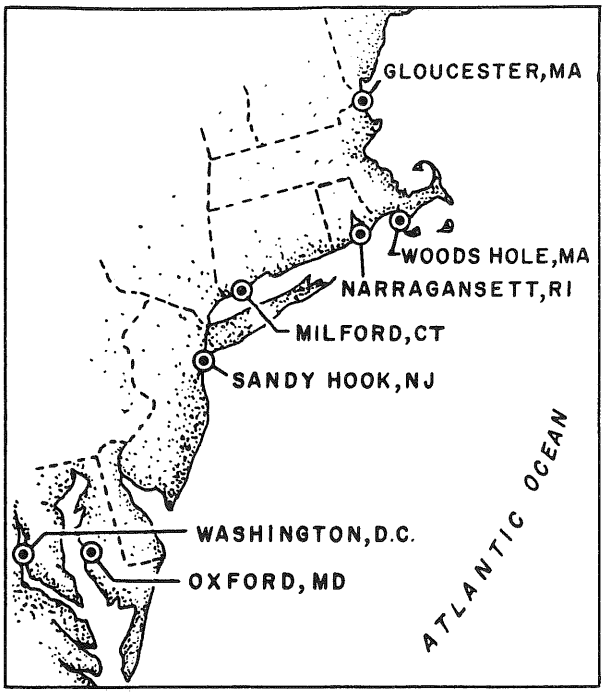
NEFC

Northeast Fisheries Center

NEWS



MONTHLY NARRATIVE REPORT
APRIL 1977

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

RESOURCE ASSESSMENT DIVISION

Resource Surveys Investigation

The Middle Atlantic segment of the spring bottom trawl survey was completed on 8 April. The Delaware II, with Wallace Morse as chief scientist, completed 147 stations from Shinnecock Inlet, New York, to Cape Hatteras, North Carolina.

The Northeast portion of the spring bottom trawl survey began on 13 April with Albatross IV south of Long Island continuing where Delaware II had terminated. During Part I, with Linda Despres as chief scientist, about 110 trawl stations were completed in the area from Long Island through Georges Bank before finishing on 27 April. This was the maiden voyage of Albatross IV following renovation in the shipyard. Part II, with Henry Jensen as chief scientist, began on 30 April and will cover the Gulf of Maine-Browns Bank area.

Interface components for various parameter sensors (position, course, speed, time, temperature, etc.) for the Automatic Data Logger were installed aboard Albatross IV by Patrick Twohig and James Crossen prior to Part I of the bottom trawl survey and proved successful during field operations during the survey.

Thurston Burns of NEFC and Clayton Dixon (Environment Canada, Fisheries and Marine Service, St. Andrews, New Brunswick) were aboard the USSR R/V Noglicki from 19 April to 3 May participating in the International Herring Tagging Study. The Nogliki, a purse seiner, searched for herring concentrations from Hudson Canyon to Georges Bank and into the Gulf of Maine and finally located herring on Jeffreys Ledge where a successful set was made and nearly 11,000 fish were tagged.

Data processing and report preparation is now in progress for the completed portions of the spring bottom trawl survey. Equipment and supplies are being assembled and a sampling design is being developed for a scallop survey which will be conducted in May.

Recreational Fishery Investigation

During April samples of Atlantic mackerel, Scomber scombrus were collected from both recreational and commercial catches made in Virginia, Maryland, Delaware, and New Jersey waters. These samples will be analyzed to determine spawning time and mode, as well as, fecundity of the species in the Middle Atlantic Bight.

The creel survey of charter- and party-boats has been expanded to encompass ports from Maryland to New York, for the purpose of closely monitoring the recreational fisheries for Atlantic mackerel, Scomber scombrus; silver hake, Merluccius bilinearis; and Atlantic cod, Gadus morhua.

Age-Growth Investigation

Otoliths contained in the fish meal that was taken from the impounded USSR trawler, Taras Shevchenko, were sent to the Age Unit for identification to determine if the meal contained any prohibited species. Samples are presently being examined. Unculled samples are being obtained from sea scallop vessels landing in Woods Hole to determine the length and age composition of the apparently very dense beds of sea scallops that have developed near the Nantucket Shoals.

Fisheries Analysis and Biostatistics Investigations

During April, investigation personnel continued the assessment of surf clam populations in the Middle Atlantic Bight. Efforts were directed at integrating surf clam survey cruise data with information obtained from port sampling interviews and landings. Fred Serchuk, Sukwoo Chang, Emma Henderson, Otis Jackson Bill Callahan, and Steve Murawski participated in the data analysis, which will serve as a basis for the development of a fishery management plan for the surf clam and ocean quahog fisheries to be prepared by the Mid-Atlantic Fishery Management Council.

Estimation of the catch of river herring (alewives) aboard the seized USSR fishing trawler, Taras Shevchenko, was accomplished by Judy Brennan and Joan Palmer. Approximately 20 metric tons of alewives were landed by the vessel, an amount significantly above the allowable catch for this species.

Design of a sea scallop survey cruise planned for two weeks in May and two weeks in September, covering an area from Georges Bank to Cape Hatteras, was undertaken by Judy Brennan, Joan Palmer, Paul Wood, and Brad Brown. Emphasis was placed on developing a sampling scheme which considered both areal and sampling variation of scallops. Previous sea scallop surveys have been based only on sampling area and usually consisted of a grid pattern of stations.

Stock assessments of Div. 4VWX-SA5 pollock and SA5 haddock continued through April. Steve Clark, Thurston Burns, and Joan Palmer participated in these yearly population analyses.

Vaughn Anthony presented testimony on the biological assessment of the Atlantic herring, used in the Preliminary Fishery Management Plan, at a hearing conducted on 19-20 April in Peabody, Massachusetts. Investigation personnel assisted in the preparation of materials for this occasion.

Completion of a draft EIS/PMP for northern shrimp was accomplished in April by Steve Clark in cooperation with personnel from other state and federal agencies.

Mike Sissenwine and Emma Henderson continued review of the Hudson River Power Plant Impact in preparation for adjudicative hearings commencing in August 1977.

Fred Serchuk began preparing material for a red crab assessment to be used in the formulation of a fishery management plan to be prepared by the New England Fishery Management Council.

Two manuscripts were refereed for the editor of the Fishery Bulletin and one manuscript was refereed for the editor of the Transactions of the American Fisheries Society. Various investigation personnel assisted in these reviews.

Thurston Burns prepared a working paper for the ICNAF Assessments Subcommittee Meeting in Halifax during 19-29 April, summarizing the international herring tagging program to date.

