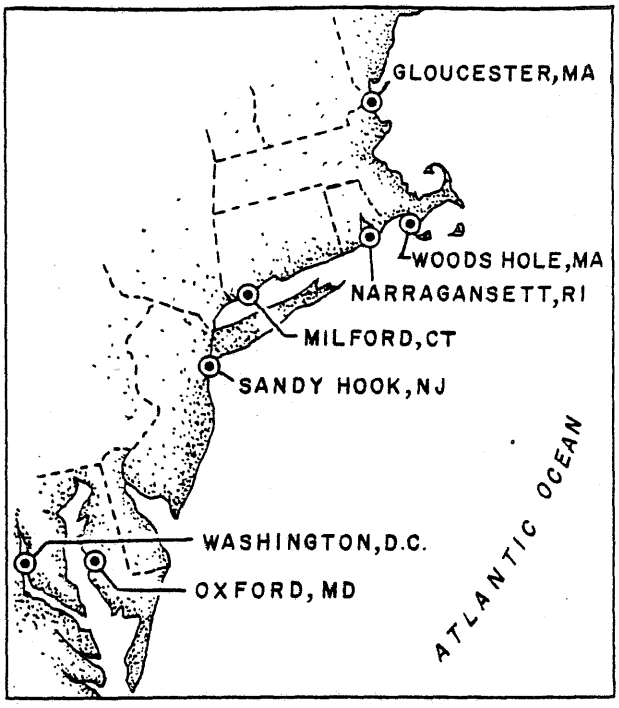
NEFC

Northeast Fisheries Center

NEWS



MONTHLY NARRATIVE REPORT
NOVEMBER 1977

Editor, Jon A. Gibson

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

RESOURCE ASSESSMENT DIVISION

Resource Surveys Investigation

The third part of the autumn bottom trawl survey (Georges Bank and the Nova Scotian shelf) aboard the Delaware II (Bill Overholtz, Chief Scientist) was completed on 7 November. The fourth part (Gulf of Maine) began on 12 November on the Delaware II and was to be completed by 22 November. However, a breakdown of the trawl winch necessitated returning the vessel to port for repairs on 14 November. The cruise resumed on 28 November and is scheduled to be completed early in December.

Anne Tibbetts-Lange and Charles Byrne were the US participants in a survey aboard the Soviet R/V Argus. The 13-day survey (13-25 November) was designed to sample squid (Illex) populations for distribution patterns related to spawning diel movements, and food habits. The survey concentrated in two areas, one on the northern edge of Georges Bank the other near Lydonia Canyon.

Pat Twohig continued the integration of the Vidar data logger with hydrographic operations aboard the Albatross IV. Jim Crossen continued to modify and refine the NEFC hydroacoustic instrumentation system, which was successfully tested and calibrated this fall aboard the Albatross IV and FRG R/V Anton Dohrn.

Age and Growth Investigation

Louise Dery met with Jean Chenoweth to complete transfer of Atlantic herring material to the Boothbay Harbor Laboratory where this species will be aged through contract with the State of Maine. Our method of embedding and aging herring otoliths was discussed.

Fred Nichy met with Dr. K. Able and C. Grimes to review aging of tilefish. Fred Nichy also completed tests on a modified silver stain that has resulted in more uniform staining of otoliths. A series of redfish otoliths will be stained to determine if there is any improvement in aging this species using stained otoliths.

Judy Penttila and Vi Gifford completed re-examining all the Atlantic cod age samples and audits from the autumn bottom trawl surveys of the Albatross IV.

The US-USSR-Canadian silver hake otolith exchange will have to begin again with new otolith samples. The age samples, aged by Canadian and US biologists, were ruined going through USSR customs and could not be used. A new sample is being circulated among participating countries. Cuba has shown interest in this species and has joined the otolith exchange.

Hilary Herring completed examining various hard parts from goosefish to find a structure to use besides the otolith in the age-reading process. The only other structure worth considering, based on her work, is the vertebra.

Age samples processed during November were: haddock (audits were completed for Albatross IV Cruise No. 77-02, second quarter 1977 commercial samples, and all 1976 R/V Belogorsk cruises); pollock (audits were completed for Albatross IV Cruise 77-02); silver hake (aged but not audited for Albatross IV Cruise No. 76-09); and red hake (aged but not audited for Albatross IV Cruise No. 77-07).

Sandy Hook Investigation

Processing of data from the New Jersey creel survey continued. The numbers and mean weights of fishes caught during the first 15 mo of the survey have been determined. Auditing and correcting weight data for the last 9 mo of the survey was initiated in November.

Age samples of Atlantic mackerel were sent to the Woods Hole Laboratory for analysis in order to determine relationship of age to fecundity. Fecundity studies of summer flounder were initiated for specimens collected in the Middle Atlantic Bight.

Fishery Assessment Investigation

A recent reorganization within the Resource Assessment Division was necessitated by the departure of Vaughn Anthony to become research director of the Maine Department of Marine Resources, and of Eugene Heyerdahl to serve as Regional Data Base Administrator. The Fishery Assessment Investigation is one of three investigations which were created to replace the former Fisheries Statistics Investigation and the Fisheries Analysis Investigation. Personnel include Emory Anderson (Chief), Steve Clark, Emma Henderson, Thurston Burns, Frank Almeida, William Overholtz, and Brian Hayden. Present species assessment responsibilities include Atlantic mackerel, silver hake, red hake, haddock, pollock, northern shrimp, American lobster, summer flounder, the "other finfish" category, and the "total finfish plus squid" category.

Andrzej Paciorkowski from the Polish Sea Fisheries Institute at Gdynia was at the Woods Hole Laboratory during 1-3 November for discussions with Emory Anderson concerning the mackerel assessment and plans for a joint background paper on the Northwest Atlantic mackerel fishery to be presented at the ICES symposium on "The Biological Basis of Pelagic Fish Stock Management" to be held in Aberdeen, Scotland, in July 1978.

Steve Clark participated in a US-Canadian scientific meeting held at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, during 1-4 November to review assessments of stocks of mutual concern to both countries and to review existing research programs and recommend future areas of cooperation. Scientists attending the meeting were from the Woods Hole Laboratory and the Canadian Fisheries and Marine Service.

Emory Anderson attended meetings on 3 and 7 November in Peabody, Massachusetts, at which NMFS, State Department, New England Council, and fishing industry representatives met to formulate the US position relative to entitlements of catches from stocks involved in the US-Canadian boundary negotiations.

Thurston Burns has been updating reports on the 1976 autumn Atlantic herring tagging study on Georges Bank and Jeffreys Ledge and the 1977 spring tagging done on Jeffreys and the Great South Channel. He has also been working on survey data for use in the pollock assessment.

Frank Almeida has continued working closely with the staff of the New England Council preparing and writing sections for a silver hake management plan. Frank attended the 9-10 November meeting of the council held in Peabody, Massachusetts, and was involved in discussions with interested fishermen concerning possible future silver hake tagging studies.

Emory Anderson attended a meeting of the Mid-Atlantic Council held in Dover, Delaware, on 9-10 November, at which time he was formally appointed by the council to replace Vaughn Anthony on the S&S Committee.

Emma Henderson was involved totally in reviewing and preparing comments on testimony for the Hudson River Striped Bass EIS. William Overholtz recently transferred to the investigation from the Resource Surveys Investigation. While with the latter investigation, he was Chief Scientist aboard the Delaware II during 25 October-7 November for the Georges Bank-Nova Scotia portion of the autumn bottom trawl survey. Bill has since begun work on developing some catch-per-effort indices for mackerel utilizing distant-water fleet data. We consider Bill to be a valuable addition to the assessment group as a result of his good analytical background.

Steve Clark attended an ICNAF STACRES meeting held at ICNAF headquarters in Dartmouth, Nova Scotia, during 15-18 November. The purpose of the meeting was to prepare assessment advice on the status of northern deepwater prawns (shrimp) and harp and hooded seals in Subareas 1-4 and Statistical Area 0. Steve served as rapporteur for the ad hoc Working Group on Shrimp.

Emory Anderson presented a well-received lecture on stock assessment methodology to Dr. Andreas Holmsen's graduate class in resource economics from the University of Rhode Island on 16 November at the Woods Hole Laboratory conference room.

Steve Clark has been involved in the completion of an assessment of northern shrimp in cooperation with other members of the Northern Shrimp State-Federal Scientific Committee. This work is in preparation for public hearings on shrimp to be held in December by the Atlantic States Marine Fisheries Commission.

Brian Hayden has been involved in a number of projects including condensation of some historical herring data, but most noteworthy being able to pack most of the approximately 70 boxes of books, papers, etc., belonging to Vaughn Anthony. It will probably take an entire building at Boothbay Harbor to house Vaughn's library! About the time he gets those boxes unpacked he'll decide it's time to move back to Woods Hole!

Fishery Analysis Investigation

Steve Murawski and Gordon Waring have completed a laboratory reference on butterfish to be used by the Mid-Atlantic Council. Fred Serchuk, Paul Wood, Harold Foster, Maureen Griffin, and Judy Brennan-Hoskins have been working on an assessment of the Georges Bank and Gulf of Maine Atlantic cod stocks. Analytical work using the 1977 bottom trawl data, and development of pre-recruit indices have continued.

Steve Murawski has been working on getting the surf clam and ocean quahog data available for computer use. Paul Wood has been doing the same on sea scallop data. Ralph Mayo compiled the final audit of the 1976 USA Statlant 21B for ICNAF. He along with Bob Boeri has continued work on sampling-summary and sampling-efficiency computer programs. He is currently completing a computer program to calculate a weighted length-frequency distribution of species landed in the US industrial fishery.

Maureen Griffin and Paul Wood participated in the Delaware II survey of the Georges Bank-Scotian Shelf area. Bob Boeri is currently on the Delaware II surveying the Gulf of Maine area.

