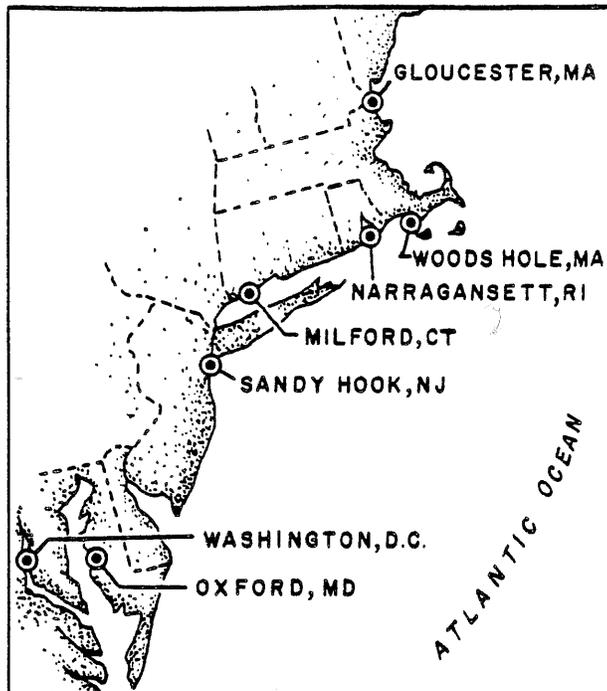


# NEFC

Northeast Fisheries Center

# NEWS

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## MONTHLY NARRATIVE REPORT MAY 1977

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U.S. DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL MARINE FISHERIES SERVICE



## RESOURCE ASSESSMENT DIVISION

### Resource Surveys Investigation

A new series of shellfish assessment surveys was initiated when the Albatross IV departed Woods Hole on 24 May. The first cruise, with Tom Azarovitz as chief scientist, will assess sea scallop populations on Georges Bank and the southern New England shelf. A second cruise, scheduled for this fall, will continue the coverage south to Cape Hatteras.

The Woods Hole Survey Operations Group completed the spring bottom trawl survey on 20 May. Henry Jensen was chief scientist on the Gulf of Maine portion, 30 April to 14 May, and William Overholtz was chief scientist on the last part which completed the Massachusetts Bay area during 16-20 May.

John Nicolas recorded 30-40 humpback and finback whales on the northwest part of Stellwagen Bank on 18 May during the third leg of the spring survey. A tow in the area of the whales contained 0.5 metric tons of sand eels (Ammodytes americanus) as well as 150 cod and 17 haddock. Stomach analysis indicated that the cod and haddock were feeding on the sand eels; presumably the whales were also.

Rhett Lewis collected biological data during a 2-day pair trawling experiment for squid headed by Alan Blott of the Gloucester Laboratory.

Warren Handwork completed the necessary repairs and refurbishing of the scallop dredges and accompanying equipment for the scallop survey, 24 May-3 June. He crimped together several thousand rings and links while repairing the ring bags.

Frank Almeida and Andrew Thoms of NEFC and Bernard Swan (Environment Canada, Fisheries and Marine Service, Halifax, Nova Scotia) participated in Part II of the International Herring Tagging Program aboard the USSR R/V Nogliki during 5-20 May. Four successful purse seine sets were made in the Great South Channel southeast of Nantucket Island, and nearly 23,000 herring were tagged. A total of 33,855 herring were tagged during both parts, which generally exceeded expectations.

Other activities include: (1) the completion of two Fishermen's Reports by Eva Montiero covering the Georges Bank and Gulf of Maine portions of the spring survey; (2) work on the hake and mackerel assessments by William Overholtz; (3) chart preparation for the scallop and summer trawl survey cruises by Evelyn Howe; (4) the collection and transferring of mammal observations to the College of the Atlantic by John Nicolas; and (5) the ever-continuing survey data processing headed by Linda Despres.

### Recreational Fisheries Investigation

Nine hundred Atlantic mackerel (Scomber scombrus) have been collected from both commercial and sport catches from Maryland to New York. To date, 750 specimens have been processed for length, weight, maturity, ovary samples, and otoliths for age determination.

Approximately 5,000 shipboard maturity observations, representing 17 species, have been collected during all phases of 1977 spring groundfish survey. These data are presently being analyzed for size at maturity and adult spawning parameters.

The New Jersey creel survey of charter- and party-boats continued during May. Preliminary results indicate silver hake (Merluccius bilinearis), red hake (Urophycis chuss), and Atlantic mackerel (Scomber scombrus) catches continued good through the first half of the month then rapidly declined. Bluefish (Pomatomus saltatrix), summer flounder (Paralichthys dentatus), black sea bass (Centropristis striata), and weakfish (Cynoscion regalis) became increasingly important late in the month. Exceptional catches of large weakfish (6-10 lb) were made by Cape May boats late in the month.

## Age and Growth Investigation

Ms. Louise Dery and Violet Gifford aged 100 alewife and blueback herring otoliths for Mr. J. W. Kornegay, a graduate student at the Department of Biology at East Carolina University to corroborate his method of aging these species.

Fish meal from a seized Soviet trawler was examined for the presence of otoliths from prohibited species. The otoliths found in the meal were from "fresh species" normally processed for meal.

A sample of 50 silver hake otoliths was aged by F. Nichy for a silver hake otolith exchange. Participating countries are Canada, United States, and the Soviet Union. Purpose of the exchange is to isolate the problems in aging this species.

## Fisheries Analysis and Biostatistics Investigation

Investigation personnel were involved in the preparation of species assessments for presentation to the New England Fisheries Management Council scheduled for June. Assessment species included: Atlantic mackerel, silver hake, red hake, squids, Atlantic herring, haddock, Atlantic cod, yellowtail flounder, sea scallop, surf clam, ocean quahog, northern shrimp, red crab, redfish, other flounders, alewife, blueback herring, pollock, lobster, butterfish, summer flounder, scup, weakfish, other finfish, and total finfish and squids.

Emory Anderson, Don Flescher, Ralph Mayo, and Wanda Cain provided coordination and instructor support for the second training session for foreign fishery observers. Fifteen observers are now on duty and are being assigned shipboard duty out of newly occupied facilities at Cape Cod's Otis AFB. Logbook observations are being analyzed by Resource Assessment Division personnel for summarization and format modification as this new program gains experience. It is possible that NEFC volunteers will be recruited this coming September to help cover the herring fishery.

## Meetings, Talks, Visitors, Publicity

Donald Flescher, John Nicolas, and William Overholtz participated in the foreign vessel observer training program by instructing in fish morphology, taxonomy, and dissection; marine mammal identification; and charting methods.

Ruth Turner of Harvard University has been successful in getting wood-boring bivalves, obtained from wood samples collected during Albatross IV trawl surveys, to spawn. She has found that the samples from shallow water taken during Albatross IV cruises are outbreeders, while the deep water samples collected during Alvin cruises are inbreeders.

Emory Anderson gave a talk on stock assessments and data requirements to the recent foreign vessel observer trainees.

Tom Azarovitz participated in an anoxic fish-kill workshop at AOML in Miami, Florida. Biological and physical data were exchanged and discussions held concerning the multi-authored NOAA professional paper now in preparation describing the 1976 New Jersey anoxic event and resulting "fish-kill."

Vaughn Anthony attended the ICES Lobster Working Group Meeting held 3-6 May in Bergen, Norway, and the second meeting of the Statistical and Scientific Committee of the Mid-Atlantic Fishery Management Council held on 9-10 May in Cape May, New Jersey.

Mike Sissenwine chaired a session at the Conference on Assessing the Effects of Power-Plant-Induced Mortality on Fish Populations held in Gatlingsburg, Tennessee, on 3-6 May.

Many investigation personnel participated in a statistical ecology workshop held 31 May-1 June at Woods Hole. G. P. Patil and other members of the Department of Statistics, Pennsylvania State University, collaborated in this effort.

On 5 May the NEFC hosted the NMFS National Data Management Committee, on which Eugene Heyerdahl sits as the Northeast Regional Representative. The function of this committee is to help coordinate national data compatibility and exchange as required for NMFS management inputs, and to aid in the long-range planning for a NMFS Information System to provide this functional requirement.

In addition, Gene attended the annual meeting of the ICNAF Standing Committee on Research Statistics held in Ottawa, Canada, 24-30 May. Although the US is no longer a member of ICNAF, it was accorded observer status.

### Manuscripts

Don Flescher completed a report, "Research Vessel Cruises, 1948-1963," which is a companion report to Laboratory Ref. 76-14 (Research Vessel Cruises 1963 to 1975) which he completed previously. These reports summarize the Woods Hole cruise activities between 1948 and 1975.

### MARINE ECOSYSTEMS DIVISION

#### Larval Physiology Investigation

In situ experiments using the environmental chamber to monitor growth and survival of laboratory produced winter flounder larvae were completed in the Narrow River estuary of Narragansett Bay. Results during the 2-wk experiment were encouraging. Virtually all of the 1,000 larvae "seeded" in the chamber were accounted for. Seven hundred sixty-eight larvae were recovered alive and 218 were recovered dead and decomposing for a survival rate of 77%. Ninety-nine percent of the live larvae had metamorphosed while in the chamber. Mean standard length and dry weight of larvae at the start of the experiment were 6.58 mm and 248.0  $\mu$ g, and at the end of the experiment were 10.42 mm and 1,105  $\mu$ g. The specific growth rate in terms of dry weight was 10.7%/day. Plankton and hydrographic samples taken inside and immediately outside the chamber are still being analyzed. Preliminary indications show that the planktonic prey densities inside the chamber were in the order of 0.1-1.0 organisms per milliliter. These prey densities are in the range of those predicted for good growth and survival based on previously conducted laboratory studies. Future studies on predation, larval first feeding, and larval density effects will be conducted with the chamber.