Brad Brown, Steve Clark, Candy Cain, and Ralph Mayo helped coordinate and participated in the first session of training for the newly established NMFS program of foreign fishery observers. The session was held in Woods Hole during 29 March-8 April and eight observers were placed aboard USSR commercial fishing vessels from 11 to 29 April. The first observer data set is now being analyzed for coverage and modification and a second session of training is planned for May.

The major statistics output for April was the preparation of the provision FAO STATLANT 21-A, summarising the total species catch in 1976 for the US by ICNAF/FAO area designations.

Meetings, Talks, Visitors, Publicity

Mike Sissenwine attended the 18-29 April 1977 Assessments Subcommittee Meeting of ICNAF held in Halifax, Nova Scotia, and also participated in a workshop on compensation in fish copulation and power plant impact held in Ann Arbor, Michigan on 4-5 April. Present at the Ann Arbor meeting were scientists from EPA, Oak Ridge National Laboratory, NMFS, and the National Power Plant Team (Fish and Wildlife Service).

Steve Clark presented a paper entitled "An Assessment of the Northern Shrimp Resource of the Gulf of Maine" by S. Clark and V. Anthony, and Steve Murawski presented his work on the weakfish fishery in the Mid-Atlantic, at the Northeast Fish and Wildlife Conference held in Boston, Massachusetts, on 3-6 April.

Vaughn Anthony attended the first meeting of the Statistical and Scientific Committee of the Mid-Atlantic Fishery Management Council held in Baltimore on 5 April.

Eugene Heyerdahl attended a summary workshop on the BLM Georges Bank Environmental Studies program held on the University of Rhode Island Campus on 4 April.

Emory Anderson attended a meeting of the Groundfish Plan Review Committee of the New England Fishery Management Council in Peabody, Massachusetts, on 1 April to discuss the cod assessment.

Fred Nichy attended a bluefin tuna workshop held in the American Museum of Natural History in New York City (a wonderful meeting place). Otoliths and stained vertebrae methods of aging tuna were compared and papers were presented on the aging of tuna.

Stuart Wilk attended a meeting at Sandy Hook to discuss the NEFC/SEFC/MESA/NYU Interpretive Report on Heavy Metals in Fish Tissues.

MARINE ECOSYSTEMS DIVISION

Larval Physiology Investigation

Data analyses, statistical relationships, and computer plotting have been completed for standard length-dry weight relationships of six species of larval fishes reared in the laboratory during the period from hatching to metamorphosis. An experiment monitoring the in situ growth and survival of laboratory-produced winter flounder larvae is currently in progress in a Narragansett Bay estuary using a controlled environmental chamber. Yellowtail flounder adults are presently under hormone induction to produce embryos and resultant larvae for an early May cruise in the New York Bight area to conduct in situ shipboard bioassay studies of larval feeding abilities.

The DNA, RNA, and protein content of winter flounder eggs and larvae was followed for a period of 21 days after hatching at 8°C. DNA levels showed the greatest change increasing more than 10 times prior to hatching (day 10). RNA showed a gradual increase (ca. 24%). Protein remained essentially constant until hatching when a 20% decrease was observed. The ratio of RNA to DNA decreased from 69 one day after spawning to 4.6 at hatching. Nine days after hatching larvae deprived of food had a RNA/DNA ratio of 2 and contained 26% less DNA, 50% less RNA, and 35% less protein per individual, than fed larvae which had a RNA/DNA ratio of 3.

Oceanography Investigation

Recovery of the current-meter array in the Northeast Channel has occupied much of the time of members of the investigation this month. The instruments (three current meters on each of three moorings) were deployed in September 1976 across the channel just inside the sill, to monitor deep flow into and out of the Gulf of Maine. The second setting of instruments, mooring gear, and deck equipment was loaded on Albatross IV when she arrived in Woods Hole. A good deal of time was spent getting the STD and hydrographic equipment set up properly in the new layout. Ten minutes before sailing on 7 April the A/C power supply to the bridge blew out, and on Friday the 8th the cruise was canceled when it became apparent the ship would not sail before the following Wednesday. Through NOAA's Office of Fleet Operations, the NOS ship George B. Kelez was provided for the weekend of 14-17 April. George Tupper of the WHOI Buoy Group was hired as chief scientist as neither W. R. Wright nor Ron Schlitz was available, and John Vermersch of WHOI, who is under contract to supervise the work, was on leave. Kelez succeeded in recovering one complete mooring; another was located and released but did not come to the surface, and the third was not located at all. Under the circumstances Mr. Tupper decided not to set any of the new instruments. On Monday, 18 April, arrangements were made to charter the 65-ft tug Whitefoot to try to recover the two remaining moorings, and the vessel sailed 19 April, returning the 23rd. The mooring Kelez missed was recovered intact but efforts to drag up the other were unsuccessful although its position was precisely determined.

Albatross IV will try to recover the final mooring by trawling the weekend of 29 April; if that fails, another attempt will be made early in June when a hydrographic cruise is scheduled. The second array of instruments will be deployed at that time. In the meantime the six meters that were recovered have been sent to the Physical Oceanography Laboratory at Nova University, under contract for reconditioning and preliminary processing of data. The releases are being reconditioned in-house.

Work on historical data in Great South Channel continues: about half the observations have been plotted, month by month, in both vertical sections and T/S diagrams. A simple program for calculating density (Sigma-t) from temperature and salinity data has been written and will be used in the construction of density sections. A progress report on the hydrography of the Northeast Channel has been prepared by Lt. R. J. Pawlowski. In addition, he has written a report on the March XBT section from Portland, Maine, to Yarmouth, Nova Scotia, and it has been distributed. Salinity samples from the larval herring cruise on Mt. Mitchell in February were run in the laboratory. Horizontal sections of surface and bottom salinity, and temperatures at standard depths have been drawn. Drafting of vertical sections from past cruises continues; Albatross IV Cruise No. 76-05, August 1976, is presently being worked up.

Ecosystem Dynamics Investigation

Dave Potter, George Bolz, and Pat Carter have completed processing the backlog of chlorophyll samples from all but one cruise (R/V Researcher samples just received from Sandy Hook on 26 April). Pat has also calculated chlorophyll concentrations (mg/m^3) for all depths at each station and nearly finished plotting results for all stations. In addition to supervising work on chlorophyll analysis, Ed Cohen has continued literature search on zooplankton grazing on phytoplankton as well as ecosystem modeling in general. He attended a workshop in Seattle (18-23 April) on modeling primary and secondary production and will circulate a report next month. Ed Cohen and Mike Pennington have continued to work on the trawl survey data with emphasis on the problems of estimating availability coefficients, and effects of diel variations in catch rate on variance estimates. In addition, they have begun an analysis of feeding models and the problem of estimating daily ration sizes based on gut content data.