Fred Serchuk attended a US-Canadian scientific meeting during 1-4 November in Dartmouth, Nova Scotia, where the current state of the stocks was examined and catches and stock sizes for 1978 were projected. Fred Serchuk, Paul Wood, and Judy Brennan-Hoskins met in Woods Hole with members of the New England Council concerning sea scallops.

Fishery Systems Investigation

Mike Sissenwine attended a US-Canadian scientific meeting at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, during 1-4 November. Along with Emma Henderson, Mike also prepared for cross-examination of direct testimony by the Consolidated Edison Company, Inc., in the hearing on the Hudson River's Indian Point Power Plant.

Otis Jackson set up the Tektronics graphics terminal with hard copy and tape input.

Participants in research cruises were Anne Tibbetts-Lange on a joint US-USSR squid study, and Margaret McBride and Gordon Waring on an autumn bottom trawl survey.

Reports

Suomala, J. B., J. M. Crossen, and W. M. DeRusso. Preliminary report of an in situ hydroacoustical experiment, August 1977. Charles Stark Draper Lab. Rept. No. C-4986.

Wilk, S. J. 1977. Biological and fisheries data on bluefish, Pomatomus saltatrix (Linnaeus). Sandy Hook Laboratory, NEFC, NMFS. Tech. Ser. Rept. 11.

Lange, A. M. T., and M. P. Sissenwine. 1977. Loligo pealei stock status: November 1977. NEFC Woods Hole Lab. Ref. No. 77-28.

Sissenwine, M. P., and E. H. Henderson. 1977. Comments on Exhibit 4 (Chapter 10) and Exhibit 3 (Part 2) by Consolidated Edison Company in Hudson River Power Plant Licensing Administrative Hearing. 31 pp.

McBride, M. 1977. A review of selected literature cited by McFadden (1977), Chapter 10. 30 pp.

Manuscripts

Wilk, S. J., W. Morse, D. E. Ralph, and T. R. Azarovitz. 1977. Fishes and associated environmental data collected in New York Bight, June 1974-June 1975. NOAA Tech. Rept. NMFS SSRF-716.

Overholtz, W. J., and J. R. Nicolas. Northwest Atlantic fin whale (Balaenoptera physalus) and humpback whale (Megaptera novaeangliae) feeding activity on the American sand lance (Ammodytes americanus). Jour. Mammal. (S)

Clark, S. H., and B. E. Brown. Trends in biomass of finfishes and squids in ICNAF Subarea 5 and Statistical Area 6, 1964-1977, as determined from research vessel survey data. In: Proc. Pop. Dyn. Fish. Workshop, Oct. 1977, Barcelona, Spain, Investigacion Pesquera. (S)

Sissenwine, M. P. 1977. A compartmentalized simulation model of the southern New England yellowtail flounder, Limanda ferruginea, fishery. Fish. Bull. 75(3): 465-482. (P)

MARINE ECOSYSTEMS DIVISION

Oceanography Investigation

The current-meter records from the Northeast Channel for the winter of 1976-1977 continue to provoke interest. A correlation of temperature and velocity showed that inflows at 230 m were always accompanied by a drop in temperature. It appears that the inflow consists largely of the colder Eastern (or Labrador) Slope Water rather than the Western Slope Water that is normally resident south of Georges Bank. Analysis is continuing. Current-meter records from the second setting--summer of 1977--have still not been received from Nova University, but we have a report that all of the instruments contained fine aluminum filings and that the compasses were out of their housings in several--indicative of excessive vibration and jolting. We are exploring the possibility of arrangements for care of our instruments which will not require shipping them to Florida. The Plessey salinometer has been repaired but still needs calibration. Gil Dering has also been designing and building a digitizer which will provide a direct readout of temperature, salinity, and depth values from the STD.

Two members of the group, Ron Kirschner and Tom Laughton, were in the scientific party for the larval herring cruise on Anton Dohrn, 31 October to 18 November. They worked with the ship's hydrographic party and also were in charge of drogue operations during the detailed sampling with MOCNESS. One drogue was launched and followed for about 1 day but was not recovered.

The MARMAP cruise on the vessel Argus resulted in some 1,500 salinity samples which Tim Cain has been analyzing. At the same time gear was readied for additional MARMAP cruises on the Mt. Mitchell and Kelez: our group provided Niskin bottles, salinity sample bottles, XBT probes, oxygen equipment and chemicals, and log sheets. Tom Laughton is aboard Kelez for the first leg of the cruise; he will be joined by Dan Patanjo on 5 December for the second leg.

Ecosystem Dynamics Investigation

In November the Ecosystem Dynamics Task Group continued work on Georges Bank productivity studies. Mike Pennington analyzed latest results of the experiment on storage life of nutrient samples and found that nutrient levels appear to decline with age of samples and that filtered as well as unfiltered samples show this reduction. Ed Cohen and Pat Carter continued work on the primary production cycle on Georges Bank as well as the energy budget. Mike Pennington attended a short course on multivariate analysis by Maurice Kendall

in Washington, DC. Ed Cohen participated in the larval herring cruise on the Anton Dohrn where he (together with Jack Green from Narragansett) performed several experiments on zooplankton grazing rates using fluorometric techniques. Marv Grosslein assisted with development of the 1978 and 1979 MARMAP I survey schedules and planning for the 1978 Georges Bank patch study, including liaison with the scientific parties on Anton Dohrn and the Argus, and with Brookhaven National Laboratory personnel.

Recruitment Processes

The major activity for the Recruitment Processes Task Group during November was the Anton Dohrn larval herring survey of the Georges Bank-Nantucket Shoals area, 1-18 November 1977. NEFC participants included Greg Lough, George Bolz, Robert Halpin, Ed Cohen, Hal Merry, Ron Kirschner, Tom Laughton, and Jack Green. The entire study area was surveyed with a grid of standard plankton-hydrography stations and in addition, for the first time, two vertical series were made with our newly acquired electronically controlled opening/closing net (MOCNESS) to study the vertical structure of herring larvae and associated zooplankton community. High numbers of herring larvae (several hundred per haul) were collected in the Nantucket Shoals area but only a few larvae were collected across the northern part of Georges Bank. Most larvae were in the 10-20 mm size range. More recently hatched larvae (<10 mm) were observed in the shoaler area of Nantucket Shoals. Both MOCNESS series, one at the beginning and the other at the end of the cruise, were conducted in the Nantucket Shoals area where larval herring abundance was greatest. Preliminary observations of the MOCNESS samples indicated that larvae were found throughout the water column. Larvae sometimes appeared to be most numerous near the bottom (60-70 m) and/or at the surface, but not necessarily corresponding with daylight or darkness. The Canadian vessel E. E. Prince joined with Anton Dohrn at the end of the second MOCNESS series to attempt various larval "patch" mapping methods in surrounding areas. Progress continued ashore on larval herring condition factor-gut content analysis by Roz Cohen and a new growth model based on larval herring daily growth ring increments in otoliths by Andy Rosenberg and Mike Pennington.

Benthic Dynamics Investigation

Analysis and evaluation of the quantitative data pertaining to the New England macrobenthic invertebrate fauna were continued. Two sections (Zoantharia and Pogonophora) for a report on the quantitative aspects of this New England fauna were completed. Updating and checking of the data files for quantitative multispecies invertebrate analyses and the bivalve mollusk studies were continued throughout the month.

The report by Richard Langton and Ray Bowman, "Food Habits and Food Resource Partitioning by Northwest Atlantic Demersal Fishes. Part I. The Gadiformes," is currently being edited as a draft manuscript. A manuscript on the effect of the Argo Merchant oil spill on fish food habits is in preparation. A talk on this subject is being prepared by Ray Bowman, which will be presented at a meeting later this winter. The preliminary analysis of the food habits of juvenile haddock is in progress. The feeding chronology of this species between 1953 and 1976 is now being investigated. The stomach content analysis of all flatfishes collected during the years 1969-1972 has been completed. The resulting data are now being tallied and prepared for keypunching.

Larval Physiology and Biochemistry Investigation

Research is continuing on the prey-capture efficiency of summer flounder larvae. Hormone induction of adult summer flounder females which were induced to spawn 1 mo ago is in progress to establish the frequency between successful inductions. Dr. Jan Beyer, Danish Institute of Fishery and Marine Research, has arrived for a 2-wk stay to confer about stochastic models of larval survival. Construction has finally started on the large cooling compressor systems for the experimental aquarium. Excretion of ammonia and primary amines (e.g., protein and amino acids) by summer flounder larvae is being monitored on a weekly basis. Accumulation of ammonia in the media has been shown to be linear with time over a 4-hr period after transfer of the larvae to filtered seawater.

Ichthyoplankton Investigation

Members of the Ichthyoplankton Investigation met with Ken Sherman, Division Manager, and Dr. Leonard Ejsymont, Director of the Plankton Sorting Center, Szczecin, Poland, to discuss schedules for sorting MARMAP samples collected from Cape Hatteras to the Gulf of Maine in FY 1978 and 1979. We are optimistic that a 3- to 4-mo turnaround time from sample collections to specific composition output data can be achieved. We also worked out a tentative timetable for sorting and enumerating plankton samples collected on Georges Bank and the Gulf of Maine during the early 1970's. The second MARMAP survey of FY 1978 is underway. We completed sampling the Gulf of Maine on 17 November. Work is now ongoing on Georges Bank and will continue southward into the Middle Atlantic Bight.

We continued to place emphasis on formatting the hydrographic data collected in conjunction with ichthyoplankton samples, so that they can be forwarded to NODC, entered into the existing data file, and incorporated into BLM outputs. We have initiated the transfer of ichthyoplankton cruise data from Sandy Hook to Narragansett where it will be entered into the University of Rhode Island computer. Consideration is being given to a telephone linkup between URI and Sandy Hook to provide us with direct access to data files and, thereby, speed quality control.