Measurements of the DNA, RNA, and protein content of larval winter flounder were continued from the 28th through the 50th day after hatching. During this period the RNA/DNA ratio of fed larvae fell within the range of 4 to 5.7. In a population of larvae of the same age, the larger fish near metamorphosis had the highest RNA/DNA ratios. The ratio was 3.2 in larvae deprived of food for 2 days and fell to 2.1 after 8 days in filtered seawater when a 50% mortality was observed. Lab experiments are presently under way studying growth and survival at 18°C of larval scup at five different constant prey densities.

Two manuscripts were reviewed for the editor of the Fishery Bulletin.

## Oceanography Investigation

Preparations for Albatross IV Cruise No. 77-04 continued. The major items were: (1) reconditioning of current meters; (2) calibration of the STD; and (3) design and fabrication of a pivoting strut to hold the directional transducer for locating subsurface moorings.

Ten AMF vector-averaging current meters (VACMS) which had been subjected to a good deal of trucking and handling since delivery in March, were opened and checked by Gil Dering and Ron Schlitz with the help of WHOI Buoy Lab personnel and facilities. Only four were in proper working condition. Four others have been repaired; faulty circuit boards in the final two are being replaced by AMF. The episode emphasized the need for developing the capability to recondition our instruments locally. The STD was shipped to the US Coast Guard instrument lab in Washington, D.C., and Dering spent a week there learning the techniques of calibration. It should be possible, using WHOI facilities, to do this work in Woods Hole from now on. One of the three current meter moorings set out last fall has not been recovered, despite attempts by the George B. Kelez, Whitefoot, and Albatross IV. If the release transponder is still working in June, Albatross IV will try again with the hull-mounted directional transducer. A pivoting strut to hold the transducer below keel depth while the ship is underway was designed by Red Wright and Jack Brennan and is now being fabricated in the shop. Gil Dering and Sam Nickerson repaired the Beckman salinometer after rejecting a \$1,700 estimate from the manufacturer. It appears to be working well now. Sam Nickerson has run surface salinities for the spring groundfish and Annandale cruises, and has read, plotted, and contoured XBT temperatures for the groundfish cruises. With Bob Pawlowski, he is preparing a report on trends in surface salinities over the past several years. Bob Pawlowski completed the April report on XBT transects across the Gulf of Maine, the first to include the new section from Gloucester to Cape Sable on the M/V Caribou Reefer. He has also made the May section in Caribou Reefer. Steve Ramp spent 2 wk on R/V Knorr setting polymode current-meter moorings with the WHOI Buoy Group to learn about gear and techniques.

Ron Schlitz continued analysis of historical data from Great South Channel, while Ronald Kirschner, Tim Cain, and Ray Cloutier continued plotting sections from 1976 cruises. Tim Cain completed his spring courses at Bridgewater State College. And all hands were involved in moving to new office and laboratory space.

## Ecosystem Dynamics Investigation

All personnel moved to new offices during May. Some space is being shared with Dr. Wright's oceanographic group which did not have adequate space after the shuffle. If the ecosystems group recruits any of the new positions identified in the TDP, we will then be short of office space again. Marv Grosslein spent most of May attending meetings and developing coordinated research plans with Federal Republic of Germany and USSR. Mike Pennington worked on a variety of analytical problems including the nature of equations estimating daily food rations, time-dependent analysis of nutrients from water samples, and sources of error in groundfish survey abundance estimates.

Ed Cohen assembled equipment and materials for the plankton productivity cruise on R/V Nogliki; this has required mutual exchange and loans of equipment with USGS and WHOI in Woods Hole. Considerable time was spent organizing the

chlorophyll data from 1976-77 cruises of Annandale, Anton Dohrn, Wieczno, and Researcher (samples processed by George Bolz, Dave Potter, and Pat Carter). Preliminary tables and graphs have been prepared by Pat Carter and analysis has begun. A copy of the chlorophyll data from the inshore survey by Annandale (Cruise No. 76-01) was sent to the Bigelow Laboratory as part of our continuing cooperative work on the Gulf of Maine. Ed Cohen and Mike Pennington analyzed replicate nutrient samples (run by URI) in relation to storage time and have a manuscript in preparation. An experiment was designed to investigate the problems of small scale patchiness within a Niskin bottle, and also the storage life and differences between filtered and unfiltered water samples; these experiments will be run on the next Albatross IV cruise by Pat Carter. Finally, Ed Cohen and Mike Pennington assisted Dave Potter and Andy Rosenberg with computer processing and analysis of their data.

### Recruitment Processes

The Recruitment Processes Task Group continued preparations for the June workshop on larval herring studies to be held in Poland. Further analysis of the special vertical hauls collected in October 1974 on Georges Bank and Jeffreys Ledge indicates that recently hatched larvae (<10 mm SL) were distributed throughout the water column but with maximum abundance at mid-depth, and there was little evidence for any extensive diel vertical migration. In contrast, on Georges Bank chaetognaths showed pronounced diel migrations. Analysis of the gape of recently hatched herring larvae (<10 mm SL) suggests these larvae can ingest prey organisms generally less than 0.50 mm. Examination of the fine mesh (.053 mm) samples from this same time series of vertical hauls indicates that in October 1974, Georges Bank had three times as many potential prey organisms for small herring larvae than did Jeffreys Ledge. Dave Potter and George Bolz continued work part-time on chlorophyll analyses, and Dave assisted with outfitting the Nogliki for plankton sampling. George worked on the October 1974 vertical sample series and did inventory and quality control of computer outputs of ICNAF larval herring data. Roz Cohen and Janet Murphy continued processing larval herring gut contents from Albatross IV cruise No. 75-2. Gut content data from two cruises were keypunched and are being verified. Bob Livingstone continued work on the manuscript of haddock reproduction on Georges Bank, and conducted a training session for the observer corps in identifying reproductive maturity stages in fish. Dave Potter completed a first draft description of the experimental tube apparatus used in the 1975 Helgoland study.

### Plankton Ecology Investigation

An estimate was made of secondary productivity on Georges Bank using counts of copepodite and adult Calanus finmarchicus. Samples of Calanus were obtained with Clarke-Bumpus samplers (0.366-mm mesh) on five Atlantis cruises made during the period 21 March-27 June 1940. The cruises were of 7-10 days duration and were made at approximately 2-wk intervals. A grid of 21 to 36 stations covering most of Georges Bank was occupied during each cruise. Of the variety of methods that have been used to estimate secondary productivity, only the cohort or age-class method allows direct calculation from field data. The change of biomass of a particular cohort is estimated over the sampling interval taking into account growth and loss due to predation. The basic assumption is that reproduction takes place at intervals, so that cohorts are clearly demarcated and followed during the sampling period. The method further requires that the mean weights of individuals

within each age class be known and that the samples be representative of the entire population under consideration. Initial summaries of the abundance and distribution of the developmental stages of C. finmarchicus revealed serious deficiencies in the data: (1) the entire population was not sampled (abundance greatest at outlying stations) and there was movement of organisms in and out of the sampling area, and (2) undersampling of copepodite stages I, II, and III due to extrusion through the meshes. In view of these limitations, a simplified analysis was attempted to express the change in biomass relying on the basic formulation of the cohort method. The mean abundance ( $N_0/m^2$ ) of four developmental stages (copepodites I&II, III, IV, and V&adults) of C. finmarchicus for each cruise were converted to dry weights (based on freeze-dry weight values determined by Jack Schwartz). Production within a given stage is given by the net change in biomass over the interval between samples. Biomass change was calculated as the product of the change in number of individuals from one sample period ( $N_1$ ) to the next ( $N_2$ ) and the mean weight of the individuals in that stage ( $w$ ). The estimate obtained of total productivity of C. finmarchicus for the 100-day period was  $38.8 \text{ mg}/m^2/\text{day}$  ( $12.4\text{-}15.1 \text{ mg C}/m^2/\text{day}$ ). This is well in excess of Kamshilov's (1953) estimate for C. finmarchicus for a 1-yr period in the Barents Sea ( $7.8 \text{ mg C}/m^2/\text{day}$ ). Because nauplii and early stage copepodites were underestimated by the coarse mesh nets, it is most likely that the production of C. finmarchicus is even higher on Georges Bank during the spring.

#### Ichthyoplankton Investigation

The ichthyoplankton survey team completed the spring survey sampling in the Gulf of Maine and Scotian Shelf. In collaboration with the USSR, a followup primary productivity-zooplankton survey of Georges Bank and the Gulf of Maine is now in progress on the R/V Nogliki. In the Middle Atlantic Bight, we completed the second survey of the month, bringing the total to five since the spring survey began in mid-March. This concentrated field progress is designed to determine the spawning success of yellowtail flounder and Atlantic mackerel. On the latest survey, 16-27 May, heavy concentrations of Atlantic mackerel eggs were found off southern New England. This suggests that spawning, which proceeds northward as the season progresses, has run its course in the bight.