Recruitment Processes

The third planning meeting was held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia on 5 April 1977 to discuss the proposed US-Canadian larval herring patch experiment. It was the consensus of both the Canadian and US scientists to postpone the full-scale study until October 1978, when schedules would be less busy, and to allow time to do some preliminary experiments this fall. Greg Lough served as chairman of the meeting and circulated minutes of the meeting last week. Two trips were made by Lough this month to confer with Hal Petersen and Bob Marak (MARMAP) on computer processing of ICNAF Larval Herring 505 data, 1971-1977, for the Poland meeting in June.

A coding format was prepared for larval herring gut analysis and condition factors. Records for Albatross IV Cruise No. 76-1 have been transcribed and are ready for keypunching. Dr. Lough compiled a bibliography on herring larvae in the Northwest Atlantic (85 references) for Vaughn Anthony in preparation for the legal hearing last week. George Bolz participated in the spring groundfish survey to collect plankton.

Plankton Ecology Investigation

Sorting is continuing on zooplankton samples collected in autumn from Georges Bank. A 5-yr time series (1971-1975) will be completed by the first week in May. Initial results indicate that of the 21 major taxonomic groups in the samples only three were dominant--copepods, euphausids, and chaetognaths. The copepod Centropages typicus was the dominant species in each of the years, followed by Para-Pseudocalanus minutus and Calanus finmarchicus. The three species are important in the energy budget of Georges Bank. C. typicus and C. finmarchicus are large copepods that constitute an important food of juvenile and adult herring and mackerel. Para-Pseudocalanus represents a mixture of two of the smaller species; together they represent the principal food of larval herring on Georges Bank. Studies are underway to determine the contribution of the three species to the growth of herring and mackerel stocks. In addition to the species analysis, total volumes of zooplankton are being compared among five geographical areas between Cape Hatteras and Nova Scotia. The year 1972 appears anomalous;

volumes are significantly higher than for the other 4-yr of the survey. Subsequent analyses will include examinations for possible relationships with recruitment strength of several fish species.

Assistance is being given to the MARMAP Field Group in the entering and auditing of ichthyoplankton and zooplankton data to be presented at the Larval Herring Workshop in Szczecin.

Ichthyoplankton Investigation

We participated in two Resource Assessment surveys of Georges Bank and the Gulf of Maine in collaboration with Poland and GDR. The spring survey from Cape Hatteras to Nova Scotia has been completed as far north as the Gulf of Maine. Most of the samples taken on the first leg of the spring survey, the Middle Atlantic Bight, have been sorted. Sand lance, Ammodytes americanus, continued to be the predominant species in the plankton, followed by cod, Gadus morhua, and pollock, Pollachius virens. The spring survey of the Middle Atlantic Bight was followed closely by an ichthyoplankton survey, 12-29 April. Gross observations of the samples indicate that Atlantic mackerel, Scomber scombrus, began spawning the second week in April. Eggs were initially collected off the eastern shore of Virginia. They continued to occur north and east to Block Island, where the survey ended.

Benthic Dynamics Investigation

Compilation of the benthic invertebrate data base pertaining to the Gulf of Maine-Georges Bank region was continued throughout the month. Special effort was given to assembling the organic carbon content for bottom sediments at sampling stations where quantitative grab samples were obtained. Except for minor additions, this task is completed. A second major aspect of the data-base compilation was the updating of taxonomic entries. This is rather involved and several additional weeks of work will be required to complete this task.

The 1969-1972 food-habits data base for Gadiformes has been thoroughly checked and put on tape. Computer analysis is now in progress; summing and listing the data by predator, prey, year, predator sex, and geographical area. This listing is expected to be completed within a few weeks. A review of the literature on methods used for estimating gut evacuation rates and calculating the daily ration for fish has been completed. The purpose of this review was to identify the factors which must be considered in attempting to convert the food habits data collected by NEFC into estimates of the daily ration for selected fish species. Preparations have been made for the collection of fish stomach samples on the northern leg of the spring (1977) groundfish cruise.

Apex Predators Investigation

During last March and early April, Jack Casey, Chuck Stillwell, Wes Pratt and Larry Lindgren participated in a longline cruise aboard the R/V Wieczno. Objectives were: to tag pelagic sharks for migrations and age and growth studies; to conduct internal examinations of sharks and other apex predators for food and reproduction studies and to sample two eddy systems for the possible occurrence of oil from the Argo Merchant spill. Nineteen

longline sets resulted in a total catch of 255 fish (10 species) of which 190 were tagged, 49 were brought aboard for examination and 16 broke free at the rail. Makos were unusually abundant along the edge of the shelf east of Oregon Inlet and accounted for 96 of the 246 sharks hooked.

Examinations of stomach contents from 32 sharks and 6 teleosts showed cephalopods and a few species of teleosts were the principal food items. The principal squids observed were Loligo sp. and Illex sp. Mako sharks were feeding almost exclusively on small (30 + cm) bluefish. Examination of blue sharks for reproduction studies revealed that the skin of the females is twice as thick as that of the males. During mating the males inflict bite and slash marks on the females. The thickened skin of the females is very likely an adaptation that prevents serious injury to females during mating activity.

Neuston transects through two "Eddy" systems on the north and south boundaries of the Gulf Stream produced collections of tarlike balls in 13 of 20 tows made. Visual evidence of surface oil was not observed in either eddy. Two nightlighting stations off Cape Lookout and Oregon Inlet, North Carolina, resulted in dip net collections of larval fish representing 11 species including: flying fishes (Parexocetus brachypterus) and (Hirundichthys rondeleti), Atlantic saury (Scomberesox saurus), red goat fish, (Mullus auratus), striped mullet (Mugil cephalus), skipjack tuna (Euthynnus alletteratus), blueback herring (Alosa aestivalis), American sand lance (Ammodytes americanus), menhaden (Brevoortia tyrannus), chub mackerel (Scomber japonicus), and hake (Urophycis sp.).

Three tag recoveries from blue sharks tagged by Stillwell (1) and cooperating sportsmen (2) were returned to the laboratory from the Fisheries Experimental Station at Kanagawa-Ken, Japan. The tags were recovered in the Northwest Atlantic by the tuna longliner, Sumiyoshi Maru No. 7.