Plankton Ecology Investigation

A summary was prepared of the principal spawning areas and times of the more abundant fishes in the Gulf of Maine-Georges Bank area. Most of the ichthyoplankton biomass is represented by 15 species. Four spawn principally in winter, American sand lance, Atlantic cod, pollock, and American plaice; five in spring, cusk, red hake, fourbeard rockling, haddock, and yellowtail flounder; four in summer, Atlantic mackerel, redfish, butterfish, and silver hake; and two in autumn, Atlantic menhaden and Atlantic herring.

Centropages typicus from Albatross IV Cruise No. 75-12 and 74-11 and part of 73-8 have been sorted and measured prior to freeze drying to determine a length/dry-weight relationship (for C. typicus).

Jack Green worked with Ed Cohen on a grazing experiment using samples from the MOCNESS during the recent cruise of the Anton Dohrn. Samples were roughly sorted on board from each tow depth and frozen for later fluorometric analyses to determine relative chlorophyll contents of the gut of the dominant species which were Centropages typicus, Calanus finmarchicus, and Pseudocalanus minutus. Results

of the analyses will be correlated with tow depth and time of day to provide information on diel feeding and migration patterns of copepods of Georges Bank.

We are presently cooperating with two graduate students from McGill University, Montreal, Canada, to analyze zooplankton samples from the area of the Argo Merchant oil spill for the presence of Argo oil. Scientists from the University of Rhode Island and the USCG R&D Center, Groton, Connecticut, are performing the analyses. Frozen and formalinized replicate samples are being compared to determine whether differences result due to treatment with formalin. The formalinized samples for the study were provided by our laboratory. Joe Kane will take samples at a series of stations in the vicinity of the Argo spill on the ecosystem monitoring cruise being conducted by the Kelez (25 November-4 December). The samples will be examined and analyzed to determine if Argo oil is persistent in the food web. The results of the study will be presented at the biological section of an Argo Merchant symposium to be held at the University of Rhode Island in January 1978. Studies of effects of Argo oil on ichthyoplankton and zooplankton conducted by NEFC since the oil spill in December 1976 are being summarized for presentation at the symposium.

Biostatistics

During November a series of spring cruises from 1972 to 1976 for Georges Bank was selected for analysis of the ichthyoplankton data. Several of these cruises were either partially or wholly in the computer system and are being summarized for ichthyoplankton using the computer. The remainder of the cruises are being summarized by hand for expediency. The results will summarize the ichthyoplankton data in the Georges Bank area from 1972 to 1976 in terms of the numbers of each organism per 10 m^2 at each station. This data will complement the data now available for the Middle Atlantic area.

Computerized plots of cruise tracks and station positions were produced for several of the recent cruises for which the basic station data have been entered. Dan Geary, a student at URI, has joined the group as a programmer under a part-time 1040 appointment.

Automatic data processing requirements for the FY 1980 TDP's were compiled for the division and submitted in conjunction with the TDP package.

Jerry Prezioso is developing a computer program which will provide automatically updated listings of the location of all plankton samples archived at NEFC.

Data concerning egg and larval haddock in ICNAF Division 4X were compiled and sent to Robert O'Boyle of Environment Canada at Bedford Institute of Oceanography in response to a written request for information concerning haddock on the Scotian Shelf.

Plankton Sorting

A contract has been awarded to examine the stomach contents of 200 larval scup, summer flounder, Atlantic herring, and Atlantic cod. These larvae are from a series of controlled feeding experiments conducted by the Larval Physiology Investigation. The stomach content information will be an important part of the modeling effort on larval survival.

The plankton lab is continuing its key role in oil spill research. Joe Kane and Ray Maurer are completing the quantitative analysis of zooplankton from a series of neuston and bongo samples taken in the vicinity of an oil spill by the USNS Potomac off the coast of Greenland. A report will be prepared and submitted to the NOAA Center for Experiment Design and Data Analysis.

Presently the sorting group is assisting the Biostatistics unit with the preparation of tabular summaries of the ichthyoplankton data base. These will be analyzed for trends in species abundance which may indicate replacement of heavily fished commercial species (e.g., herring) by less desirable types (e.g., sand lance). Activity in the plankton laboratory has centered around the completion of the 1971-1975 spring-fall zooplankton data base. Delivery of the B&L Image Analyzer is scheduled for the end of December.

US-USSR Joint MARMAP Surveys

Jerry Prezioso participated in Part II (Cape Hatteras-southern New England) of the joint US-USSR ecosystem monitoring cruise (No. 77-01) aboard Argus from 25 October to 11 November. He worked on both hydrography and chlorophyll determinations. Neuston and bongo samples from the Argus cruise were archived. Argus will return to Woods Hole in January 1978 to continue joint research with NEFC scientists.

Apex Predator Investigation

Jack Casey, Chuck Stillwell, and Wes Pratt participated in a longline cruise aboard the commercial fishing vessel Diane Marie in the Gulf Stream margin east of Cape Hatteras, North Carolina. Objectives were to: (1) tag pelagic sharks and swordfish for migration and age-growth studies, (2) perform internal examinations of specimens brought on deck for reproduction and food habits studies, and (3) study the diurnal swimming patterns of swordfish using hydroacoustic telemetry equipment. Ten longline sets resulted in a total catch of 233 fish of which 168 (164 sharks, 4 swordfish) were tagged. Preliminary analysis of stomach contents from sharks and swordfish collected during the cruise suggests squid was a major food source. Beaks and body remnants have not been identified to species, but dip-netted specimens from the fishing area indicated the availability of Illex sp. Remains of offshore hake (Merluccius albidus), Atlantic saury (Scomberesox saurus), bluefish (Pomatomus saltatrix), and scombrid flesh were also observed. Reproductive collections and field observations on this cruise were made later than in any previous year. Mature male blue sharks are still sexually active in November. Two gravid females, each 4 or 5 mo pregnant were captured and dissected. Uteri were frozen unopened for laboratory dissection. Standard meristics and histological samples were taken for nine specimens.

Dr. Frank Carey of the Woods Hole Oceanographic Institution, a member of the scientific party, tagged a swordfish with a sonic pulsing unit and was able to track and monitor its swimming behavior for 68 continuous hours.

Information from an additional 125 sport-tagged sharks was key punched and added to the ADP data base on apex predators. Verification of previously punched tagging data was continued.

Meetings, Talks, Visitors, Publicity

Bob Pawlowski completed and issued the October report on the SOOP XBT run from Maine to Nova Scotia. His paper with Sam Nickerson on the 1972-1976 groundfish survey surface temperature and salinity is virtually ready for the printer.

Red Wright attended two MARMAP planning meetings, in Boston and New Bedford, to try to organize schedules for the balance of FY 1978 and for 1979.

With Marv Grosslein, Dr. Wright gave an informal seminar on the larval herring patch study planned for next fall at the newly instituted weekly seminars on physical oceanography of the continental shelf at WHOI. Plans for German participation in the patch study were discussed with Gunnar Joakimsson of the Anton Dohrn.

During November, Carolyn Griswold attended an Ocean Pulse planning document revision meeting at Sandy Hook. Discussions centered around presenting it in terms of the NMFS mandate. New formats are being developed for individual study areas which will allow the reader a concise description of planned procedures.

Carolyn Griswold attended a meeting of the BLM Biological Task Force in New York City. Completed rig-monitoring studies were discussed. Newly established EPA requirements for rig-monitoring studies were presented. No plankton studies were included and the task force as a whole felt that EPA should be approached and recommendations be made that such studies be included in the final proposal.

Dr. A. J. Belling from the Department of Biology, New York University, visited the Woods Hole Laboratory on 17 and 18 November. The purpose of her visit was to obtain information and specimens pertaining to postglacial migration of Chamaecyparis thyoides in the northeastern part of the US.

Dr. Leonard Ejysmont, Director of the Polish Sorting Center at Szczecin, Poland, arrived on a 30-day visit to NMFS laboratories at Narragansett and LaJolla. Zooplankton sorting protocols and priorities will be discussed on his return from California.

Kenneth Sherman convened a division meeting at Logan Airport, 3 November, to plan MARMAP surveys for FY 1978 and 1979.

Perry Jeffries of URI met on 4 November with Kenneth Sherman regarding the joint NEFC-Sea Grant project for development of an image-scanning system for zooplankton sorting and counting.

On 7 November, Dr. Jim Aiken gave an informal seminar on the "Status of the Development of the Undulating Oceanographic Recorder." Dr. Aiken is from the Institute of Marine Research of Plymouth, England.

Solomon Shenouda, of General Foods, Schenectady, visited Donna Busch at the Narragansett Laboratory on 10 November.

Kenneth Sherman had a luncheon meeting with Francine Jacoff of EPA, and Bob Sexton of URI, regarding plans for meeting next August for American Fisheries Society.

Renata Polak and Audrey Fillion visited the laboratory on 21 November. They are from McGill University, Montreal, Quebec.

On 22 November Wally Smith, Doris Finan, and Mike Fahey of the Sandy Hook Laboratory met with Narragansett staff and Dr. Leonard Ejysmont to establish sorting priorities for ichthyoplankton and zooplankton in FY 1978 and 1979.

Kenneth Sherman attended a meeting at Ruggleshouse, URI, to plan the agenda for the Argo Merchant symposium on 22 November.

On 28 November, Dr. Wilhelmina deLigny of Shell Internationale Research Maatschappij B.V., Gevestigd te Den Haage, visited the laboratory to discuss Argo Merchant oil spill assessment work.

Also, on 28 November, Earl Rayfield of NOS visited the laboratory to discuss NOAA Officer Corps fisheries training programs and MARMAP curriculum.