#### Benthic Dynamics Investigation

Compilation of the benthic invertebrate data base for the Gulf of Maine-Georges Bank region was continued throughout the month. Computer listings pertaining to faunal components in relation to the organic content of bottom sediments were completed. The major task of updating the taxonomic entries in the invertebrate data base computer listings has been started. Inasmuch as this is a formidable task, we anticipate formulating the methodology and then evaluating the schedule for completing this task. A report on the distribution of 129 species of decapod crustaceans off the northeastern US has been completed. This study, conducted in collaboration with the National Systematics Laboratory, is based on preserved specimens in the reference collection at the Woods Hole Laboratory.

Computer listing of the 1969-1972 Gadiformes food-habits data base was completed and analysis was initiated. The data are being tabulated for 15 fish species, individually, by year, cruise, area, and sex; also for all cruises, areas and sexes are finished. Retrieval of length data from groundfish survey computer tapes has just begun. Further data analysis to estimate dietary overlap

between species is in progress. Routine duties related to the spring groundfish cruise have been completed. A final draft of a review of methods used for estimating gut evacuation rates and calculating the daily ration for fish was prepared. An abridged account of predator-prey interaction for some northwest Atlantic fish and squid is in preparation. This is being prepared for use by the New England Fishery Management Council.

### Apex Predators Investigation

During May, recoveries from 4 tagged sharks including 2 blues, 1 sandbar, and 1 blacktip were reported. One of the blues was a pregnant female recaptured on longline gear by an American vessel. The captain also supplied us with the embryos along with 8 whole sharks (5 makos, 2 night sharks and 1 sandbar) and intact stomachs from 15 additional specimens. Data from over 4,300 sharks tagged on 27 research cruises (1966-1976) have been transcribed into ADP formats. This block of information is the initial step in developing the data base for the Gamefish Tagging Program. Shark tagging data obtained through the efforts of sportsmen cooperators over the past 12 yr are presently in the final stages of keypunching by the ADP group at Woods Hole. The final report, "Apex Predators in Deepwater Dumpsite 106" was submitted to project manager, M. C. Ingham. In this report historical longline catch data is summarized from four principal data bases covering an overall time span of 20 yr. These are: (1) Japanese commercial statistics (1963 to 1972); (2) Bureau of Commercial Fisheries and Woods Hole Oceanographic Institution exploratory cruises for tuna (1957-1965); (3) Bureau of Sport Fisheries and Wildlife research cruises for sharks (1961-1972); and (4) commercial swordfish logs (1963-1974). Much of these data are unpublished. To compile a list of species of apex predators that could be expected to occur in DWD 106 at one time or another, the historical longline data was summarized and compared for the following areas: (1) an area approximately 300 mi square, as defined by Marsden Square 116(3); (2) an area approximately 120 mi square, as defined by the four 1° squares surrounding the dumpsite; and (3) the area within DWD 106. Forty-six species of fishes are recorded in longline records within Marsden Square 116(3); thirty-one species from the 120-mi square surrounding the dumpsite; and seven species are recorded from the dumpsite. Species lists and summaries for each area, including comparisons of catch per effort and percent species composition for the major species are provided together with information on their food habits, migrations, and other elements of their life histories.

### Meetings, Talks, Visitors, Publicity

Steve Ramp and Ron Schlitz attended the annual spring meeting of the American Geophysical Union in Washington, D.C.

Dr. Wright spoke on the hydrography of the western slope water at the IDOE workshop on warm-core rings held at WHOI, and helped draft the preliminary proposal for physical oceanographic study of rings. He also spoke at the Narragansett Lab on hydrography of the Gulf of Maine, and attended (with Marv Grosslein) a meeting with Brookhaven National Laboratory and NOAA ocean engineers at Brookhaven. A report on the Kelez and Whitefoot cruises was written and a draft for the first of a series of "environmental reports" on hydrography and biomass was prepared.

Greg Lough had several meetings with MARMAP personnel regarding processing and computer outputs for ICNAF larval herring time series; he also met with Peter Wiebe (WHOI) to review progress on the MOCNESS sampler. Dave Potter attended a review of Student Sea Grant Projects at the University of New Hampshire, and also a meeting on renovation of the Woods Hole Aquarium.

Marv Grosslein attended a program review at the Brookhaven Laboratory on 10 May, a meeting of the Science and Statistical Committee for the New England Council on 18 May, and meetings of the Standing Committee of Research and Statistics (STACRES) of ICNAF from 23-28 May. Mike Pennington, Ed Cohen, and Marv Grosslein also participated in the statistical workshop at Woods Hole on 31 May-1 June with statisticians from Pennsylvania State University.

Roger Theroux participated as an instructor in the second NEFC training program for observers who will be assigned to monitor fishing operations aboard foreign vessels fishing in US waters.

Rich Langton gave an illustrated lecture at the WHOI biology seminar on 12 May.

Roland Wigley gave a lecture on benthic invertebrates to veterinary students in the "Aquavet" program at the Marine Biological Laboratory, Woods Hole. Also, he was in Washington, D.C. the week of 31 May as a member of an interdepartmental technical evaluation committee assembled by the Department of the Interior.

During the month considerable time was spent by Carolyn Rogers and Donna Busch in Ocean Pulse planning meetings at Milford, Woods Hole, Washington, D.C., and Narragansett. Carolyn Rogers met with representatives of the Geological Survey and Bureau of Land Management to discuss criteria for establishing areas of "special biological significance" in the Mid-Atlantic Bight OCS gas and oil lease areas. Virtually all of the area designated for leasing lies within important spawning, feeding, and fishing grounds.

Jack Casey attended a meeting on swordfish assessments at the SEFC, Miami. Ken Sherman presented a paper on the "Potential Influence of Warm Core Eddies on the Fish Biomass off the Northeast Coast," to a workshop on warm core eddies sponsored by the National Science Foundation at WHOI. He also participated in a briefing for the Associate Administrator on the Ocean Pulse Program Plan, a meeting of IYABA, and a workshop on statistical ecology at the Woods Hole Laboratory. As part of a multi-agency survey team, he visited with scientists and administrators in Norway to discuss the effects of the EKOFISK blowout on the fish stocks and ecosystem of the Central North Sea. The group visited with Philips Petroleum staff in Stavanger, scientists at the Institute for Marine Research in Bergen, and the Minister of the Environment in Oslo. No large-scale mortalities of juvenile or adult fish was observed. Some damage to fish eggs and zooplankton, and a small localized area of depressed primary production were reported. Studies of the long-term effects of EKOFISK oil on the fish stocks of the Central North Sea is funded and continuing. Arrangements were made to establish closer liaison between NEFC and the Institute of Marine Research in studies of the effects of petroleum on ecosystem productivity.

Donna Busch and Jerry Prezioso participated in the first US-USSR survey of ichthyoplankton, hydrography, and productivity on the Nogliki as part of the program for joint research in 1977. Carolyn Rogers, Lorrie Sullivan, and Jack Schwartz participated in the spring groundfish survey on the Albatross IV Cruise No. 77-02.

Jack Schwartz successfully defended his master's thesis entitled "An Investigation of Biomass Determined from the Allometric Growth of Calanus finmarchicus (Gunnerus) from Georges Bank." He will receive his Master of Science (Biology) degree at the June graduation ceremonies of Southeastern Massachusetts University.

Walthar Kühnhold completed his research at Narragansett and flew to California on 28 May prior to returning to the Institut Für Meereskunde, FRG.

John Skerry, retired Officer-in-Charge of the Narragansett Laboratory was awarded a Bronze Medal for outstanding service at a special staff meeting on 27 May.

David Bearse and Jack Green attended the workshop on Statistical Ecology at the Woods Hole Laboratory on 31 May-1 June with Pennsylvania State University personnel.

## RESOURCE UTILIZATION DIVISION

### Resources Development and Improvement - Shellfish

A rotary fish scaler was modified to skin squid. Preliminary tests with fresh Loligo pealei and frozen and thawed Illex illecebrosus showed the machine to be 97% effective. This work is continuing.

A study concerned with the quality of mussels, Mytilus edulis, during frozen storage (0°C) was started. The following tests will be made during the storage period (12 mo): organoleptic, microbiological, moisture analyses, ash, total lipids, and proteins.

### Resources Development and Improvement - Finfish

A report of the completed second phase of the guaranteed quality study has been written. This phase of the study gave good evidence of the acceptance of the concept by both industry and consumers, and in an independent venture (but using our techniques) one supermarket chain that a few months ago was selling about 200 lb of US Grade A fillets per week in five of its stores is now selling nearly 10,000 lb in about 200 of its stores. We have entered the third phase of this study which involves yet another supermarket chain.

### Resources Development and Improvement - Engineering

Our prototype of a Spanish squid processing machine is thus far less than effective. We have tested a modified Thompson Roto Scraper (spring wires of equal length mounted in a hub that is turned by an electric drill) which promises to be more effective for removing the skin than the present principle employed by the machine.

An extruder designed to facilitate the uniform incorporation of additives in minced fish flesh is being fabricated.

In activities associated with harvesting and gear, Al Blott prepared equipment for the NEFDP squid pair trawl charter of commercial vessels out of Pt. Judith and participated in two of the trips. Mike Corbett went to New Jersey to observe testing of the Bering Sea exploratory shellfish dredge, and work is progressing on preparation for the August dredge performance cruise.

### Product Safety and Standardization

The preparation and consolidation of comments on Codex (International) Standard and Codes of Practice accounted for a large amount of this month's activities.

## Product Quality and Safety

Work was completed on a second look into the possible presence of volatile N-nitrosamines in hot smoked whitefish. Whitefish extracts isolated by the multidetection method of Fazio et al. were analyzed by gas liquid chromatography. Chromatograms were submitted to the FDA laboratory in Washington, D.C., as required by that agency in connection with the whitefish petition.