Meetings, Talks, Visitors, Publicity

W. R. Wright spoke on the Hydrography of the Northeast Channel and the Deep Basins of the Gulf of Maine at the Gulf of Maine Workshop at WHOI (12-14 April). An abstract of the papers presented will be circulated among the participants. Dr. Wright is also preparing a talk on the Slope Water for the Warm Core Ring Workshop to be convened at WHOI in May.

Ed Cohen attended a workshop in Seattle (18-23 April) on Modeling Primary and Secondary Production and will circulate a report next month.

Marv Grosslein, Redwood Wright, Ron Schlitz, and Greg Lough attended a planning session on the proposed Larval Herring Patch Study in Halifax on 5 April (see comments above). Dr. Grosslein presented a talk on Scope of On-Going Plankton Work by Northeast Fisheries Center at the Informal Workshop on the Physical Oceanography of the Gulf of Maine and Adjacent Seas at WHOI, 12-14 April. Abstracts of the presentations probably will be circulated at a later date by Dr. Beardsley of WHOI.

Marv Grosslein (and Mike Sissenwine of Assessment Division) attended the ICNAF Assessment Subcommittee meetings in Halifax, 18-23 April. Although we were only observers, we presented progress reports on herring research in 1976. Dr. Grosslein also attended two meetings (11 and 26 April) with members of the Science and Statistical Committee for the New England Fishery Management Council; discussions involved management plans for herring, scallops, and groundfish.

Dave Potter attended two meetings on renovation of the aquarium in Woods Hole.

Tom McKenney attended a pre-cruise meeting at Milford, Connecticut, on 20 April to plan for the DWD 106 cruise scheduled for July.

Ray Bowman was on the southern leg of the groundfish survey (R/V Delaware II) through 8 April.

Rich Langton attended an introductory course in Fortran programming from 27-29 April at the Boston Region Training Center.

Roland Wigley was in Washington, D.C., during the week of 18 April as a member of an interdepartmental technical evaluation committee under the auspices of the Department of the Interior.

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

Technical Report

Dave Potter completed an in-house technical report on "Some observations on plankton net cod end types and subsequent larval fish condition."

Manuscripts

Kendall, A. W. 1976. Predorsal and associated bones in serranid and grammistid fishes. Bull. Mar. Sci. 26(4): 585-591 (P).

RESOURCE UTILIZATION DIVISION

Resources Development and Improvement - Shellfish

Meat yields (11%) and incidence of shell (0.18%) were obtained for blue crabs processed by a new roller extraction method that appears promising for the industry.

Meat of red crabs, for which the roller extraction process has already been satisfactorily demonstrated, has been formed into simulated lump meat and found to be quite acceptable after 14 days of storage on ice, receiving an average score of 6.8 on a 9-point hedonic scale. The process is apparently also acceptable microbiologically having a standard plate count of only $3x10^3$/g after the storage period.

Squid mantles, that were cut into strips and breaded to simulate the popular clam strips which are now in short supply, are highly acceptable in organoleptic quality after 2 mo of storage at $-29^{\circ}C$.

Resources Development and Improvement - Finfish

With the termination of one experiment in our study to determine the effect of guaranteed grade A quality of seafoods on sales trends, we are now analyzing the data and preparing to conduct another experiment.

Analysis of newly developed, prepared products (made from deboned fish flesh) that have been held frozen for up to 8 mo are still highly acceptable, and collaborative marketing tests with industry have generated interest in buyers.

Product Safety and Standardization

Dr. Frederick King, an Associate Referee in collaborative testing for the Association of Official Analytical Chemists, had his report on the quantification of the seafood component in commercial seafood cocktail formulations accepted by the association.

Mr. John Ryan and Dr. King are presently collaborating with personnel from the US Department of Agriculture and FDA to arrive at a standard for frozen fish blocks made from deboned fish flesh.

Product Quality and Safety

During April, research into the possible presence of volatile N-nitrosamines in hot-smoked salmon and whitefish is continuing. Raw data from the analyses are submitted to a collaborating FDA laboratory as they are generated.

Southern New England Fisheries Development Program

Our investigation of the stability of the quality of frozen, deboned, whiting meat has established certain facts: (1) meat from the nape has significantly less fat than that from the tail; (2) meat from the nape is less stable than that from the tail with respect to texture which agrees with the theoretical direct relationship between fat content and textural stability, but it is more stable than that from the tail with respect to flavor which agrees with the theoretical inverse relationship between fat content and flavor stability; and (3) sodium erythorbate is an effective antioxidant from stabilizing the flavor of fatty meat. These facts appear to provide a basis for investigating the textural stabilization of lean meat by the addition of fat that is stabilized against oxidative rancidity by prior hydrogenation or by the addition of 0.15 - 0.30% sodium erythorbate.

A study involving us with personnel from USDOC inspection and foreign suppliers of fillet blocks has been initiated in order to arrive at a basis for promulgating a standard for "laminated blocks." A laminated block is one which contains a mixture of fillets and an amount of deboned flesh equivalent to that which can be recovered from fish frames, v-cuts, and skin by deboning machinery.

A new analytical instrument, the LKB Tacophor (employing the isotachophoresis principle), has been found to produce unique reproducible patterns from the sarcoplasmic proteins of each of different species of fish. The analysis requires considerably less time than is required by other procedures, and it appears to have the potential for identifying species even after some denaturation of the proteins.

We are presently trying to isolate an enzyme, present in gadoid species, that reportedly splits trimethylamine oxide, also present in gadoids, resulting in the formation of formaldehyde, a compound known to denature proteins.

Resources Development and Improvement - Engineering

We are still testing the prototype of a Spanish squid processing machine. The beheading and eviscerating functions perform satisfactorily, but removal of either the fins, pen, or skin is not, at this stage, satisfactory, and further

modifications are required. Removal of the skin is the critical function since this is the one that most requires mechanization if squid processing in the US is to realize its potential growth. Thus far, the applications of physical principles are most promising with the shearing action of a high-speed water stream appearing to be the most effective one.

Work is continuing on machines for uniformly distributing additives, in liquid form, to deboned fish flesh, for sorting catches of mixed species of fish, and for grading specific species of fish into size categories.

Arrangements were made for an August cruise aboard the Delaware II to examine dredge performance. This cruise will require the assistance of the Center's diving team, and meetings were held with them to prepare for the coordinated effort.

Final drawings and specifications for Laboratory renovations at Woods Hole were prepared.

Miscellaneous Activities

Messrs. John Early of the Torrey Research Station and Gerald Claude of Young's Seafoods, both from Aberdeen, Scotland, visited to discuss the NMFS centrifugal process for the mechanical recovery of crab meat -- a process that has been assimilated by the industry.