The first of a bimonthly luncheon meeting was held on 28 November with Dean Knauss, URI; Eric Schneider, EPA; Bob Sexton, URI; Francis Di Meglio, URI Nuclear Center; and Kenneth Sherman of the Narragansett Laboratory, to discuss areas for greater scientific cooperation among the principal facilities of the Bay Campus.

On 29 November Perry Jeffries, Tom Murray, and Alex Poulacaris visited Kenneth Sherman regarding a Sea Grant project. Then later the same day, Kenneth Sherman went to Washington, DC, to meet with Reuben Lasker regarding the ICES Larval Fish Symposium.

Manuscripts

Pratt, H. L., Jr. Reproduction in the blue shark. Fish. Bull. (S)

MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

Monthly activity centered on manuscript reports of former and recent field activities. Reports in preparation include studies on lobsters, surf clams, and sand lance. Final draft of a multi-authored compendium on lobster trap design and ghost fishing was submitted for publication.

Manuscripts

Smolowitz, R. J. (Ed.). Lobster (Homarus americanus) trap design and ghost fishing. Mar. Fish. Rev. (A)

ENVIRONMENTAL ASSESSMENT DIVISION

Behavior of Marine Fishes and Invertebrates Investigation

Analysis of tagging data for cunner, Tautogolabrus adspersus, indicates that the majority of adults exhibit a restricted home range, remaining in close proximity to the structure (i.e., shelter) to which they were recruited as juveniles. This supports our earlier conclusions based on results from ultrasonically tracked individuals which showed that cunner remained within approximately 2 m of a given homesite.

From March through November, 839 fish (14.0-25.7 cm) were captured, tagged, and released. A total of 176 (21.0%) fish was recaptured by trapping, spearing, or by hook and line, by recreational fishermen. Of these recaptures, 166 (94.3%) occurred at the release site (homesite), while only 10 (5.7%) were from other locations. The apparent dispersal of a small fraction of the population appears to be related to the availability of seasonally intermittent habitats, i.e., beds of eel grass and macrophytic algae. Fish utilizing these habitats are significantly smaller which may reflect size intraspecific competition.

Although most fish have generally been considered to be too mobile to use as indicator species, fish that have a limited home range may be effectively utilized as biological monitors of pollutants from point sources.

Biological Oceanography of Stressed Environments Investigation

During November, Dr. James Thomas, Jay O'Reilley, and Craig Robertson participated in the third SINC-MESA cruise with personnel from Lamont-Doherty Geological Observatory and from the Bigelow Laboratory. The cruise extended over a period of 15 days and was designed to investigate the cycling of nitrogen, carbon, and oxygen in the New York Bight Apex. Personnel from Sandy Hook investigated the release of dissolved organic matter from phytoplankton and water column respiration while following a series of drogue buoys.

Andy Draxler, Bill Phoel, and Al Matte participated in MARMAP cruises aboard the NOAA Ships Mt. Mitchell and Kelez collecting water samples between Cape Hatteras and Nova Scotia to determine phytoplankton distribution, abundance, and composition (netphytoplankton versus nannophytoplankton), using discrete chlorophyll a measurements. The physiological state of the phytoplankton also is being determined on these samples based on chlorophyll-phaeophytin relationships. Ms. Christine Evans has recently become subtask leader for our Phytoplankton Baseline Studies (including MARMAP) and will oversee the day-to-day operations of the above collections, their analysis, and data preparation and presentation.

Effort has also continued toward the completion of our chapter, "Maintenance of Anoxic Conditions off the New Jersey Coast during the Summer of 1976."

Coastal Ecosystems Investigation

We concentrated on processing and analyzing benthic macrofauna samples taken in the Baltimore Canyon Trough (70 mi east of New Jersey) in 1974. Information from this survey will be combined with data of groups such as USGS and the Virginia Institute of Marine Science to form a "baseline" characterization of the BCT area. The baseline will permit future assessment of impacts related to oil exploration and production off New Jersey. We have begun cluster analyses to identify faunal assemblages and groups of similar stations in the BCT. A monthly report on progress of this task, as well as status of other NMFS studies in the BCT area (finfish, ichthyoplankton, and pathobiology) was submitted to the project's sponsor, the Bureau of Land Management.

We began development of a serial atlas illustrating distribution and abundance of benthic macrofauna in the New York Bight. The first charts in this series will be based on samples taken quarterly in 1973 and 1974 from the MESA grid of 100 stations in the bight apex. Data reports based on these quarterly cruises are nearing completion, as is a manuscript on community analyses of the MESA macrofauna. With the help of a handicapped volunteer, we initiated an inventory and maintenance program for samples in the MESA museum at Sandy Hook.

A survey of oyster populations in Raritan Bay was completed; oysters were found in low densities in most areas where they had historically been harvested. Highest densities were found off Ward Point (southwest Staten Island). Charts of oyster distributions in the bay will now be prepared.

Work also continued on a manuscript concerning impacts of the 1976 anoxia on the benthos off New Jersey.

Coastal Monitoring, Assessment, and Prediction Investigation (COMAP)

A proposal entitled, "Coastwide Fishery Resource Assessment," was received from the Massachusetts Division of Marine Fisheries and forwarded by John Cookson of the State-Federal program to the NEFC for review. It was circulated to Fred Lux, Brad Brown, and others in the Center for comment. George Kelly prepared a combined response for the signature of the Director. The response was strongly in favor of funding the proposal and recommends close liaison of the Center staff with the Division of Marine Fisheries in implementing the program. Fred Lux and George Kelly met with Jack Pearce at Logan Airport on 11 November to review the current COMAP program and discuss liaison of the Center staff with state and private components involved in inshore environmental assessment studies.

A report entitled, "Crisis Science: Investigations in Response to the Argo Merchant Oil Spill," was received from Keith D. Stolzenbach, Associate Professor in Water Resources and Hydrodynamics, Department of Civil Engineering, MIT and coauthor of the report. Responses to the report will be varied, but some sections may be helpful for developing plans for a better coordinated response to future oil spills.

Environmental Chemistry Investigation

Mr. Merrill Heit, Environmental Measurements Laboratory, US Department of Energy, New York City, contacted Mr. Richard Greig in regard to analytical laboratories which conduct metal analyses of marine samples. Mr. Heit was very interested in the possibility that the Environmental Chemistry Investigation could do cooperative work with them and will contact the division in the near future to present their needs for metals analyses in the New York Bight area.

The first of several experiments set up by Mr. MacInnes of the PEPS Investigation on copper effects on Macoma was started this month. Our investigation will analyze the seawater and animals for uptake of this metal. This species is being considered as a key species in Ocean Pulse studies.

A study was initiated to monitor from three to five trace metals and NH_3 concentrations in Milford Harbor water in relation to a dredging operation at a marina near the laboratory. We also plan to furnish samples to Dr. James Thomas, Sandy Hook, for investigations to determine the usual nutrient compounds normally analyzed for.

Physiological Effects of Pollutant Stress Investigation (PEPS)

Physioecology

A study of the effects of copper on adult Macoma balthica was initiated this month. A preliminary test was performed to determine the tolerance of this clam to copper as the chloride. Parameters to be examined in this study are bioconcentration of copper by Macoma in short-term (96 hr) tests and measurements of oxygen consumption.

Studies on the effects of heavy metals on oyster embryos have been temporarily halted due to lack of viable gametes at this time of year.

A study to determine the effects of copper and zinc, both singly and in combination, on juvenile scallops, Argopecten irradians, was completed. The data are now being analyzed statistically and will be reported in a subsequent narrative.

Our study to determine the effects of eight heavy metals on embryos of the surf clam, Spisula solidissima, are continuing. Preliminary data indicate that the order of metal toxicity to surf clam embryos is Hg > Cu > Ag > Ni = Zn > Pb > Cd > As. Surf clam embryos exhibit a high sensitivity to mercury, 3 µg/ℓ being lethal. Experiments are continuing to determine final LC_5, LC_{50}, and LC_{95} values.

The remainder of the month was used to prepare proportional dilution test systems in anticipation of long-term cadmium-exposure studies with winter flounder, Pseudopleuronectes americanus.

Physiological Effects

The effort of this month was split between two major events - moving this research program to a new and larger laboratory and attending the Third Symposium on Pollution and Physiology of Marine Organisms (see "Meetings, Talks, Visitors, Publicity").

We are in the process of moving to a larger laboratory in the original Milford Laboratory building. This process will take another month while new benchwork, cabinets, and sinks are installed. In the meantime, we are continuing some research in our original lab while renovations are being made in the new laboratory.

Biochemical Effects

Biochemical testing of scallop adductor muscles from the scallop assessment survey cruise of September 1977 was finished. With data analyses nearing completion, no clear pattern of stress at any one station has been seen, as there is considerable variation among samples.

Tissues frozen-stored in a -29°C locker were inventoried during transfer to a new -80°C freezer. Two or three "lost" lots emerged, among them ample material for working up a kinetics protocol for two zinc metalloenzymes, MDH and LDH, in flounder gonads. We expect to emphasize gonad analysis in the forthcoming flounder-cadmium recovery experiment this winter, although the kidney, heart, and skeletal muscle will be thoroughly examined, as well.

A summary of laboratory activities was written for the annual Newsletter of the NE Division, American Fisheries Society. The balance of the month was spent writing reports, analyzing data, and preparing a talk which is to be given at the forthcoming AAAS meeting in Washington, DC.

Anaerobic Bacteriology/Metabolism

Bottom sediments were obtained from the recent Kelez cruise to the New York Bight and from the New London dumpsite area in Long Island Sound for methodology evaluation and analysis for anaerobic bacteria.

