring Program Annual Report Workshop.