## Southern New England Fisheries Development Program

A storage study was initiated to determine the effect of mincing temperature on the quality, particularly texture, of frozen minced whiting. Protein denaturation, which contributes to toughening, is a function of temperature and this study should serve to indicate the degree of temperature control required in a minced fish operation.

Treatment of cod fillets with a chlorine solution for the purpose of eliminating pathogenic bacteria caused changes in appearance, odor, and flavor when a certain threshold concentration was exceeded. These changes were more readily detected in the cooked (steamed) state than in the raw state. During storage of the treated fillets at refrigerator temperatures, the chlorine odor gradually dissipated. The threshold level of chlorine for a 30-sec dip not causing any significant change in quality was 800 ppm.

## Meetings, Talks, Visitors, Publicity

Visitors to the laboratory included Mr. Paul Duarte from Chile to discuss laboratory activities; Mr. L. W. Cummings of Goodrich Engineering Co. to discuss utilization of red crab waste; and Mr. Jeff Logier to discuss processing of rock crab.

Meetings attended by our staff included a workshop on Codex Standards for canned fish products in Washington, D.C.; a meeting with the FDA on proposed standards of identity of certain fishes in Washington, D.C.; a meeting of the Northeast Regional Automatic Data Processing Committee in Boston; the annual meeting of the American Oil Chemists' Society in New York City; a meeting of the New England Fisheries Development Program held in Portsmouth, New Hampshire; and a meeting of an advisory panel of experts on the efficacy, safety, and wholesomeness of irradiated finfish held at the Gloucester Laboratory.

Dr. Frederick King was reelected for a third 2-yr term as Secretary of the New England Fisheries Institute. The other officers of this association of about 250 members are from industry.

## Manuscripts

- Learson, R. J., B. L. Tinker, V. G. Ampola, and K. A. Wilhelm. 1976. Roller extraction of crab meat. Proceedings of the First Annual Tropical and Subtropical Fisheries Technological Conference 2:619-630. (P).
- Licciardello, J. J., E. M. Ravesi, and M. G. Allsup. 1977. Minced whiting block oxidation studies show need for high density packaging. Quick Frozen Foods 39:58. (P).
- Ronsivalli, L. J. 1977. Technology in Fishery Development, MFR, 39(2):7-10. (P).

## ENVIRONMENTAL ASSESSMENT DIVISION

### Behavior of Marine Fishes and Invertebrates Investigation

The present series of laboratory experiments on the response of juvenile bluefish to thermoclines and decreasing temperature have been completed. Data analysis of these results is continuing.

Experiments in the large experimental aquarium on the behavior and metabolic requirements of young and adult tautog under changing seasonal temperature and photoperiod are continuing.

### Biological Oceanography of Stressed Environments Investigation

Dr. James Thomas, Mr. Jay O'Reilly, and Mr. Craig Robertson participated in a MESA Synoptic Investigations of Nutrient Cycling (SINC) cruise during 9-20 May 1977. The purpose of the cruise was to follow an estuarine water mass offshore from Sandy Hook for a period of time using drogue buoys and to measure changes occurring in biomass and activity and relate these changes to changes in physical and chemical variables. In all, six buoys were set. Buoys set near shore moved toward the New Jersey coast. Buoys set further eastward (5 nautical mi) moved northeastward. No parcel of water could be followed more than 1-3 days. Samples were collected from four to five depths including the chlorophyll maximum layer and the near-bottom layer (1-2 m above bottom) two to six times a day depending on the variables measured. Variables measured included netplankton (>20  $\mu\text{m}$ ) and nanoplankton (<20  $\mu\text{m}$ ) primary productivity and phytoplankton release of dissolved organic matter (<0.45  $\mu\text{m}$ ) under saturating light intensity (photosynthetic capacity) and under sunlight (simulated in situ), chlorophyll a and phaeophytin also fractionated, nutrients,  $\text{N}^{15}$  uptake experiments, electron transport system measurements for potential respiration, water column oxygen uptake rates, bacterial heterotrophic uptake rate experiments with labeled compounds, zooplankton biomass and grazing rates, ATP, dissolved oxygen, temperature, and salinity.

The area was well oxygenated from top to bottom with only slight stratification at the start of the cruise. During the cruise surface temperatures warmed almost  $4^{\circ}\text{C}$  and a concentrated layer of chlorophyll developed at the surface. Whole water respiration rates at the surface increased from about 9 to nearly  $40 \text{ ml } \text{O}_2 \text{ m}^{-3} \text{ hr}^{-1}$  during the cruise. Bottom water respiration rates remained low even when subjected to surface water temperatures indicating a paucity of organisms and/or fuel in bottom waters.

The data are presently being computerized and graphed. Dissolved oxygen data have been sent to the MESA, New York Bight Project Office at Stony Brook, to assist in plotting the decline of oxygen as the season progresses.

### Coastal Ecosystems Investigation

The final draft of MESA Data Report "Distribution and Abundance of Benthic Macrofauna at Nested Stations in the Sewage Sludge Disposal Area, February 1975" was prepared by Janice Caracciolo, Martha Halsey, and Leslie Rogers. Dave Radosh is attempting to review comments on a final draft of the MESA Monograph "Benthic Macrofauna of the New York Bight". A laboratory manual for processing benthic samples was prepared. This manual was developed to: standardize methods, become a training guide for any future new personnel, and establish standards for possible external contract work in this area.

Work continued on collection of information relative to Georges Bank productivity and food chains. Additional samples were processed from the Block Island Sound baseline survey. Preparations for Delaware II Cruise 77-07-1 during 31 May-5 June are in progress. This cruise will survey hydrographic conditions in the New York Bight as part of our cooperative monitoring program with the New Jersey Department of Environmental Protection.

Robert Reid, Coastal Ecosystems Investigation Chief, returned from his 8-mo long-term training assignment in Boston University's Marine Program at Woods Hole, Massachusetts.

Frank Steimle is preparing portions of two chapters for a NOAA Professional Paper dealing with last year's anoxia phenomena. The chapters are concerned with the development of the anoxia condition and impacts on benthic invertebrates.

#### Coastal Monitoring, Assessment, and Protection Investigation (COMAP)

COMAP project personnel are cooperating in a coordinated state-federal-private sector lobster larvae sampling program in Buzzards Bay, the Cape Cod Canal, and Cape Cod Bay which is aimed at assessing the effects of the Canal Electric Power Plant on the environment. Sampling with a neuston net at six stations in Buzzards Bay began the first week in May and will be continued weekly until mid-August. The first lobster larvae were caught on 18 May when the bottom temperature had reached 12-13°C. Increasing numbers of larvae (first, second, and third stage) have been caught in subsequent weeks. Sampling was done by Fred Lux, Larry Davis, and Roger Clifford working from the NMFS 40-ft work boat Phalarope II.

Fred Lux and George Kelly attended a meeting of the Canal Power Plant Technical Committee at the power plant to review the biological research in progress. Steve Collings, Massachusetts Division of Marine Fisheries, reported on the results of neuston and plankton sampling for lobster larvae and ichthyoplankton, and Steve Hall, Canal Power Plant staff, reported on the results of sampling the plant intake wash racks for fish. During a tour of the discharge canal, there was some discussion of how to sample a population of large oysters that have grown on the steel pilings during the past 18 mo. Despite a virtual absence of harvestable oysters within 10 mi of the plant site, the walls of the 700-ft discharge canal are covered with 8-12 cm oysters. The plan is to sample the population for size composition, meat weight and condition and to analyze the meats and shells for mineral content and contaminants. It is anticipated that a pilot study of the potential for oyster aquaculture at this site will be undertaken by the plant management very soon.

In mid-May, George Kelly was appointed to the New England Marine Advisory Service as representative of the Northeast Fisheries Center replacing John B. Skerry, former Officer-in-Charge at the Narragansett Laboratory, and recently retired. Activities of this agency are coordinated by John K. Hutchinson under the NOAA Sea Grant Program at the University of New Hampshire.

#### Environmental Chemistry Investigation

Paul Gleason and Vincent Zdanowicz participated in a cruise primarily to collect Atlantic mackerel eggs for genetics work. The investigation's involvement was to collect water and egg samples for organic and metal analyses. All samples except the metal analyses of eggs (which will be done at Milford) are being analyzed under contract to the National Analytical Facility, NMFS, Seattle, Washington (for organics), and the College Park Laboratory, NMFS (for metals in seawater). The cruise was quite successful, all sampling objectives were

met except that at certain key stations the samples consisted of only a small percentage of mackerel eggs, the rest being mainly copepods. In particular, trouble was anticipated with the collection of "microlayer" seawater samples which required investigation personnel to leave the vessel and use a rubber boat. This sampling went very well, primarily because of good weather.

An experiment was initiated this month in which oysters obtained from what is apparently a heavily polluted area in regards cadmium concentrations were transferred to Milford water to determine if the relatively high cadmium concentrations can be depleted or not. The oysters from this polluted area contain as much as 10-14 ppm (wet-weight basis) of cadmium.

## Physiological Effects of Pollutant Stress Investigation

### Physioecology

A study to determine the effects of heavy metals, both singly and in combination, on embryos of the American oyster held at various temperatures has been completed. The results are now being tabulated and analyzed and will be reported in subsequent narratives.

A study to determine the effect of various combinations of salinity and temperature on the toxicity of silver to embryos of the American oyster is still in progress.