Meetings, Talks, Visitors, Publicity

Dr. James Thomas, Mr. Wally Smith, and Dr. John Pearce met at Logan Airport, Boston, on Thursday, 3 November, with personnel of the Marine Ecosystems Division, to discuss the nature of future cruises concerned with primary and secondary productivity, as well as cruises for the Ocean Pulse program. It was decided that we would go ahead with five minimal primary productivity cruises during this fiscal year. These cruises will cover the general area from Cape Hatteras to Georges Bank. Commencing in FY 1979, however, the cruises will be concentrated in more limited areas over Georges Bank and within the Middle Atlantic Bight and fewer stations will be occupied within these areas.

On Monday, 7 November, Dr. Pearce met with Commissioner Rocco Ricci, Dr. Glen Paulson, Mr. Russell Cookingham, and other staff members from the New Jersey Department of Environmental Protection (NJDEP). The meeting, held in Trenton, was concerned with the Ocean Pulse program and how the state marine fisheries and environmental programs could be involved with the Pulse initiative. The NJDEP continues to be involved with research activities at the Sandy Hook Laboratory, especially those concerned with the low dissolved oxygen situation and red tides in the New York Bight, as well as activities concerned with the distribution of contaminants in inshore waters.

Drs. Anthony Calabrese and Fred Thurberg met with other division personnel at Sandy Hook on 10 November to review their planning documents for FY 1980 and to integrate these plans into the Ocean Pulse program.

Dr. John Graikoski attended an open house of the recently established Institute for Anquilliform Research and Mariculture of the University of Bridgeport on 10 November.

On Friday, 11 November, Dr. Pearce met with the Center and Regional Directors and staff at Logan Airport, Boston. The principal purpose of this meeting was to discuss the Ocean Pulse initiative and Regional planning with the Regional Director. Following this meeting, Dr. Pearce met with Mr. George Kelly and Mr. Fred Lux in regard to planning for FY 1980 and involvement of the COMAP investigation in the Ocean Pulse program.

Bod Reid described types of impacts on the New York Bight and how they are being studied by NMFS to Dr. Gray Multer of Fairleigh Dickinson University and nine of his students in a coastal zone management seminar on 11 November at Sandy Hook laboratory.

On Monday, 14 November, Dr. Pearce testified in a court case in New Brunswick, New Jersey. Dr. Pearce presented evidence in behalf of the NJDEP in a case against a company discharging zinc and other metals into the Middlesex County sewer system, and thus indirectly into the Raritan Bay estuary and New York Bight. Based on testimony by Dr. Pearce and others the judge ruled that the particular company must cease and desist from dumping heavy metals and other contaminants into the domestic sewage treatment system. This was a significant ruling inasmuch as it indicates a first step towards reducing industrial discharge into domestic systems, thus allowing recylcing of sewage wastes.

Drs. Anthony Calabrese and Frederick Thurberg and Ms. Margaret Dawson attended the third symposium on "Pollution and Physiology of Marine Organisms" held in Georgetown, South Carolina during 14-17 November. This symposium was cosponsored by the Belle W. Baruch Coastal Research Institute and the School of Public Health of the University of South Carolina and the Northeast Fisheries Center. Ms. Dawson presented a paper entitled, "Hematological Effects of Long-Term Mercury Exposure and Subsequent Periods of Recovery upon the Winter Flounder, Pseudopleuronectes americanus."

On Tuesday and Wednesday, 15-16 November, an Ocean Pulse Workshop was held at Sandy Hook Laboratory. Dr. Robert Lippson and Ms. Ruth Rehfus represented the Regional Environmental Assessment Branch, and Dr. Douglas Lipka represented the Washington Environmental Assessment Division. Several representatives from major Center investigations were also present. An outline was developed and contributions were written to be included in the final Ocean Pulse planning document.

On Thursday, 17 November, Dr. Pearce met with Cdr. Swanson and other personnel from the MESA New York Bight Project Office. Dr. Pearce discussed the current status of Ocean Pulse and solicited input from the MESA office as to how the Ocean Pulse program and the MESA office could coordinate and integrate various activities at New York Bight sampling strata. Cdr. Swanson volunteered 2 wk of Kelez time in September to be used for the Ocean Pulse cruises. It was also indicated that during other MESA-oriented cruises in FY 1978, Pulse investigators could be aboard to make measurements at Pulse sampling strata in the Middle Atlantic Bight.

Mr. Wenzloff and Mr. Zdanowicz attended a 1-day session of the Eastern Analytical Symposium, Inc., held in New York City.

Manuscripts

Ecosystems Investigations. 1977. Physical, chemical, and biological effects of dredging in the Thames River (CT) and spoil disposal at the New London (CT) Dumping Ground. Natl. Tech. Infor. Serv. Rept. No. AD-A044164. 346 pp. (P)

Olla, B. L., and C. Samet. 1977. Courtship and spawning behavior of the tautog, Tautoga onitis (Pisces: Labridae), under laboratory conditions. Fish. Bull. 75(3): 585-599. (P)

Phoel, W. C. 1977. The history, physics, and physiology of saturation diving. MTS Jour. 11(4): 15-19. (P)

Simeone, C. 1977. A preliminary survey of the intertidal benthic macrofauna of Sandy Hook Bay. Bull. N. J. Acad. Sci. 22(2): 6-12. (P)

AQUACULTURE DIVISION

Aspects of Nutritional Requirements of Mollusks Investigation

Numerous requests have been received by this investigation from commercial hatchery personnel for training in algal culture methodology. On-site visits by Dr. Ukeles confirmed the fact that the techniques used in culturing algae in hatcheries for the food supply should be improved. To provide the information needed, this investigation conducted a 3-day (29 November-1 December) workshop in algal culture techniques-laboratory procedures for marine unicellular algae.

Attendance was restricted to an enrollment of 10, due to space limitations. Participants represented five commercial hatcheries in the Northeast, and one commercial hatchery in France, with whom we had been in previous contact. A 35-page illustrated manual was prepared for this workshop. Each participant received a notebook containing a copy of the manual and four reprints dealing with algal culture methodology. One morning was devoted to a lecture by Dr. Ukeles on, "Growth Requirements of Unicellular Algae." There was an afternoon of demonstrations by Dr. Ukeles and the staff. Laboratory bench space, glassware, equipment, chemicals, and prepared growth media were made available to each participant. This provided them the opportunity to practice the essential techniques following the instructions in the manual and with supervision of the investigation staff. The workshop was concluded with suggestions on obtaining good sources of equipment and chemicals. At various times during the workshop there were discussions of specific problems and experiences of each participant.

All participants were very satisfied with the workshop and felt that they benefited considerably from it.

We conducted several larval feeding experiments utilizing an artificial food particle, developed by Dr. L. Provasoli of Haskin Laboratory of Yale University, that has proven to be a good food source for several crustacean species. At a "low" concentration the straight-hinge larvae survived well for 48 hr but did not demonstrate new growth and died in 4-5 days. At "high" particle concentrations larvae died in 24 hr. It is not possible to determine at this time if the mortality was due to toxic factors in the particles or to secondary factors.

At this time of year the demand for algal foods is decreasing; nevertheless, we still harvested 1,064 liters of larval foods and 1,066 liters of juvenile foods. The food requests received from the various investigations were as follows: Aquacultural Genetics, 470 liters; Spawning and Rearing of Mollusks, 768 liters; Physiological Effects of Pollutant Stress, 166 liters.

Spawning and Rearing of Mollusks Investigation

We successfully marked 2,500 juvenile scallops (20 mm) with a quick-drying underwater marine epoxy. These tagged animals became part of a group of 10,000 seed scallops planted in Connecticut waters with the cooperation of the Aquaculture Division of the Department of Agriculture. We plan to follow this population by periodic observations over the next year.

Some results are available from our first attempts to ripen scallops for spawning this fall. The best treatment appears to be a constant 15°C flow-through system with available natural algae. Groups held in flow-through systems at 20°C and in static and recirculating systems with additional cultured algae are not as satisfactory for ripening bay scallops at this time of year.

Aquacultural Genetics

Selection, Inbreeding, and Hybridization of Commercial Oysters with Related Experimental Work

Theoretical heritability estimates based on half-sib correlations of hatchery-cultured juvenile American oysters indicate that selection for juvenile growth rate in commercial hatcheries would result in faster growing juveniles. These estimates averaged about 0.5, falling in the middle range of possible values. American oyster larvae metamorphosing to the adult form early and those

metamorphosing late failed to show any statistically significant differences in their rate of growth as early juveniles. There may be, however, some tendency for the earliest metamorphosing larvae to grow faster as juveniles than those that metamorphosed last. This matter is of importance to commercial hatcheries where it is most convenient to collect only the earliest setting (metamorphosing) larvae, and where this is often the practice. Of further importance is the correlation between growth rates of early and late stages of juveniles right up to market size. Because the environment may be more generally controllable for early than for late stages, selection of stock for breeding might more profitably be made at early than at late stages if these correlations are good.

Data on the parthenogenic stimulation of egg development in the American oyster without any contribution of genes from the male have been examined statistically. Some doses of X-irradiation tested over a rather wide range appear more promising in the genetic inactivation of oyster sperm than do others. The oyster is showing itsefl more resistant to induction of parthenogenic development than the surf clam or fish generally. The approach is still regarded though as an attractive means of producing inbred larvae in one generation, which would otherwise take years to breed. Such inbreds once obtained might be compared to the oysters of lines being inbred at the Milford Laboratory by conventional means. They would also serve purposes of more basic study.

A small number of mangrove oysters has been obtained from Florida. These belong to the same genus as the American oyster and are intended for hybridization research and possibly for hybridization breeding.

Two manuscripts have been prepared for presentation at the World Mariculture Society meeting in Atlanta this January:

Losee, E. Influence of heredity on larval and spat growth in Crassostrea virginica.

Stiles, S. Conventional and experimental approaches to hybridization and inbreeding research in the oyster.