Mr. Henry Svehaug of the Key Electro Sonic Co. visited to discuss progress on a crab butchering machine under development in a collaborative effort between that company and this facility.

Dr. Vladimir Bykov and Ms. Irena Tsenker from the Central Fisheries Institute in Moscow visited us after attending the First International Chitin-Chitosan Conference in Boston. In discussions of mutual interest, the foreigners appeared to focus on radiation preservation of seafoods and on our approaches for stabilizing the quality of frozen minced fish flesh.

Other visitors included Mr. James Brooker of the USDOC Inspection Service to discuss coordination of current Codex Alimantarius projects; Messrs. Michael Smith and William Reigherd of the Arthur Treacher Fish & Chips Co. to discuss quality assurance in seafood processing; Mr. Charles Schwede of Notrus, Caracas, Venezuela, to discuss aquaculture; Mr. Ron Blumberg of Boston Consulting Group, Boston, to discuss "Deoxidant"; Mr. J. Felix Castillo, consultant from Montevideo, Uraguay, to discuss quality assurance of seafoods; Mr. Richard Nollman, student from the Boston University School of Journalism to learn about the USDOC Inspection Service and the quality standards prepared at this facility; Mr. William Tupman of Seamark Corp. to discuss the use of antioxidants to stabilize the flavor of frozen fillet blocks; Mr. James Orphanos of the Massachusetts Department of Environmental Quality Engineering for assistance in the organoleptic evaluation of shellfish taken from areas affected by oil spills.

Technical assistance was provided Mr. Rency Spaulding, Kalve-Kone, Hawaii, on spiny-lobster potting; Mr. William Murphy, Fishery Reporting Specialist, Newport, Rhode Island, on trawls and net mending; Mr. Fred Leber, Washington, D.C., and Manchester, Massachusetts, on trawling and refrigeration; Mr. Jim Olean, Gloucester, Massachusetts, on gill nets; and Mr. A. H. Karlsen, President of O. Musterd and Son, Auburn, New York on longlining.

Mr. Robert Learson attended the First International Conference on Chitin-Chitosan in Boston, held 11-13 April.

Mr. Robert Learson and Dr. Soliman Shenouda participated in the Second Annual Tropical and Subtropical Fisheries Technological Conference in Biloxi, Mississippi, during 17-20 April. Both presented papers and Mr. Learson also chaired one of the sessions.

Mr. John Kaylor met with the Northeast Regional Directors of NMFS and FDA regarding the legal aspects of mercury in swordfish.

Mr. Joseph Mendelsohn met with scientists of the consultant firm Foster D. Snell, Inc., to review their progress under a research contract with the NMFS.

Mr. John Ryan and Dr. Frederick King participated in an industry/government workshop convened by the National Fisheries Institute in Boston on 31 March to prepare US comments on Codex Alimentarius drafts of proposed standards for certain frozen seafood products.

Dr. Soliman Shenouda particpated in a seminar on proteins at MIT. Dr. Shenouda presented a paper on denaturation and stabilization of fish proteins during frozen storage.

Laboratory personnel undergoing training were Mr. Vincent Ampola, a 3-day course in "creative problem solving"; and Ms. Jean Knight, Ms. Judi Krzynowek, and Ms. Dale Yeager attended a course on "The mature woman in the federal work force".

Dr. Frederick King gave a seminar on utilization of blue whiting in Great Britain on 1 April to Laboratory staff and invited guests.

Outside personnel receiving training in the Laboratory are Mr. Peter Egan, a University of Massachusetts sophomore on a 2-mo training tour, and Ms. Melissa Bonnie and Mr. Wayne Peterson, both seniors at Manchester, Massachusetts High School, are on a 6-wk training tour.

Manuscripts

Green, J. H., and J. D. Kaylor. 1977. Variations in the microbial log reduction curves of irradiated cod fillets, shrimp, and their respective homogenates. Applied and Environmental Biology, Vol. 3, No. 2, p. 323-327. (P).

Mendelsohn, J. M., T. J. Connors, and J. G. Callan. 1977. A machine for heading and eviscerating small fish. Mar. Fish. Rev., Vol. 39, No. 2. (P).

King, F. J. 1977. Past, present and future uses of minced fish in the United States, p. 78-81. In J. N. Keay (editor), Proceedings of a Conference on the Production and Utilization of Mechanically Recovered Fish Flesh (Minced Fish), 7 and 8 April 1976, Torry Research Station, Ministry of Agriculture, Fisheries and Food, Aberdeen, Scotland. (P).

King, F. J., and J. J. Ryan. 1977. Development of a color measuring system for minced fish blocks. Mar. Fish. Rev., 32(2): 18-23. (P).

Ryan, J. J., and F. J. King. 1977. Proposed United States General Grade Standards for Fish Fillets. Federal Register, 42(40): 11849, 1 March 1977. (P).

Ryan, J. J. 1977. Instructions for grading whole and dressed fish fishery products - Inspection manual part II grading. (P).

King, F. J., and P. J. Regan. 1977. Determination of amount of seafood in seafood cocktails: A collaborative study. J. Association Official Analytical Chemists. (A).

King, F. J., and J. J. Ryan. 1977. United States Interim Standards for Grades of Frozen Minced Fish Blocks. Federal Register. (S).
King, F. J. 1977. Determination of added polyphosphate. Technical Notes, NMFS, Seafood Quality and Inspection Division. (S).
King, F. J. 1977. Determination of percent of thaw drip in fish fillet blocks. Technical Notes, NMFS, Seafood Quality and Inspection Division. (S).
Licciardello, J. J., E. M. Ravesi, and M. G. Allsup. 1977. Oxidation gradient in frozen minced whiting. Quick Frozen Foods. (S).

DIVISION OF ENVIRONMENTAL ASSESSMENT

Behavior of Marine Fishes and Invertebrates Investigation

Personnel continued laboratory experiments concerned with the response of young bluefish to thermoclines and temperature changes. Data analyses resulting from these experiments are continuing. Principal investigators are working on several manuscripts and the data analyses necessary for these papers.

Ongoing in situ field studies at Fire Island have continued. These investigations are designed to determine the seasonal changes in behavior which occur with both increasing water temperatures and photoperiod. Investigators are working with juvenile winter flounder and other important juvenile recreational species.