We are still performing tests to determine the feasibility of flow-through bioassay systems for determining metal toxicity to bivalve larvae. Several tests have now been completed, but results vary considerably from one test to the next. Further tests will be performed.

### Physiological Effects

We have recently completed a study on some effects of anoxia on the surf clam (Spisula solidissima). This study was conducted as part of the NOAA Professional Paper study being prepared by many cooperating scientists in the vicinity of the New York Bight where an anoxic condition occurred last summer. Our studies have included survival and respiratory experiments at three dissolved oxygen levels (<1, 2, and 3 ppm) at both 10 and 20°C. A flowing water system was also designed for experiments at 2 ppm. As expected, surf clams of several size classes are remarkably tolerant of low oxygen conditions. The combination of low oxygen and other environmental factors such as high temperature, hydrogen sulfide, or toxic metabolites was often lethal, however. Such additive effects undoubtedly contributed to the massive kill of surf clams in New Jersey waters last summer.

Glucose levels were measured on the blood of 30 mercury-exposed flounder, and serum sodium, potassium, and osmolality readings were made on a series of fish for pathobiological investigators at Oxford.

Considerable time was spent on manuscripts this month. Two fish hematology papers and a manuscript on silver-exposed bivalves, as well as the contribution to the NOAA Professional Paper are all in preparation. Additional time was spent planning for the first Ocean Pulse cruise this July and in purchasing supplies and equipment for this activity.

## Biochemical Effects

Teleost and bivalve gonad samples from the oil-spill cruises (Delaware II and Wieczno) have been analyzed; no clear patterns of metabolic disturbance are evident in the data thus far. Various questions of assay protocol have been answered in the course of working with these different tissues and different species.

Analyses nearing completion are those of adductor muscle from Placopecten magellanicus and Modiolus modiolus. These include tissues from animals taken from either clear or impacted areas, and either brought back alive or frozen (whole) at sea. The animals frozen at sea were thawed and dissected just prior to analysis. Data thus far indicate no significant metabolic differences (other than temperature-related) between the animals taken from clear waters and those taken from impacted waters, whether in the groups returned to the lab alive or in the groups frozen at sea. There are some significant differences, however, in the data from the animals returned alive and from those frozen at sea, an observation that points to the importance of a consistent sampling technique, one of the variables tested during the two cruises. The next step is to repeat the comparison of tissue from bivalves returned alive, from those frozen whole at sea, and, additionally, from those dissected at sea, with muscle samples being frozen immediately thereafter. Along the same line of investigation, we have begun an experiment in which various metabolic pathways will be examined in the adductor muscles of surf clams (Spisula solidissima) after their exposure to anoxic conditions.

Considerable time was spent in helping to plan for the cruise to DWD 106, scheduled for late July, and arranging for the procurement of the necessary equipment and supplies.

## Anaerobic Bacteriology/Metabolism

Most of the effort this past month has been involved in manuscript preparation. A separate status report on these activities has been prepared.

Laboratory activity involved the analysis of eight bottom sediments collected during the Advance II cruise of March-April obtained by Mr. John Babinchak and one from a Long Island Sound area from Dr. Walter Blogoslawski for anaerobic bacteria. Black colonies were observed on the differential media from all sediment samples, with one exception, a sediment sample from Georges Bank area. Counts varied from 5 to  $10^4$  per gram of sediment with a significant number of the bacteria being in the spore state. A tentative identification would indicate that the bacteria are of the perfringens type. It was observed that one sediment sample obtained from offshore of the New Jersey coast had a characteristic sulfide odor.

Information on eel culture was transmitted to a professor at the University of Bridgeport and on botulism and bacteriological background information on the fisheries to a Peace Corps volunteer being assigned to the Philippines.

## Meetings, Talks, Visitors, Publicity

Dr. John Pearce participated in several meetings, workshops, and hearings during the month of May. During 5-6 May he participated in a Center budget meeting and planning session for continued BLM work with historical samples and data.

On 9-10 May he participated as a member of the Scientific and Statistics (S&S) Committee, Mid-Atlantic Fishery Management Council, in Cape May, New Jersey.

During the period 10-12 May, he attended a Washington, D.C., habitat protection workshop. This workshop involved scientists from all research Centers in the United States as well as personnel attached to the Environmental Assessment Branch, Regional Offices.

On 13 May, Dr. Pearce led a meeting concerned with upcoming Ocean Pulse research to be conducted at DWD 106 in July. This was the first meeting of all principal NMFS/NEFC investigators who will be involved in the research.

On 18 May Dr. Pearce chaired a meeting of the Interagency Scientific Advisory Subcommittee on Ocean Dredging and Spoiling. The Subcommittee reviewed the final US Navy proposal for continued research at the Thames River dredging and spoiling site, as well as the final report on Phase I dredging and spoiling developed by Division of Environmental Assessment personnel.

On 19 May, Dr. Pearce met with Regional personnel and Carolyn Rogers, Narragansett Laboratory, to consider problems of Regional planning which involve Environmental Assessment Branch and Center research personnel. The preliminary aspects of Regional planning within the context of the National Fisheries Plan were discussed and another meeting was scheduled for 3 June.

On 24 May, Dr. Pearce met with representatives from EPA, Region II. These included John Frisco and Steve Rubin. The purpose of this important meeting was to consider how EPA Region II data on industrial and municipal contaminant inputs to the ocean environment can be obtained from EPA Region II data files. These data will be used in a report to MESA concerned with elevated loading of the marine environment in relation to heavy metal body burdens in marine fish. The same data can be used in a report to the International Council for the Exploration of the Sea (ICES) which is being prepared by Dr. Pearce.

Finally, on 31 May, Dr. Pearce participated in an EPA hearing in Toms River, New Jersey, concerned with ocean dumping of sewage sludge and whether present inshore disposal sites should be moved to DWD 106. Following a presentation by Dr. Donald Martineau, Dr. Pearce, Dr. Joel O'Connor (MESA), and Dr. Merton Ingham (AEG) discussed the relationship between ocean disposal of sewage sludge and problems of fish kills and wastes washing upon beaches.

Mr. Bori L. Olla, Leader, Behavior Investigation, delivered two seminars at Battelle, Pacific Northwest Laboratory, Richland, and the Marine Research Laboratory, Sequim, Washington. The seminars were "Behavior as an Ecological Factor" and "The Effects of Environmental Change on Marine Fishes".

Tom Wilhelm, presently a volunteer in Coastal Ecosystems Investigations, presented two talks to junior and senior high school groups in Monmouth County on 18 May.

Ann Frame conducted a tour of Sandy Hook Laboratory for the Northern Burlington Regional School Science Club on 12 May.

Frank Steimle attended a workshop on last year's New York Bight anoxia problem, at AOML in Miami, Florida, on 10-11 May, with Dr. Carl Sindermann and Thomas Azarovitz. At this workshop he presented his compilation of all hydrographic data collected by Sandy Hook Laboratory personnel investigating the anoxia to the AOML oceanographers. Robert Reid and David Radosh attended a Deep Sea Conference at WHOI on 2-3 May. Notes from this conference will be considered in planning this July's benthic work at DWD 106.

Fred Lux attended a meeting of the New England Fishery Development Program task force in Portsmouth, New Hampshire, on 17 May.

Fifteen students from Gordon College under the supervision of Professor Richard T. Wright, visited Woods Hole for a tour of the Fisheries Laboratory, Marine Biological Laboratory, and Woods Hole Oceanographic Institution. George Kelly outlined the Center research program for them and reviewed the changes in the fisheries, the past role of the United States in ICNAF, and prospects for the future under extended jurisdiction.

Four boys from the sixth grade in the Falmouth Out-of-School Program visited Woods Hole Laboratory for several days in mid-May for a firsthand look at the activities in a fishery laboratory. Under the supervision of William Callahan, Resource Assessment Division, the boys, all volunteers, were exposed to most of the major functions in data collection and analysis that are normally performed. COMPA personnel participated in these activities.

David Nelson, Physiological Effects of Pollutant Stress Investigation, participated in the recent MESA-Mutagenics cruise.

Frederick Thurberg attended the Center IYABA meeting at Woods Hole on 3 May.

Dr. John Graikoski talked to the Milford Rotary Club on 21 April.

Margaret Dawson attended the anoxia workshop meeting at Sandy Hook on 26 April and the spring NEERS meeting in Durham, New Hampshire on 21-22 April.

Edith Gould hosted two Stratford High School students, who acted as "observers" for a day; reviewed three Sea Grant proposals, and attended an Awards Committee meeting at Woods Hole on 19 April.

### Manuscripts

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- Waldhauer, R., A. Matte, and R. K. Tucker. 1977. Lead and copper in the waters of Raritan and Lower New York Bays. *Mar. Pollut. Bull.* (A).
- Pearce, J., J. Caracciolo, R. Greig, D. Wenzloff, and F. Steimle. A study of Deepwater Dumpsite 106: Benthic infauna and heavy metal burdens in marine organisms and sediments. Marcus Wellenberg Foundation for International Cooperation in Science, Stockholm, Sweden. (Abstr.) (S).
- Greig, R. A., D. R. Wenzloff, C. L. MacKenzie, Jr., A. S. Merrill, and V. Z. Zdanowicz. Trace metals in sea scallops, Placopecten magellanicus, from Eastern United States. *Arch. Env. Cont. & Toxic.* (S).
- Pearson, W. H., and B. L. Olla. Chemoreception in the blue crab, Callinectes sapidus. *Biol. Bull.* (S).