Mutagenics

Cytogenetic and Related Cytological and Embryological Studies on Plankton Fish Eggs from the Field and from Laboratory Experimentation on Contaminants (report covers a 3-mo period)

Cytogenetic and cytological data on May 1974 Atlantic mackerel eggs from stations scattered over more- and less-impacted areas of the New York Bight (Westward cruise) have been treated statistically. Dr. T. Holford of the Yale School of Public Health, Department of Biometrics, did these analyses after thorough discussions of the data, of strengths and weaknesses of the total approach, and of the general problems being addressed in this field study of fish eggs. The uniqueness of mackerel egg collections from different sample stations is now further evidenced by significant ($P < 0.01$-0.001) correlations between cytological mortality-cytogenetic moribundity for early development Stages II, III, IV and V, VI, and VII (i,e., morula to tail-free embryo). Also showing signficant within-station correlations for different development

stages of the embryo are cytological mortality-cytogenetic moribundity of one stage and chromosome division rate of another, and the rates of chromosome divisions of the several development stages ($P < 0.001$). There must be chromosome divisions (mitoses) for cell division and development to occur, and this alone is an index of the well-being of these embryos insofar as it is uninfluenced by temperature. Study of temperature records from the 1974 cruise by Dr. M. Ingham indicates that temperature varied little.

In an effort to explore the applicability of cytogenetic methods to the several early development stages, as well as to appraise correlation between stages, an assortment of different-stage data was finally available for the several stations. This, as well as the fact that some development stages often are not sampled in critical areas, other stage data were used to estimate data for Stages IV-V, the development class for which most data existed for most stations (35/49). Stein estimators were used to improve the overall accuracy of comparing the many estimates of mortality and moribundity over the bight. Stations were grouped by geographic area in and out of the bight apex and by general characteristics of major water movements in the bight. Differences between the various groups were evaluated using nonparametric tests based on ordering of the egg mortality. An overall test (Kruskal-Wallis) of differences among the areas showed that there were significant differences. Pair-wise tests were used to determine which areas contributed to this overall difference. These comparisons of one area to another showed some quite significant differences between presumed most- and least-impacted bight regions. All data details are being organized for a second NOAA Technical Memorandum on the subject with a full treatment of updated methodology and description of the egg classification system developed. A shorter manuscript is being prepared for publication in a regular scientific journal with an accompanying paper on methodology.

In spite of the relatively good shape of the earliest stage (compared to 1974 samples), 1977 mackerel eggs sampled in the New York Bight experienced a rather high and a rather general difficulty at a subsequent critical developmental stage not prevalent to any degree in the 1974 bight collection. In the 1974 collection gastrulation showed a sharp drop in embryos with abnormal chromosome divisions as would be expected on the basis of published experimental studies on fish and on an assortment of other species. In 1977 roughly a quarter of the gastrular embryos had double or multiple, instead of the normal single invagination. A check on the 1974 Westward collection confirmed that any forms of gross abnormality of gastrular embryos were very rare for that year-class mackerel in the bight. Generally, events at the cell and chromosome levels in the 1977 gastrular embryos of mackerel eggs indicate some sort of stress situation. Earlier- and later-stage embryos do not reflect this. Abnormal gastrulation does not appear to correlate with station variations in temperature, salinity, pH, dump-site or coastal proximity, or with any combination of two of these factors alone. However, surface water seems to have been colder in May 1977 than in May 1974, and the possibility remains that temperature was a factor here.

It seemed inadvisable to concentrate initial cytogenetic-cytological study of the Annandale May 1977 collection of Atlantic mackerel eggs on a development stage with such a high degree of disorder seemingly unrelated to earlier and later stages. These studies are, therefore, being concentrated on the preceding and succeeding development stages. The mackerel eggs sampled at the Rockaway Inlet-Sandy Hook transect station in the heavily polluted bight apex were

outstandingly poor in just about every respect, some of them rather atypical, even though egg density there was high. Eggs taken at this station showed fairly good development for Stage I (cleavage) eggs. Subsequent stages had largely ceased to undergo chromosome divisions. The later-stage (tail-bud and tail-free) embryos showed extensive gross malformation. Embryo cells were often de-differentiated, and lacked the islands of blood cells typical of these development stages. Other embryos had cells atypically and prematurely differentiated. Chromosome divisions that were yet in process were very abnormal. A portion of the embryos appeared to lack yolk sacs. When examined cytologically the yolk-sac cells, where present, were like their embryos - outstandingly abnormal. The outer membrane (chorion) of still viable eggs further showed deterioration of their chorion structure. This transect station had low salinity and low pH. Another station with equally low salinity and another with an even lower measured pH, however, do not now show anywhere near such an extremely anomalous development of their mackerel eggs.

Extensive experience with the cytology of fish embryos now allows reliable scoring for three categories of differentiation problems at the cell level. One relates to the formation of the blood islands in the tail-bud and tail-free embryos, which later make up part of the circulatory system; another to the yolk-sac cells in embryos from gastrulation on; another to the general phenomenon of de-differentiation of stressed embryos, and to abnormal advance differentiation of early-stage embryos. Differentiation problems are tied in many instances to genetic difficulties and to overall cell toxicity so these parameters are supportive of the cytological and cytogenetic aspects of the overall study on planktonic fish eggs.

In experiments salinity often acts in synergism with contaminants by affecting their uptake. Chemicals or conditions adversely affecting the chorion (outer membrane) of a fish egg will also affect selective permeability and, like salinity, alter the response to a specific concentration of a harmful contaminant in the seawater. The chorions of mackerel eggs from a "clean" and "dirty" station in the bight were used to demonstrate the appropriateness of scanning electron microscopy to this aspect of the fish egg research. Extensive chorion abnormality or deterioration was observed in eggs at the Rockaway Inlet-Sandy Hook transect station; none in mackerel eggs sampled off Montauk Point.

In the usual process of making embryo preparations for cytogenetic study of planktonic fish eggs, the embryo is dissected off the egg and the remainder of the egg and associated membranes discarded. Now it has been determined that the ordinarily discarded yolk sac is an excellent source of mitotic figures, the chromosome configurations of which can be readily spread apart so that details of individual chromosomes, as exact number and morphology, can be determined. Because fish eggs are so abundant, fish would have long ago been popular subjects for cytogenetic-embryological studies were suitable methods available for displaying the chromosomes. The chromosomes of fish eggs, however, have always been refractory to detailed study of individual chromosomes as conducted widely first in plants, and then in mammals and in man. Now the yolk-sac method can provide material to match that of mammalian material in workability; and fish eggs, of course, are so abundant and available compared to eggs of mammals. They are importantly also a sensitive link in the life cycle of a valuable natural resource. Somewhat apart from this type of research is the possibility also of identifying otherwise unidentifiable fish eggs on the basis of chromosome details of their yolk-sac cells. Different populations of spawning fish could be recognized on the basis of the yolk-sac chromosomes of their spawned eggs should the separate spawning groups carry chromosome polymorphisms as some of them must.

Meetings, Talks, Visitors, Publicity

Warren Landers and Edwin Rhodes visited the warmwater effluent facility of Marine Research Inc. at the Millstone Nuclear Plant in Waterford, Connecticut. They talked with John Gary and Doug Morgan about scallop and oyster culture at the facility.

PATHOBIOLOGY DIVISION

Comparative Pathobiology Investigation

Two species of hatchery-reared clams, Mercenaria mercenaria, and Tapes semidecussata, from Kahuku, Hawaii, were examined to determine if heavy mortalities were caused by an infectious pathogen. No organisms were noted and the histopathology observed suggest that either stress or some toxic substance probably was responsible from the observed mortalities. Blocked tissues of 250 oysters from the James River, Virginia, collected during 1971-1974, were provided by the Virginia Institute of Marine Science. Sections made from these blocks were examined for histopathology attributable to Kepone. Although vascular lesions characterized by proliferation of intima collagen have been observed in oysters from the James River, only five out of 250 of the oysters recently examined exhibited this condition. Most of the pathology observed occurred in connective tissue spaces and consisted of acute inflammation, metaplasia of digestive tubules, ciroidosis, perivascular infiltration, and edema. Preliminary drafts of all sections of the monograph on normal histology of the blue crab (except the reproductive system) have been completed and portions of the manuscript are being typed in rough draft. Mr. Ray Bowman of the Woods Hole Laboratory has submitted several amphipods taken from the stomach contents of a winter flounder collected from the Argo Merchant oil spill site. As noted by Mr. Bowman, the amphipods have cuticular erosion of appendages and body segments. The lesions appeared similar to ones noted in shrimp collected from areas of the New York Bight. The amphipods are being prepared for histological examination to determine more adequately the identity of the observed lesions. Examinations for gross anomalies were made on 165 Ammodytes sp. larvae from five neuston net and six bongo net tows from the Argo Merchant oil spill area. Subsamples for microscopic examination were prepared either as whole mounts or embedded in paraffin and sectioned. Samples from bongo nets were not in good condition due to the method of capture; however, neuston samples were in relatively good condition. Difficulty was encountered in distinguishing traumatic injury from developmental abnormalities. Some dead larvae and larvae with ocular lesions were noted at some stations. However, because few fish were examined and because no baseline information exists on the normal frequency of these events, no conclusions can be made at this time. During the month, the histology laboratory sectioned 1,649 blocks and stained 1,344 slides from a large variety of marine fishes, crustaceans, and mollusks.