Biological Oceanography of Stressed Environments Investigation

Following the Advance II cruise in the New York Bight and over Georges Bank, personnel of the investigation continued work up of C_{14} samples, nutrient samples, and salinity samples collected at stations occupied during the cruise. Speciation of phytoplankton species was initiated; the taxonomic breakdown of phytoplankton populations will be important in future data analyses. Preliminary results of the Georges Bank cruise indicate that the Bank was unstratified and relatively productive. Data indicate an increase in water column respiration over the southeastern half of Georges Bank. A substantial cruise report was prepared for submission to the Center Directorate and NOS.

Personnel began preparations for the Synoptic Investigation of Nutrient Cycling (SINC) cruise which will be conducted in May. Investigation personnel will be measuring water column respiration at noon and midnight as well as determining the release of dissolved organic matter (DOM) resulting from primary productivity. Samples for dissolved organic carbon will also be taken. This cruise is a cooperative effort and Dr. Tom Malone of the Lamont-Doherty Laboratories will be measuring primary productivity, chlorophyll and standing stocks of phytoplankton species. Dr. Chris Garside, Bigelow Laboratory will also be working with Drs. Malone and Thomas. Dr. Carol Litchfield, Rutgers University, will be aboard the cruise to study heterotrophic uptake in bacteria and ATP in the water column and sediments.

Dr. Thomas and personnel of the investigation are preparing a chapter for the MESA professional paper concerned with anoxia which developed in the New York Bight during the summer of 1976. Their work is principally concerned with the maintenance of anoxic conditions off the New Jersey coast during the summer.

COMAP Investigation

From 11 through 16 April, Larry Davis, Fred Lux,and Warren Handwork conducted a groundfish and plankton survey covering 18 stations in the inshore waters of Massachusetts and Cape Cod Bays. A one-half scale No. 35 Yankee trawl was used for fishing, with paired 61-cm bongo nets and a 0.5 x 1-m neuston net used for plankton. Eighteen species of fish were sampled and, as in the mid-March cruise on the same grounds, winter flounder was the most plentiful species and was taken at every station. Although total weight and number of species were generally lower than in April 1976, catches at several stations produced moderately good numbers of juvenile Atlantic herring, Atlantic cod, haddock, red hake, yellowtail flounder, sand flounder, and winter flounder. Cursory examination of the plankton catches indicates that some well advanced Atlantic herring larvae were collected at several stations.

During the month, final plans were settled for another season of coordinated sampling for lobster larvae abundance in Cape Cod and Buzzards Bays. This cooperative program involving investigators from state, federal, and private sectors is an outgrowth of separate investigations at the Pilgrim Power Plant at Plymouth, Massachusetts, and the Canal Power Plant on the Cape Cod Canal. Weekly sampling by four field parties will begin the first week in May and will continue into August. Results of 1976 studies revealed the transport of significant numbers of lobster larvae from Buzzards Bay into Cape Cod Canal and Cape Cod Bay.

A sonic detection package, put together by an electronics firm for potential use in locating strings of lost lobster and crab traps, was tested in Vineyard Sound by Fred Lux, Pat Twohig, and Roger Clifford aboard the Phalarope on 20 April. Work on this gear was done by NEFC personnel in cooperation with Warren Rathjen of the New England Fisheries Development Program at Gloucester.

A controversy has arisen over the maximum seawater discharge temperature allowable at the Brayton Point Power Plant on Mt. Hope Bay at Somerset, Massachusetts. Discussions at recent meetings of the power plant Technical Committee have centered on the review of biological and physical data from past operations at a permitted temperature of 95°F. The power company has asked EPA for permission to raise the temperature initially to 96°F. and ultimately to more than 100°F. Members of the Technical Committee (NEFC members are George Kelly and Randy Smith) are debating the wisdom of permitting discharge temperatures above 90°F. as a dangerous precedent that might have serious repercussions at this site and others in the future.

Coastal Assessment and Environmental Monitoring, South Investigation

During April Robert Reid and Dave Radosh completed preparation of the final report on the US Navy New London Dredging Project. It is a 332-pg document on the physical, chemical, and biological impacts of dredging and spoil disposal in the vicinity of the Thames River estuary (Connecticut), between June 1974 and September 1976. It has been submitted to the Navy and the Interagency Scientific Advisory Subcommittee on Ocean Dredging and Spoiling (ISASODS) and is available as Division of Environmental Assessment (DEA) Informal Report #2.

Frank Steimle, coordinator of last year's oxygen depletion phenomenon investigation by the Center, has completed a compilation of all hydrographic data, collected from 40 cruises in the area during the problem. It is available as DEA Informal Report #4, prior to its possible publication as a NOAA Technical Report. With Dr. Carl Sindermann, he also assisted in preparing a report to the International Council for the Exploration of the Sea (ICES) on the oxygen depletion phenomenon and is preparing contributions to a comprehensive NMFS-MESA publication on the subject.

We have continued our literature search for material on the productivity of Georges Bank benthic organisms as our contribution to the Georges Bank Energy Budget Project. Preliminary results, thus far, indicate there is very sparse to nonexistent data on nonestuarine western North Atlantic benthic productivity. We may be forced to make approximations from the more extensive data base for related European species.

Dave Radosh and Frank Steimle assisted in the preparation of a "Red Flag" report on reported fin- and shellfish mortalities off central New Jersey during early March 1977. The reported deaths of surf clams, blue crabs, tautogs, and other species are thought to be mortalities which are not unusual during severe winters, but they may also represent an additional impact of last winter's extremely low temperature on latent impacts from last fall's bottom water oxygen depletion phenomenon. A complete report on the observations and investigative efforts have been prepared as DEA Informal Report #3.

Ann Frame attended a workshop, in Narragansett, Rhode Island, on the use of the Density-Gradient Column to facilitate sorting plankton and benthic samples. It was generally agreed, after some trials, that the technique is not feasible for benthic samples. She has also completed drafts of two manuscripts on the taxonomy of several new polychaete and amphipod species found in the New York Bight in recent collections.

Work continued on sorting and identifying benthic samples collected in Block Island Sound as part of our baseline surveys of coastal benthic populations. Nine stations were sampled last February and September; the February samples have been completed and two of September stations are complete.

Progress is being made on draft manuscripts for two of four special benthic studies data reports in the New York Bight: the nested grid sewage sludge and the outer continental shelf benthic studies. Final drafts are expected by next month.

Ms. Leslie Rogers assisted Dr. Pearce in the preparation of a microconstituent survey paper for ICES and in the distribution of heavy metal intercalibration samples for 1977 ICES tests.

Dr. Pearce, Ms. Rogers, and Ms. Mabel Trafford, Librarian, Sandy Hook Laboratory, solicited reports from investigators working within the field of benthic ecology on both the east and west coasts of the United States. These reports were combined as a report to the ICES Shellfish and Benthos Committe. A substantial bibliography on benthic studies was also submitted to the Committee through its Chairman, Dr. James Stewart, Canada.