#### AQUACULTURE DIVISION

##### Spawning and Rearing

Reassessment of standard bivalve culture techniques continues. This seems appropriate now because much of the methodology for larvae culture was developed at least 20 yr ago. In the light of our own culturing experience and that of the commercial hatcheries, it is important that we re-examine some of the techniques which influence survival and growth of bivalve larvae in culture. Larvae of the oyster, Crassostrea virginica, are being used because most of the initial techniques were developed with this species. We recently conducted several experiments to determine the effects of crowding on the growth of oyster larvae. Larval concentrations ranged from 2/ml to 60/ml. When food was not a limiting factor, growth was directly related to larval concentration, being fastest at 3/ml and decreasing steadily to the slowest growth rate at 60/ml. Standard larval concentration at Milford Laboratory has always been 15/ml, a compromise between faster growth at lesser larval numbers and adequate numbers of larvae in 1-liter cultures for meaningful population data. The experiments recently completed showed that growth at 3/ml was almost 50% faster than growth at 15/ml. Since it is axiomatic in any culturing operation that fast growth is the surest way to successful results, it would appear that concentrations of oyster larvae closer to 3/ml than 15/ml be adopted as the standard and larger containers be used to maintain adequate population numbers.

Recent problems associated with rearing bay scallops (A. irradians) larvae have been overcome. Two groups of animals reared in May using Neomycin-treated water grew rapidly and metamorphosed in large numbers. Larvae in cultures without Neomycin survived a maximum of 10 days. Larvae resulting from bay scallops spawned in Neomycin-treated water did no better than those in cultures to which the antibiotic was added after fertilization had taken place. Activated carbon filtration and UV irradiation did nothing to enhance larval survival or growth.

An experimental larval rearing system utilizing a recirculating system with a gravel biological filter is undergoing an initial test. Although larval growth was relatively slow, some larvae did survive to metamorphosis in the system without the use of antibiotics. We are currently perfecting the engineering of this system.

An experiment comparing static and flowing systems for the growth of late scallop larvae (200  $\mu$ ) as they develop into the juvenile phase has been completed. Although most animals metamorphosed in both systems, survival and growth of the young juveniles in the flow system were superior to those in the static system. After 8 days 61% of the scallops in the flowing treatment were alive and averaged 482  $\mu$  in length. Only 18% of the scallops in the static system were alive and they averaged 390  $\mu$  in length.

Experimental evaluation of our pumped raceway, tank farm system, has begun a month earlier than in 1976. It is anticipated that a longer growing season and larger seed animals may enable us to produce a marketable surf clam (Spisula solidissima) in one growing season. If overwintering can be avoided, expense of maintenance and mortality will be minimized.

Fluorometric analysis of our seawater system is giving us new insight into the problems of water quality and the nutritional requirements of juvenile bivalves. It has been demonstrated that mechanical filtration of raw seawater does not remove all organic matter. Only after extensive ultraviolet and charcoal treatment is no chlorophyll detected. We have also observed that in our 10- $\mu$  filtered system we may be providing less than half of the total diet of bivalves. Dripping cultured algae into this system increases the background fluorescence by about 3.5 times. Since feeding is not continual, this represents only about 40% of the total available plant material.

Post-set surf clams (<1 mm) are growing satisfactorily in a 50-liter recirculating system. This system is superior to a "once through" system for very small clams since it conserves algae but it is not economical for juvenile surf clams greater than 10 mm, because of their enormous food requirements. One hundred seventy-five 10-mm Spisula (35-ml biomass) are capable of clearing 8 liters of algae at  $10^7$  cells/ml over a 24-hr period.

### Larval Nutrition

Laboratory experiments investigating liquid nitrogen as a method for the cryopreservation of algal cells are now being conducted. Current work is systematically testing the effects of several cryoprotectorants, each in three concentrations, on the viability of six species of algae after exposure to the protectorant for 20 min and freezing at  $-60^{\circ}\text{C}$ . The following species remained viable after suspension and freezing at 1, 5, and 10% dimethyl sulfoxide: Chlorella autotrophica, Phaeodactylum tricornutum, Chlorococcum sp., and Tetraselmis maculata. However, there was no increase in population of Dicrateria sp. or Isochrysis galbana in any concentration of dimethyl sulfoxide although a

few motile cells were still observed after freezing and thawing. This latter observation is extremely interesting but needs reinvestigation. Similar experiments are now in progress using three concentrations of glycerol as a cryoprotectorant.

Our work on developing a minimal growth medium for the culture of algal food cells is showing promise even in the culture of sensitive larval food species. In a growth medium with the concentration of nitrate and phosphate reduced and a reduction by 50% of the vitamin concentration, there was no significant effect on the maximum populations in this medium. Two serial sub-cultures in a larger volume (250 ml) than used in previous experiments resulted in excellent growth of the following species: Monochrysis lutheri, Isochrysis galbana, Tetraselmis maculata, Dicrateria sp., Phaeodactylum tricornutum, and Pseudoisochrysis paradoxa.

This month the total harvest of algal foods from axenic culture carboys amounted to 1,924.6 liters of larval foods and 1,541.4 liters of juvenile foods. These food cultures were distributed to other laboratory programs as follows: Pathobiology, 60 liters; Bioassay, 50 liters; Genetics, 1,125 liters; and Spawning and Rearing, 1,284.5 liters.

## Genetics

### Experimental Breeding of Oysters

In the large mass selection experiment on the American oyster (Crassostrea virginica) work continues on dividing the 1976 year-class animals into fast growth, slow growth, and random lines. Selection criterion is total shell surface area. The 1976 year-class consists of 10 spat (juvenile) groups, each group having been spawned on the same day. Two of the spat groups have been completely counted, measured, and selected. Work is under way on a third group. In the first group there are 2,131 animals with a median shell area of 12.90 cm<sup>2</sup>. Each of these groups is selected separately to minimize environmental bias between groups and to avoid inbreeding in the next generation. High-line animals of Group 9 will so be crossed with high-line animals of the remaining nine groups, and so forth.

All animals with shell area greater than 12.90 cm<sup>2</sup> were assigned to the high line; those with shell area less than 12.90 cm<sup>2</sup> were assigned to the low line. One-third of the animals were randomly assigned to the control or random line. The high-growth line consists of 719 animals: mean length - 5.57 cm; mean width - 2.94 cm; mean shell area - 16.38 cm<sup>2</sup>. The low line consists of 710 animals: mean length - 4.26 cm; mean width - 2.12 cm; mean area - 9.03 cm<sup>2</sup>. The control line consists of 702 animals: mean length - 4.89 cm; mean width - 2.57 cm; mean shell area - 12.57 cm<sup>2</sup>. The selection differential for the high line is +3.70 cm<sup>2</sup>; the selection differential for the low line is -3.65 cm<sup>2</sup>.

Three separate heritability (theoretical predictions of selection progress) studies are under way. All three study groups have produced spat. Larval measurements for all three studies were collected at 7, 14, 21, and 28 days. Juvenile measurements at 6 wk post-setting have already been made for the first two studies.

Six full-sib families have been spawned for family selection. One family has produced abundant spat, and three families are still in the larval stage. It is hoped that ultimately these families will be used to select for traits that cannot be measured on a live animal, i.e., meat weight.

More crosses of eggs of one female with sperm of one male oyster were made this past month to establish more lines of the American oyster for the purpose of inbreeding.

#### In-House Mutagenesis Program and Ocean Pulse

Plankton sampling strategy and bioassay plans are being worked out for the July Ocean Pulse cruise to DWD 106. For use in on-vessel cytogenetic bioassays at this test site and for experimental exposure work in the laboratory, Mr. J. Hughes is exploring different species of small fish and invertebrates. These would be regularly cultured at Milford.

On the MESA-sponsored May cruise into the New York Bight for cytogenetic samples, care was taken to obtain mackerel eggs in slope waters on the approach to DWD 106 so that these could be used in studies on this toxic chemicals disposal area, as well as in our MESA Bight studies.

A salinity experiment was performed on Atlantic mackerel eggs collected off Long Island on this recent MESA-sponsored cruise into the New York Bight. Fixed material will be processed and studied in the laboratory over the next few months to determine what impact, if any, variable salinity might have on cytogenetic measurements made on planktonic fish eggs, as done for the Atlantic mackerel. This is particularly important as the most polluted water is often the lower salinity run-off from coastal regions and the rivers.

Other work exploring the likelihood of confounding effects of temperature and salinity on mitoses of fish eggs developing in a polluted milieu will be resumed once preparations for the first Ocean Pulse cruise are complete.

Roe was stripped from a number of ripe Atlantic mackerel migrating along Long Island in hopes of being able to arrive at some estimate of chromosome abnormalities in the pre- as opposed to the post-spawned egg. This could provide some insight into the role of maternal-dependent gametic wastage on mortality of early-stage fish eggs at sea. One of the factors contributing to such, however, could well be the maternal body load of contaminants. Other samples of roe were taken for studies of heavy metal and organic contaminant load (MESA chemistry contract to other NMFS groups).

#### MESA Contract Work on Developing Mackerel Eggs from the New York Bight

The 5-day MESA-sponsored genetic cruise into the New York Bight, 11-16 May, was an unqualified success in collecting early-stage Atlantic mackerel eggs for cytogenetic study, and in collecting microlayer and surface water samples for heavy metal and organic chemistry of contaminant levels. The large volumes of plankton required for broad-scan analysis of contaminants in the bight apex, and the replicated egg samples from the Apex were obtained by repeat tows, but copepods could not be removed from the fish eggs. At a couple of stations where routine samples were made for chemistry almost pure mackerel egg samples were taken. Other routine samples were a mixture of mackerel eggs and copepods. The original wish was to obtain large enough volumes of eggs uncontaminated by

other plankton and garbage to do chemistry on the mackerel eggs. Sample stations extended from Cape May up the New Jersey coast into the bight apex, along Long Island to Cox's Ledge, and back south in more offshore waters to the slope waters approaching DWD 106.