Disease and Environmental Stress Investigation

Field activities in support of MESA contract obligations began this month. Surveillance for fin rot disease in winter flounder was accomplished on two cruises to the New York Bight (Sandy Hook/Raritan Bay and Apex) and one cruise to Great Bay, New Jersey. Samples of oysters and hard clams for histopathologic

studies were obtained from Raritan Bay and Great Bay, New Jersey. Fish (winter flounder and spot) and shrimp (Crangon sp.) were obtained from the Arthur Kill, New Jersey, for mutagenesis testing. An electron microscope study of the effects of copper on the chemoreceptors of the blue crab was completed. Cytologic lesions were observed after 48-hr exposures to 1,000, 100, and 50 µg/l of copper sulfate. Complete destruction of the chemoreceptor sensilla occurred at the highest copper concentration. Cytologic changes appear to be dose-dependent. The results of this study were presented at a mid-November symposium on "Pollution and Physiology of Marine Organisms" at the Belle W. Baruch Coastal Research Institution in Georgetown, South Carolina. Histological examination of crab gills collected during the August "Home Run" EPA cruise has been completed. Gills from 40 rock crabs, Cancer irroratus, and 33 Jonah crabs, Cancer borealis, were examined. Twenty-six of the rock crabs had clean gills, however, 10 crabs were small 0-year class animals that molt more than once a year. Thus, 16, or 25%, of the adult crabs had clean gills and 75% had discolored gills. Results of our examinations will be compared with data from five previous EPA collections. Results showed that diatoms were infrequent in this collection and that copepod infestations remained high (1-34 copepods per section). The August cruise coincided with an extensive NMFS cruise in which 1,029 crabs were examined grossly and 100 were processed for histological study. Gill tissues from the NMFS cruise have not yet been examined but will provide valuable comparative data. Crab gills from the October EPA "Coliflower" cruise have been sectioned for staining and microscopic examination later this month.

Aquaculture - Control of Larval Disease Investigation

Pigment studies of the red pseudomonad continued this month. Bands on thin-layer chromatography plates spotted with pigment extracted from Serratia marcescens had R_f values very similar to the R_f values obtained with the pigment extracted from the red pseudomonad.

Ultraviolet light (UV) studies to determine the bactericidal efficiency of the Aquafine UV unit have resumed.

The Minitek and API diagnostic systems are being evaluated as part of an effort rapidly to identify bacterial pathogens in bivalve larval cultures. Since several of the biochemical tests in the Minitek system appear to be usable for marine organisms, Minitek equipment (which was on loan to us from the manufacturer) has been purchased. Some bacteria, however, do not grow well on the simple basal medium used with the system nor with the basal medium used for the standard biochemical tube tests. During the past month, we have examined a number of mineral and carbon source additives to the basal medium in order to increase the growth of refractory organisms. Thus far, no satisfactory results have been obtained.

Meetings, Talks, Visitors, Publicity

Dr. Rosenfield attended the Blue Crab Industries Annual Meeting in Atlanta, Georgia, during 4-7 November. Dr. Rosenfield traveled to Gloucester, Massachusetts, to discuss tables of organization and other personnel matters with the Regional Office personnel on 9-11 November. On 15-16 November, Dr. Rosenfield participated in an "Ocean Pulse" TDP FY80 planning meeting at Sandy Hook, New Jersey.

Dr. Murchelano conducted field research and discussed BLM ADP at Sandy Hook on 1 November. Dr. Murchelano examined collections of winter flounder at the Museum of Comparative Zoology at Harvard University on 2 November.

Dr. Sawyer participated in a current-meter maintenance cruise aboard the Kelez from 31 October to 3 November. He collected sediment samples at stations that ranged approximately 25 - 75 mi offshore.

Dr. Bodammer attended a symposium on "Pollution and Physiology of Marine Organisms," at Georgetown, South Carolina, during 14-17 November. He presented a paper entitled "The Effects of Brief Exposure of Copper Sulfate on the Fine Structure of Blue Crab (Callinectes sapidus) Chemoceptors."

Mr. Kern was a member of the Technical Proposal Evaluation Committee for a study of the Central Gulf of Mexico oil platforms (BLM, DOI). The committee met in New Orleans, Louisiana, during 14-19 November.

Mr. Farley collected oyster and clam samples from Raritan Bay/Sandy Hook Bay, New Jersey, during 15 and 16 November.

Dr. Blogoslawski attended the "Symposium on Advanced Ozone Technology" in Toronto, Ontario, and chaired one of the sessions.

Mr. Bruce Harke participated in a 1-wk (10-19 November) cruise aboard the US Coast Guard Cutter Acushnet to collect sediment samples in the Gulf of Mexico. The cruise was conducted as part of the Deepwater Ports Oil Spill Assessment Project.

Mr. Jay Lewis made two trips to Ocean City, Maryland, and one trip to Lewes, Delaware, to collect sediment samples.

Dr. Maung Htun-Han of the Fisheries Laboratory in Suffolk, England, visited the Oxford Laboratory of 9 November and presented a seminar on his experiments with the effects of light on the spawning times of flounder.

Mr. Jay Lewis presented a seminar at the Oxford Laboratory on 23 November. He reviewed his work and some important observations that he has made since his assignment to the Oxford Laboratory by the Maryland CZM office.

Visitors to the Oxford Laboratory during November included Mr. Kevin Goley, Mr. William Miles, and Mr. Gary Hirrault of the US Navy; Mr. Edward Stewart of Vandenberg Air Force Base, California; Mr. and Mrs. Edgar Allen Poe, Bolivia, North Carolina; Ms. Michelle Harrell, Alexandria, Virginia; Mr. Kirk McInerney, George Washington Law School, Washington, DC; Mr. Stephen Milhause of the CUE Club at the USDA, Washington, DC; Mr. and Mrs. William Prentice of Retired Citizens in Edgewater, Maryland; Mr. and Mrs. Glenn Plowman of Manasas, Virginia; Ms. Margaret M. Briggs, a student from Bishopsville, Maryland; Mr. Alan Wesche of Snow Hill, Mr. James Casey of Wye Mills, Mr. Chris Ostrom of Annapolis, and Mr. Edgar H. Hollis, all from the Maryland CZM office. The Congressional Underwater and Aquanaut Diving Clubs visited the Oxford Laboratory to evaluate the laboratory oyster beds. Ms. Oma Ruth Foster, a University of Maryland Ph.D. candidate in ecology, and Dr. J. M. Parry of the Department of Biochemistry and Genetics at the University of Swansea, UK, were visitors. Dr. Harold Haskins and a group of colleagues from New Jersey Economic Development Commission visited the laboratory to discuss their proposed new building at Bivalve, New Jersey.

Manuscripts

Blogoslawski, W. J., C. Brown, and M. E. Steward. Bacterial disinfection in shellfish hatchery disease control. To be presented to the World Mariculture Society at the January 1978 meeting. (S)

RESOURCE UTILIZATION DIVISION

Resource Development and Improvement Investigations

Fisheries Engineering

Beam Trawl

This month we began a cooperative project with a Gloucester fisherman to determine the feasibility of using a beam trawl in the inshore flatfish fishery.

The advantages of a beam trawl over an otter trawl are many. The beam trawl has less towing resistance due to lack of doors; it is less likely to hang up on hard bottom; it can be towed closer to bottom obstructions; it can be easily fished by one man, making it an attractive alternative for lobstermen, and it often disturbs the bottom sediment less than a trawl with doors.

We are designing the trawl, supplying some of the materials, and fabricating the beam. In return, we will test the trawl aboard a commercial vessel and receive catch and performance data when fished commercially.

A next step in the design process would be to double rig a larger dragger or scalloper with beam trawls. Double-rig beam trawlers can increase the sweep length of their gear by 40% over the otter trawl that they are capable of towing with the same power. This also means a boat switching from an otter trawl to a double beam trawl with equivalent sweep length could reduce fuel consumption due to less towing resistance.

The beam trawl can be a more consistent sampling tool than an otter trawl because its fixed mouth opening is relatively unaffected by speed and direction of tow. Because of the many advantages over an otter trawl, a beam trawl could have ready application as juvenile sampling gear.

Sampling and Harvesting Gear Development

Dan Baker is testing a prototype primary sorter intended to grade a mixed bag of fish into three size groups. He has designed his testing program and has had two test runs to date. A preliminary report based on these runs is being prepared.

Construction of a second story on the Gloucester Fish Pier building has begun. The second story has been completely gutted, and the new roof is nearing completion. Plans call for closing in the second story before winter weather begins. Mike Corbett is the construction superintendent and the contracting officer's technical representative for the job.

Squid Skinning and Eviscerating Machine

Following numerous test runs of the squid processing machine, the possibility of improving certain operations was evident. A list of changes was made, and they are now being fabricated and tested one at a time. These include a better method of holding the squid while it is being skinned and better control of the skinning while the squid is passed beneath the rotary whips.

Mussel Storage Study

A storage study (12 mo) is in progress on frozen raw and cooked mussels. We are evaluating the mussel meat by chemical, microbiological, and organoleptic means each month. Moisture content of raw fresh mussel meats varies between 76% and 86%, and of cooked meat between 76 and 81%. The moisture content of the frozen meats, raw and cooked, remained constant through 5 mo of storage.

The protein values have increased from 8 gm of protein per 100 gm of meat for the raw fresh samples (May) to 13 gm of protein per 100 gm of meat for the frozen May sample (October analyses). The cooked sample in May started at about 5 gm of protein per 100 gm of meat and increased to 15 gm of protein per 100 gm of meat for the frozen May sample (October analyses). All the other samples for the months of June, July, August, and September seem to be following this upward trend during frozen storage. Total plate count for all of the frozen samples, raw and cooked, for each month were <300/gm.

After 5 mo of frozen storage, raw and cooked mussel meats were of acceptable organoleptic quality.

Guaranteed Quality

We are continuing to generate data for analysis by our economists. At the same time, we have been trying to get information at the store level that may have an impact on our part of the analysis. Our analysis is nearly finished, and it is expected to be meshed with that of the economist about 1 December.

New Product Development

Taste panel results of the two minced silver hake (whiting) casseroles (pizza and butter) show the samples stored at -5°F are still comparable to the control samples after 10 mo of frozen storage. The samples stored at +5°F are now somewhat lower in quality but still acceptable.