Environmental Chemistry Investigation

Personnel assigned to the Division have recently received eight seawater samples and standards which are to be used in an ICES intercalibration exercise designed to compare the results of seawater analyses for heavy metals that are conducted by different laboratories in the United States, Great Britain and Europe. Mr. Richard Greig is analyzing one of the sets of standard samples and Dr. Pearce has distributed the other samples to cooperating investigators on both the east and west coasts of the United States.

The necessary equipment and supplies were either fabricated or purchased for a cruise 11-16 May in the New York Bight intended primarily to collect mackerel, Scomber scombrus, eggs for genetics work. Environmental Chemistry personnel will be responsible for collecting microlayer and surface water samples and egg samples that will be analyzed for organics and heavy metals by outside contractors. This work is being done under contract to the MESA, New York Bight Project office.

An experiment was initiated this month to determine the relative uptake of silver, cadmium, and copper by three mollusks; oysters, surf clams, and ocean quahogs. These mollusks are being exposed simultaneously to 0, 10, and 20 ppb of each of the three metals; uptake measurements will be made after 2, 4, and 6 wk of exposure to the metals.

A new instrument (Anodic Stripping Polarograph) intended primarily for measuring metals concentrations in seawater was purchased for our use by the Physiological Effects of Pollutant Stress Investigation so that we can analyze seawater samples used in the exposure of organisms to various metals. Vincent Zdanowicz spent several days with Ruth Waldhauer, Sandy Hook Laboratory, who has had experience with the instrument to learn the techniques of using this equipment for seawater analyses.

Physiological Effects of Pollutant Stress Investigation

Physioecology Subtask - This month we continued experiments to determine the effects of heavy metals on both the embryos and larvae of the American oyster, Crassostrea virginica.

In one study we are attempting to determine the effects of the metals copper, mercury, silver, and zinc, both singly and in combination, on developing oyster embryos at 20, 25, and 30°C. This month we completed two tests designed to determine the toxicity of Hg-Ag and Cu-Zn mixtures on embryos at equitoxic concentrations at 25°C, but at different metal ratios. The first test failed because of high larval abnormality in control cultures. The second was successful and the results indicated that the toxicity of these two mixtures was not markedly changed in terms of additivity when different ratios of metals in mixture were used. We are now repeating this phase of the study.

Data analysis from two February tests which measured the toxicity to oyster embryos of three metals (Cu, Zn, and Hg) as the nitrate salts indicated that the toxicity was similar to the chloride salts of these same metals.

A third test was performed this month to determine the effect of salinity and temperature on the toxicity of silver to embryos of the American oyster. The results of this test did not duplicate very well those of the first two tests performed in February. More testing is necessary.

In addition, we are still attempting to determine the feasibility of flow-through bioassay systems for determining metal toxicity to bivalve larvae. This month we performed two tests in such a system using oyster larvae exposed to mercury. In the first test, larval survival and growth was poor in both the flow-through system and in the static system used as a control. The second test looks promising, but samples have yet to be analyzed.

Physiological Effects Subtask - During the past four months we have been examining some effects of mercury on 180 winter flounder, Pseudopleuronectes americanus. These fish were exposed to 10 and 20 parts per billion of the metal in a flow-through, proportional dilution system for 60 days. At that time a portion (60 fish) were examined while the remainder (120 fish) were left in flowing mercury-free seawater. After 15 additional days, 60 more fish were examined and after 60 days in mercury-free water the final 60 fish were tested. After 60 days exposure a highly significant elevation in gill-tissue oxygen consumption was measured in fish exposed to both 10 and 20 ppb Hg. This elevation continued throughout the recovery period in clean water and may indicate some permanant or persistent metabolic damage in these flounder.

Hematological studies were also conducted on the same flounder. These studies show that most of the parameters examined were altered by exposure to mercury (Table 1). After 15 days in clean water these parameters were still changing. After 60 days, however, a complete recovery was accomplished by flounder exposed to 10 ppb, and some recovery was evidenced in the 20 ppb group. Other authors have reported a normal drop in hematocrit and hemoglobin in late winter. It has also been reported that flounder became anemic upon prolonged captivity. Either or both of these factors may be involved in the drop in hematocrit and hemoglobin in the controls from the 60-day recovery group. Because of such normal variations, each group has been compared to its own controls. Additional hematological measurements, including plasma sodium, potassium, calcium, and osmolality are yet to be completed.

Biochemical Effects Subtask - Enzyme analyses were performed on liver and kidney samples from flounder that had been exposed to mercury (20 ppb) for 60 days, then placed in uncontaminated seawater for either 15 or 60 days. All data have been worked up and tabulated, with the exception of the last of the kidney samples from the 60-day clearance study. The overall picture, judging mainly by carbohydrate metabolism, is of partial recovery after the 15-day clearance, and some lingering stress signals after 60 days. The latter observation was overlaid by a general metabolic increase (in liver; kidney analyses are not yet completed), both control and exposed animals showing higher enzyme activities than were found in two prior groups (0- and 15-day clearance). This phenomenon probably reflects the seasonal "gearing-up" to replenish tissues depleted by spawning and fasting, and may also be temperature-related.

Kidney analyses were also completed for mercury-exposed striped bass (60 days, 10 ppb) and for the teleost specimens collected during the oil-spill cruise of the Polish research vessel Wieczno. The striper data show no significant difference between control and exposed animals, a finding that agrees with earlier work here on metal-exposed striped bass and another anadromous fish, coho salmon. The "oil-spill" data have yet to be worked up. These kidney samples were of questionable consistency: many packages were not tightly wrapped, leaving air next to the tissue; and some samples had scales, clotted blood, and other foreign material. Scallop tissues brought back from the Delaware II cruise to the oil spill area will be looked at in the near future.

Anaerobic Bacteriology/Metabolism Subtask - The major activities of the past month have centered on manuscript development on past activities. The final draft of the hemolytic activity of VP strains has been completed. A variable response by the VP strains was observed on the five animal bloods employed. The activity on bovine blood agar most closely parallels that of the Kanagawa designation of the VP strains employed. (The Kanagawa phenomenon related to the pathogenicity of the strains). Work is continuing on the development of manuscripts on New York Bight microbiology and C. perfringens in marine sediments.

A cooperative study with Walter Blogoslawski of the Mariculture task on the inactivation of botulinum type E toxin by ozone has been completed. Results show that ozone can effectively inactivate the toxin with practical concentrations.