Salinity, temperature, pH, and turbidity were measured at every station and both neuston and bongo samples collected. At the transect station between Sandy Hook, New Jersey, and Rockaway Inlet, turbidity was about a minimum of 14 times that at all other stations. The pH at a station 6 mi southwest of DWD 106 was markedly low, 5.7. Another exceptional station at this Sandy Hook-Rockaway Inlet transect station, which also had the high turbidity, had a pH of only 6.7. Several other stations in the bight apex and in slope waters on the approach to DWD 106 also had low pH values in the range of 7.0-7.5. Along the Long Island coast values were in the normal range, 7.8-8.0, with the exception of a station at Great South Bay, which was 7.2. Although at least two of these pH values are exceedingly low, no basis in fact has been established to question their validity. The sea was unusually calm nearly the entire time of the Annandale cruise and this no doubt, minimized mixing of the water masses.

Grease balls, plastic beads the size and appearance of fish eggs, and an assortment of similar and different nondescript garbage were included in plankton collected in the bight apex.

In slope waters off Delaware on the approach to DWD 106 where a dump had been made about 12 hr before plankton was sampled, the mackerel egg collection contained grease and/or oil and plastic beads. A significant number of the mackerel eggs from these three stations had firmly adhering oil droplets attached to their membranes. Because these particular samples contain such large numbers of copepods and mostly early-stage eggs, it is difficult to make a quick rough estimate of the incidence of abnormal embryos in later stage eggs where these would be obvious on gross examination. Even so, perusal of these three samples indicate that again the incidence of abnormal in this area may greatly exceed that over all other stations studied, including the heavily contaminated bight apex. Exact data on this will, of course, be recorded.

Mackerel eggs from two stations in the bight apex showed signs of gross damage. Mackerel eggs from a third station showed a gross alteration and/or deterioration of their membrane pore structure as visualized in the scanning electron microscope. As in the 1974 Westward collection already studied, eggs sampled about Barnegat Bay Inlet were slightly smaller in their diameter than usual. This may be related to their poor condition as it probably was related to moribundity in the 1974 samples.

At least in regard to these grosser indications, conditions relating to mackerel egg development in the bight may be no different from those in 1974 at the time when the first collection of mackerel, now intensely studied cytogenetically, was made.

Since a predominance of early cleavage eggs was collected over the bight on this last cruise, this is the stage that will be largely selected for cytogenetic study. Later development stages of lesser sensitivity will also be studied, if indicated, to establish some gradients of effects where these earliest stage eggs may show total moribundity over a wide area.

#### Meetings, Talks, Visitors, Publicity, Services

Spisula embryos were provided to Dr. K. Kanungo, Western Connecticut State College, for his research in tissue culture.

Algal cultures were sent to Linda Plunkett, Ira C. Darling Center, Walpole, Maine, and to Dr. Wotowicz, University of Gdansk, Poland, upon their request.

Mr. R. Goldberg toured a class from Southampton College, New York, that is currently studying aquaculture in the northeast.

A Work/Study student from Lincoln University, Gail Saunders, entered on duty and is being trained by Harry Joram, Northeastern University Work/Study employee, in mass culture procedures.

One week of training in both oyster rearing, for the purpose of genetic study, and in invertebrate cytogenetics was provided to Mrs. D. Pember who will be working in aquaculture genetics at the University of Maryland's Crisfield laboratory.

Mrs. S. Jewell attended a course at the Lake Placid, New York, W. Alton Jones Cell Science Center, on "In vitro cytogenetics, karyology, and various staining techniques."

Mrs. S. Jewell conducted a tour of the aquaculture genetics laboratory and other Milford facilities for approximately 100 students from a New Haven middle school.

Dr. A. Longwell attended the last formal panel meeting of the National Academy of Science's review team on the Role of Aquaculture in the US.

Dr. R. Ukeles attended an ICES mariculture workshop at the CNEXO laboratories in Brest, France. The paper that was presented, Culture of Algae for Feeding Larval and Juvenile Mollusks in Controlled Aquaculture, was well received.

#### PATHOBIOLOGY DIVISION

##### Disease and Environmental Stress Investigation

Observational data on fin-rot disease of winter flounder taken from Raritan Bay and the New York Bight apex indicate that there is significant difference in prevalence of the disease according to fish size. Large fish were found to have a higher disease prevalence than small ones, but a possible decline in the disease among the flounder population may have an overall effect on summary data. Fin tissues from flounder collected in Great Bay have been prepared for examination with the scanning electron microscope, and photomicrographic documentation of fin morphology is in progress. New studies on lymphocystis virus in winter flounder which employ freeze-etch electron microscopy are in progress, and arrangements to use the equipment have been made with Dr. Russell L. Steers, Chief, Plant Virology Section, US Department of Agriculture.

The Oxford Laboratory was the host organization for the Second Annual Eastern Fish Health Workshop held at the Tidewater Inn, Easton, Maryland, on 26-27 May. Over 100 registrants attended the workshop. Twenty-five scientific papers were presented during the 2-day meeting.

##### Comparative Pathobiology Investigation

A report on the histopathological effects of dietary cadmium on the blue crab was prepared and submitted to the collaboratory on this project, Dr. N. Garfield Biddle, NMFS College Park Laboratory. Effects of the cadmium feeding were minimal in the test groups, which included one group fed on cadmium as the sulfate and the other organically bound to soy protein. Herpes-like virus was present in 13.5% of both test and control animals. Tissues were examined from a number of immature crayfish, Macrobrachium rosenbergi, that had been

exposed to plasticizers (phthalic esters) and had died 5 hr after the exposure. Gill epithelia of all of the exposed animals had undergone complete coagulative necrosis. Diagnostic services were performed for six organizations requesting mollusk examinations. Oysters from Delaware Bay showed a decrease in the prevalence of Minchinia nelsoni (MSX) as compared to levels seen last fall. Samples of mussels, Mytilus edulis, from Nanaimo, British Columbia, Canada, showed marked pathology of the gonads caused by two as yet unidentified parasites. Additionally, 12% of the mussels had neoplasms which were nearly identical to those found previously in mussels from Yaquina Bay, Oregon. The Korean Fisheries Research and Development Agency resumed shipment of preserved oysters, Crassostrea gigas. The April shipment from Choobong was infected with Korean Minchinia sp. (4/45, or 9%). The Histopathology Unit processed tissues from oysters, clams, crabs, and fish for laboratory investigators; 1,198 sections and 1,050 stained slides were prepared during the month.

Rock crabs (Cancer irroratus) were collected in Sandy Hook and Raritan Bays to obtain spring-season data on discolored or blackened gills, and to estimate the success of winter-season molting. Twenty crabs which ranged in carapace width from 4 to 10 cm were processed for histological examination, and an additional 75 were observed for gill condition only. Gills from the first group showed that 60% were clean from a recent molt and 40% were discolored or black. In the second group smaller crabs were examined (4-7.5 cm), and about 50% were in the papershell condition and 90% of them were clean. Histological examinations are in progress to identify the organisms associated with the blackened gills.

#### Diseases of Larval Mollusks Investigation

Studies on the disinfection efficiency of an aquafine UV seawater treatment unit have continued. To determine whether a slow seawater flow rate through the UV unit is responsible for abnormal development of fertilized oyster eggs, an experiment was conducted using a flow rate of 1 l/min versus a flow rate of 2.1 l/min. Although the data did not show a significant difference ( $P < 0.5$ ) in the number of live abnormalities, the number of live normals was significantly lower in the beakers filled at the slower flow rate. Experiments are being conducted using faster and slower flow rates.

In a study to compare bacterial growth rate in UV-treated seawater with and without the addition of fertilized oyster eggs, it was shown that the effectiveness of the UV unit can be negated by the presence of bacteria associated with the spawn. This problem probably can be corrected by conditioning and spawning adult animals in filtered, UV-treated seawater. An attempt is now being made to rear oyster larvae to setting stages in the UV-treated seawater.

Experiments carried out this month indicate that it is possible to concentrate toxic materials from the filtrates of vibrio cultures using dialysis tubing containing carbowax. Rapid degradation of toxin prevented further study at this time, but such work will continue next month.

Dr. Richard Robohm attended the Northeast Shellfish Sanitation Association meeting at Mystic, Connecticut, on 5 May. The agenda was a mixed fare with presentations by industry, state regulatory agents, Food and Drug Administration representatives, and University Sea Grant recipients.

## Meetings, Talks, Visitors, Publicity

Dr. Aaron Rosenfield attended the 32nd meeting of the Interagency Collaborative Group on Environmental Carcinogenesis at Bethesda, Maryland, on 18 May. The theme of the meeting was metals and metallic compounds in carcinogenesis.

Dr. Aaron Rosenfield and Mr. Fred Kern presented lectures to a visiting wildlife management class from Rutgers University on 31 May.

At the AERS meeting at Virginia Beach on 5-7 May, Dr. Thomas Sawyer presented a paper entitled "Gill fouling of rock crabs, Cancer irroratus, from ocean dumping sites," and Sharon McLean presented a talk entitled "Protozoan and metazoan parasites of rock crabs, Cancer irroratus, from the Northeastern United States."