Product Quality, Safety, and Standards Investigations

Product Quality

Minced whiting blocks which had been treated with different levels of sodium erythorbate, either alone or in combination with a metal chelating agent (EDTA), were examined after 47 wk at +5°F. The most effective of the treatments being evaluated for suppressing oxidative rancidity appears to be addition of sodium erythorbate at a concentration of 0.3%, which was the highest level used. In a previous study with precooked, breaded, minced whiting sticks, sodium erythorbate at either 0.15% or 0.3% was also the most effective antioxidant treatment.

In research concerned with isolation of the dimethylamine-formaldehyde-producing enzyme in whiting muscle, enzyme activity is being assayed by measuring dimethylamine formation using the method of Dyer and Mounsey. However, the trichloroacetic acid used in the extraction has interfered with the assay, and the procedure is being modified using a perchloric acid extraction.

Product Safety

Work on the isolation and analysis of volatile N-nitrosamines in cold-smoked king salmon (red and white) is continuing. Thirty-two samples have been worked up and analyzed by gas liquid chromatography. These samples were smoked at 85°F for 18 hr, vacuum packed, and stored at 34°F. Chloride and nitrite concentrations vary from sample to sample.

Preliminary high-resolution GC work has been completed at Biomeasure Inc. for the analysis of whitefish extracts by GC-MS.

Product Standards

As a result of the transfer of the responsibility for inspection of military fishery products from the military to the USDOC Inspection Service, many of the procurement documents have had to be revised. One item widely bought by the military has been breaded scallops for which there is no USDOC standard. An amendment is being developed for the USDOC fried scallop standard which would permit the grading of breaded scallops also. John Ryan visited the scallop processors in New Bedford to discuss the amendments and get their comments before sending the document to the Washington Office for publication in the Federal Register.

Meetings, Technical Assistance, Talks, Visitors, Publicity

Annual Blue Crab Meeting

The annual meeting of the National Blue Crab Industry Association was held in Atlanta, Georgia, during 4-6 November 1977. There were approximately 65 registrants, and the attendance by industry was greater than last year. The Gloucester Laboratory personnel assisted in planning the technical agenda as well as presenting their annual blue crab research reports. Bob Learson chaired the research portion of the agenda and served on the program committee. Burt Tinker presented research results on freezing and reforming studies of roller-extracted crabmeat and the determination of acceptable levels of shell in crabmeat. Judi Krzynowek presented the results of work on crabmeat species identification using the isoelectric focusing technique. Other NMFS participants include Jack Gehringer, Washington Office; Bill Stevenson, Southeast Region; and Aaron Rosenfield, Oxford Laboratory.

Meetings

John Kaylor attended the annual meeting of the Interdepartmental Committee on Radiation Preservation of Food in Washington, DC.

Joseph Mendelsohn and Bob Learson attended the presentation of the results of the ocean quahog contract in Philadelphia.

Fred King participated in the Tenth Session of the Codex Committee on Methods of Analysis and Sampling held in Budapest, Hungary, during 24-28 October. International referee methods of analysis and general sampling plans for prepackaged foods were reviewed and discussed.

Al Blott attended a meeting of the Groundfish Oversite Committee and the Groundfish Advisory Committee of the New England Regional Fishery Management Council as a technical advisor for the Woods Hole Laboratory's mesh selectivity study. He also provided additional requested information to the study coordinator.

Technical Assistance

Hank Svehaug of Key Electro Sonic sought the assistance of Kurt Wilhelm in solving a problem which occurs in the use of the stationary dewatering screen. In processing crabmeat by roller extraction, the meat is flumed away from the roller machine and down a dewatering screen which is tilted at a 60° angle. The flumed meat slides down the screen while the water drains through the screen. Two problems encountered are that the screen occasionally clogs with meat and the meat must be conveyed up to waist level for further processing.

With the cooperation of Frank Wetmore of Bay Trading Co., we demonstrated that if the screens were vibrated, the meat will travel across the screen horizontally, precluding the need for a second conveyor to move the product to waist level; also, the meats do not clog the screen.

Other assistance was given to: (1) Capt. Bill Sibley of the Peggy Bell II out of Gloucester on trawl design and hydraulic system problems; (2) Sam Favalora of the Anthony & Josephine out of Gloucester on design of net reels and modifications of hydraulic systems; (3) Anthony Parisi of the Natale III out of Gloucester on loan of midwater trawl and information on purse seine winch; and (4) Al King of the State Fish Pier Commission on Scottish seining, gill netting, lobstering, and vessel power and construction costs.

NATIONAL SYSTEMATICS LABORATORY

Benthic Fishes

A paper was nearly completed on the distribution and systematics of the four-bearded rockling, Enchelyopus cimbrius, in the North Atlantic. Work was done on a manuscript describing the presence of the common eel, Anguilla, on the bottom at a depth of 2000 m in the Bahamas; the record is based on photographs taken during DSRV Alvin dives made in January.

Pelagic Fishes

Research continued on the anatomy and systematics of the Spanish mackerels and of Indo-West Pacific halfbeaks. Work commenced on a field guide to species taken in the Atlantic pelagic longline fishery.

Shrimps

Work was done on the identification of postlarval Penaeus.

Other Crustaceans

A chapter on brachyuran crabs was nearly completed for a book on pollution ecology of estuarine invertebrates.

Meetings, Talks, Visitors, Publicity

A meeting of US conveners of the Joint US-USSR working group on biological productivity and biochemistry of the world ocean was attended on 28 November in Gloucester Point, Virginia, by D. M. Cohen.

A seminar on scombrid systematics was presented at George Washington University by J. Russo.

Visitors included G. Zamora of NMFS's Galveston Laboratory, who studied postlarval shrimps; C. Gruchy of the National Museum of Canada in Ottawa who studied batrachoid fishes; and M. Leiby of the Florida State Board of Conservation who discussed ophidioid fishes.

Manuscripts

Cohen, D. M. Review of Francis Day (1829-1889) and his collection of Indian fishes, by P. Whitehead and P. Talwar. Copeia. (S)

Collette, B. Epidermal breeding tubercles and bony contact organs in fishes. In Biology of Skin. Symp. Zool. Soc. London 39: 225-268. (P)

ATLANTIC ENVIRONMENTAL GROUP

Ocean Monitoring and Climatology Task Group

On 11 November, Reed Armstrong and Steve Cook conducted a dye diffusion experiment in the vicinity of the Buccaneer Oil Field off Galveston, Texas. The dye was released from a chartered vessel and periodic measurements of its concentration in the water were made from the same vessel. In addition, aerial photographs were taken periodically of the dye plume from a chartered aircraft. Transponding buoys equipped with subsurface drogues were launched in the dye patch and tracked for 4 days to depict the advective motions of the patch. This was the second in a series of studies to provide information on the dispersion and transport of potential contaminants from oil field operations on the outer continental shelf. These studies were conducted in cooperation with the Galveston Laboratory of the SEFC as part of an EPA-sponsored investigation.

During November the AEG Ship of Opportunity Program obtained five XBT transects, two in the New England area, two off New York, and one off the Virginia Capes.

Monthly flow data for all the monitored streams tributary to Chesapeake Bay and Delaware Bay have been purchased from the US Geological Survey. The data set was obtained in list-out form for use in a cooperative blue crab climatology study, but can be made available to other interested scientists in the NEFC.

Ocean Dumping Task Group

The final draft of "The Physical Oceanography and Experimental Studies at Deepwater Dumpsite 106 during June 1976" is completed and will soon be forwarded to the program office along with suggestions. A similar report is presently being written concerning this past summer's work at the site. This

report summary should be completed in first draft form during early January 1978. Also completed in final draft form is "Anticyclonic Gulf Stream Eddies and Water Circulation at Deepwater Dumpsite 106 during 1976", an update of earlier work by Bisagni.

November's monitoring transect to DWD 106 aboard the tug Ocean Prince on 18 and 19 November was not completed due to a mechanical breakdown of the tug, thus cancelling the operation.

Meetings, Talks, Visitors, Publicity

Reed Armstrong and Steve Cook were in Galveston, Texas, from 8 to 16 November to conduct a dye diffusion study as part of the Buccaneer Oil Field Investigation.

On 10 November, Mert Ingham attended a meeting of the Steering Committee for the Climate and Fisheries Workshop to be held by the Center for Ocean Management Studies of the University of Rhode Island late in March.

On 15 and 16 November, Woody Chamberlin, Mert Ingham, and Jim Bisagni attended the fifth annual Informal Workshop on the Physical Oceanography and Meteorology of the Middle Atlantic and New York Bights, held at Lamont-Doherty Geological Observatory. Chamberlin and Ingham made presentations concerning studies underway at AEG in the area of interest.

Manuscripts

Chamberlin, J. L. 1977. Strong Gulf Stream eddy currents indicated by losses of crab traps on the continental slope. Abstract submitted for Informal Workshop on Physical Oceanography and Meteorology of the Middle Atlantic Bight and New York Bight, 15-16 November 1977. (A)

Cook, S. K. In Press. Gulf Stream interaction with shelf water in the Cape Hatteras area. Gulfstream (NOAA) (A)

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

Ingham, M. C. 1977. Efforts of the Atlantic Environmental Group to construct an environmental data base for fishery climatology studies in the Cape Cod-Cape Hatteras area. Abstract submitted for Informal Workshop on Physical Oceanography and Meteorology of the Middle Atlantic Bight and New York Bight, 15-16 November 1977. (A)

NEFC PUBLICATIONS AND REPORTS

Recent papers by NEFC authors are noted in the final section of each laboratory, divisional, or programmatic write-up. Papers targeted for scientific journals are listed as "Publications;" all others are listed as "Reports." Publications are labeled as submitted, accepted, or published with an appropriate "S," "A," or "P" at the end of each entry. Reports are included only upon completion.

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