On 26-27 May, several members of the laboratory presented papers at the 2nd Annual Eastern Fish Health Workshop in Easton, Maryland: Dr. Richard Robohm, "A new Vibrio sp. pathogenic for flatfish;" Dr. Phyllis Johnson, "Viral diseases of the blue crab, Callinectes sapidus;" Mr. Austin Farley, "Virus and viruslike lesions in marine mollusks;" Dr. Thomas Sawyer and Sharon McLean, "Some protozoan diseases of decapod crustaceans." Dr. Johnson also presented a seminar at the University of Maryland on 19 April entitled "Bacteria, blue crabs, echinoderms, and others."

Dr. Joel Bodammer attended a periodic IYABA Conference at Woods Hole on 3 May.

Dr. Walter Blogoslawski attended the 3rd Congress of the International Ozone Institute in Paris and presented a paper entitled "Detoxification of marine poisons by ozone gas." After this meeting he traveled to Brest, France, and gave a paper to the 3rd meeting of the ICES Working Group on Mariculture entitled "Ozone as a disinfectant in mariculture." He also visited ozone shellfish depuration stations in Sete and Bouziques.

Carolyn Brown passed the University of Connecticut comprehensive examination required for all Ph.D. candidates.

Two Sea Grant proposals (Red Tide and Shrimp Culture) were reviewed and the comments forwarded to the Washington Sea Grant Office.

Dr. Blogoslawski attended proposal defense (the Master of Science degree) for Donna Peretti, a former student.

Miss Stewart, a volunteer working in the Pathobiology Investigation, received a fellowship for study in the School of Forestry and Environmental Science, Yale University, commencing in August 1977.

Visitors to the laboratory during May included Dr. John Dupuy, Virginia Institute of Marine Science; Mr. Fletcher Hanks, Hanks Seafood Company, Easton, Maryland; Dr. Joseph Geraci and Mr. Brad Hicke, Ontario Veterinary College, Guelph, Ontario; Dr. Jorge Leong, NMFS Southeast Fisheries Center, Galveston, Texas; Dr. Sophie Jakowska, State University of New York, Staten Island; Dr. H. J. Bowen, Franklin Institute, Philadelphia, Pennsylvania; Dr. Robin Overstreet, Gulf Coast Research Laboratory, Ocean Springs, Mississippi; Dr. Paul Cheung, New York Aquarium, Brooklyn; Dr. David Hinton, University of West Virginia Medical School, Morgantown; Drs. James E. Klaunig, Michael Lipsky, Frank Hetuck, and Ed Stephens, University of Maryland Medical School, Baltimore; Dr. John Schachte, Rome Pathological Laboratory, Rome, New York.

## Manuscripts

Johnson, P. T. 1977. Paramoebiasis in the blue crab, Callinectes sapidus. J. Inverteb. Pathol. 29:308-320. (P).

Sawyer, T. K., and S. A. Meyer. 1977. A nonfilamentous marine fungus, Sterigmatomyces halophilus, from mantle fluid of the Japanese oyster, Crassostrea gigas. J. Inverteb. Pathol. 29:395-396. (P).

Newman, M. W. 1977. Cutaneous myxosporidiosis in an American eel, Anguilla rostrata. Chesapeake Sci. 18:240-242. (P).

#### NATIONAL SYSTEMATICS LABORATORY

##### Pelagic Fishes

Worked on the description of a previously unrecognized species of Spanish mackerel from Brazil.

##### Benthic Fishes

Continued preparation of a synopsis and key to the approximately 85 genera of ophidiiform fishes.

##### Crustaceans

Completed draft of manuscript describing a new genus of xanthid crab from western Atlantic offshore reefs. Continued preparation of a guide to the temperate water decapod crustaceans of the US East Coast. Dr. Austin Williams traveled to the SEFC Pascagoula Laboratory at the request of Center Director Bullis to advise on the disposition of a large collection of crustaceans and other invertebrates from the tropical western Atlantic.

##### Meetings, Talks, Visitors, Publicity

Dr. Bruce Collette attended the annual meeting of the Council of Biological Editors in Philadelphia. He attended the Third International Coral Reef Symposium in Miami where he presented a paper entitled "Reef Fishes Over Sponge Bottoms off the Mouth of the Amazon River." He presented a seminar entitled Systematics and Evolution of the Scombridae at the SEFC Miami Laboratory.

Dr. Austin Williams attended a meeting of the Governor's Board of the Estuarine Research Federation.

##### Manuscripts

Cohen, Daniel M. Family Ophidiidae, in FAO Species Identification Sheets for Fishery Purposes, West Central Atlantic, Fishing Area 31. (S).

Collette, Bruce B., and Rutzler, Klaus. 1977. Reef fishes over sponge bottoms off the mouth of the Amazon River. Proc. Third International Coral Reef Symposium. 1. Biology:305-310. (P).

## ATLANTIC ENVIRONMENTAL GROUP

### Ocean Monitoring and Climatology

A data analysis product, consisting of 12 monthly plots and 4 seasonal plots of wind stress and Ekman transport components for the eastern Georges Bank (42°N, 66°W), was provided to the Director of NEFC and several scientists on the Center staff. The plots were produced by computer-graphic facilities of the MARMAP Information System using a data tape produced by the Pacific Environmental Group. The period of time covered by the plots was 1946-75.

### Ocean Dumping

A report of the physical oceanographic results of the June 1976 experimental effort at DWD 106 is being written. Vertical sections displaying temperature, salinity, oxygen, and sigma-t will be presented along with a discussion of the experimental results.

Preparations are underway for the July 1977 cruise to DWD 106 aboard the Albatross IV. Drogue units, XBT, and STD systems are being tested and refurbished for the cruise. Experiments are being conducted on the DuPont Edgemore waste to test its detectability by nephelometry (light scattering) in seawater. Natural fluorescence of the waste is also being studied to determine its relation to the light scattering effect of the waste in seawater. Necessary parts for the nephelometer have been ordered well in advance of the cruise dates.

### Meetings, Talks, Visitors, Publicity

Woody Chamberlin furnished information for a substantial portion of an article in the May National Fisherman about the impact of last winter's unusually early appearance and prolonged low temperatures.

Jim Bisagni and Woody Chamberlin attended and made presentations to a 2-day workshop on Gulf Stream rings held at the Woods Hole Oceanographic Institution on 16-17 May.

Steve Cook and Jack Jossi (MARMAP Field Group) conferred with members of the Marine Science Division of the staff of Commander Atlantic Area, US Coast Guard, Governors Island, New York concerning cooperative ship-of-opportunity projects.

Mert Ingham attended a conference in the NOAA Office of Marine Environmental Protection to help develop the NOAA position on the transfer of sewage sludge dumping from shelf sites to DWD 106. Subsequently he also assisted in the presentation of the NOAA position at an EPA-sponsored hearing held in Toms River, New Jersey, on 31 May.

Reed Armstrong attended a workshop held in Miami on 10-11 May 1977 on the New Jersey anoxic layer and fish kill. He presented a report of progress on two chapters of the upcoming NOAA report on the events of last spring and summer.

Jim Bisagni and Mert Ingham met with the NOS Ocean Dumping Program staff to discuss and compose the conclusions section for the Baseline Summary Report on Deepwater Dumpsite 106.

### Manuscripts

Armstrong, R. S. 1977. Climatic conditions related to the occurrence of anoxia in the waters off New Jersey during the summer of 1976. In: Compiled reports of workshops on the New Jersey fish kill. (A).

Cook, S. K., and K. A. Hausknecht. 1977. Expendable bathythermograph observations from the NMFS/MARAD ship-of-opportunity program for 1974. NOAA Technical Report SSR-F 709. (P).

Ingham, M. C., S. K. Cook, and K. A. Hausknecht. 1977. Oxycline characteristics and skipjack tuna distribution in the southeastern tropical Atlantic. Fish. Bull. 75(4). (A).

#### MANNED UNDERSEAS RESEARCH AND TECHNOLOGY PROGRAM

Major emphasis during the month of May was variously dedicated to short- and long-term program planning and budgeting, analysis of accumulated data, and preparation of a manuscript on ghost lobster pots.

#### Meetings, Talks, Visitors, Publicity

Dr. Richard Cooper and Joseph Uzmann attended a meeting in Boston, Massachusetts on 25 June to discuss with NOAA-MUST personnel and University of New Hampshire faculty the overall Oceanlab concept and potential users in government and academia.

#### EXTENDED JURISDICTION LIAISON OFFICE

The New England Fishery Management Council held two meetings in May and the Mid-Atlantic Council one. In addition to regular attendees Keith Smith and Ed Bowman, R. C. Hennemuth and R. L. Edwards attended the 3-4 May New England meeting and Mr. Hennemuth attended the 22-24 May New England meeting.

The councils are currently filling out their staffs and developing management plans for their highest priority species: Atlantic mackerel, Atlantic herring, sea clams, sea scallops, silver hake, squids, and groundfish. Other subjects of major concern, discussion, and action are: American-Canadian bilateral agreement, management of transboundary stocks (US-Canada), and post-ICNAF convention. Charters for Scientific and Statistical Committees for the two councils were approved in May establishing these committees as legal bodies.

The Extended-Jurisdiction Liaison Office has assisted council staffs by supplying reports and documents as requested. Reports of the meeting have been forwarded to the NEFC Laboratory Directors and the Scientific and Statistical Committee members.