Table 1. Hematological Effects in Winter Flounder Exposed to Mercury for 60 days with Subsequent Period of Recovery in Clean Water.

		Hematocrit (%)	Hemoglobin (g %)	RBC (10^6 cells/mm^3)	MCV (μ^3/cell)	MCH (pg/cell)	MCHC (g %)	N
Controls:	60-day (E)[1]	37 ± 1.6	6.6 ± .29	3.01 ± .12	124 ± 3.9	22.4 ± 1.0	18.2 ± .75	16
	15-day (R)	35 ± 2.5	6.6 ± .10	2.91 ± .18	119 ± 4.6	23.1 ± .7	19.5 ± .77	9
	60-day (R)	31 ± 1.5	5.4 ± .27	2.52 ± .15	121 ± 4.0	21.5 ± .7	18.1 ± .42	15
10 ppb:	60-day (E)	23 ± 1.6**	3.6 ± .28**	1.68 ± .08**	134 ± 6.0	21.1 ± 1.0	16.1 ± .82	15
	15-day (R)	23 ± 1.2**	2.9 ± .26**	1.74 ± .13**	140 ± 9.3	17.4 ± 1.1**	13.8 ± 1.14**	15
	60-day (R)	30 ± 1.2	5.0 ± .18	2.23 ± .08	137 ± 7.7	22.7 ± .5	16.9 ± .92	14
20 ppb:	60-day (E)	23 ± 1.4**	3.4 ± .26**	2.00 ± .12**	158 ± 7.7**	22.8 ± .7	14.9 ± .75*	18
	15-day (R)	25 ± 1.0**	3.4 ± .28**	1.62 ± .10**	163 ± 10.2*	20.9 ± .8	13.4 ± .87**	18
	60-day (R)	28 ± 1.7	4.3 ± .17*	2.23 ± .07**	167 ± 14.4*	24.8 ± 1.4	15.6 ± 1.02	16

* Differs significantly from controls at .01 level.
** Differs significantly from controls at .001 level.
1 (E) Exposure group; (R) Recovery group.

Meetings, Talks, Visitors, Publicity

The Physiological Effects of Pollutant Stress Investigation hosted 90 students from the University of Connecticut on 24 and 25 March.

John Graikoski participated in an annual Rotary Club sponsored Career Day at the Amity Regional High School. He talked on careers in microbiology. This program is popular with the students, since it gives them the opportunity to learn "first hand" the background needs and activities of the various professional careers.

Personnel attached to the Exxon Research Laboratories presented a paper based on cooperative research done by Exxon and Sandy Hook Laboratory at the 5th Conference on the Prevention, Behavior, Control and Clean-up of Oil Pollution, held in New Orleans. The paper was concerned with hydrocarbons in the New York Harbor waters and was entitled "Extractable organics and nonvolatile hydrocarbons in New York Harbor waters".

Mr. Bori Olla, Leader, Behavior Investigation, participated in a seminar at Florida State University, Tallahassee, and in a seminar at the EPA Biological Laboratory, Gulf Breeze, Florida. The seminars were concerned with ongoing studies of the behavior of marine finfish, especially the response capabilities of marine fish to natural and man induced stress.

Dr. John Pearce, Division Chief, Division of Environmental Assessment, spoke to the Manasquan Fishing Club. Dr. Pearce's talk emphasized environmental problems in the Middle Atlantic Bight and Center research which is concerned with various environmental problems ranging from ocean dumping to bulkheading within estuarine environments.

Dr. Pearce participated in the first meeting of the Science and Systematics (S&S) Committee to the Mid-Atlantic Fishery Management Council. The meeting was held at Baltimore Airport and was the first time that the members of the S&S Committee have met together. An overview was presented by Dr. Eugene Cronin and an attempt was made to outline the future activities of the S&S Committee.

On 20 April, personnel of the Division of Environmental Assessment, including John Pearce, Frank Steimle, James Thomas, Richard Greig, Tony Calabrese, Fred Thurberg, and George Kelly, met with personnel from other Divisions to discuss the Ocean Pulse program, especially as it relates to ongoing studies at the Deepwater Dumpsite (DWD) 106. They day-long meeting resulted in defining certain steps which must be taken in planning for the upcoming DWD 106 cruise in July, as well as implementing Ocean Pulse studies at other stations.

On 26 April, Mr. Richard Greig and Dr. John Pearce met with personnel of the MESA New York Bight project office and Southeast Utilization Research Center (SURC) to discuss the current status of a major compendium on heavy metals in fish tissue data. Deadlines were established for submission of certain data and for the preparation of various sections of the report. The report should result in a most substantial data base concerned with the amounts of heavy metals in fish from the western North Atlantic.

Richard Greig attended a meeting in Washington, D. C., the Chemistry Task Force of the National Shellfish Sanitation Workshop, on 14 and 15 April.

Mr. Frank Steimle attended a meeting on 26 April with MESA, New Jersey Department of Environmental Protection, and other Sandy Hook personnel in outlining and organizing a final report on last year's oxygen depletion program.

On 22 April George Kelly attended a Fishermen's Workshop at Woods Hole Oceanographic Institution convened by Charles Sheldon, Development Sciences Inc., to discuss the effects of the Argo Merchant oil spill on the fisheries. A similar meeting had been held on 17 February 1977 at the same location. Fishermen and fisheries representatives from several New England ports attended and told what they had seen or heard reported by others. There were no reports of direct adverse effects on adult fish of any species.

George Kelly participated in a meeting of the NEFC Awards Committee at Woods Hole on 19 April, and attended a meeting of Environmental Assessment personnel and others at Milford on 20 April to discuss plans for sampling at Deepwater Dumpsite 106 during the operational test phase of the Ocean Pulse program.

Manuscripts

Dr. John Pearce and Ms. Leslie Rogers completed a draft paper for the ICES Working Group on Pollution Baseline and Monitoring Studies. The paper was submitted to Dr. John Portmann for use during an upcoming meeting of the Working Group in Charlottenlund, Denmark. It is projected that the paper will be published as an ICES document.

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AQUACULTURE DIVISION

Culture

Early spawnings of laboratory-reared surf clams, S. solidissima, have been largely successful. Several thousand clams are being reared for experimentation using the tank farm system.

Experimentation with the methodology in handling the developing eggs of the surf clams has revealed that changing the cultures after 24 hr can enhance survival of the embryos by 80%. Early screening removes undeveloped eggs and debris that undoubtedly increase bacterial numbers. No apparent injury to the trochophore stage has been observed from such screening.

We have experienced considerable difficulty rearing bay scallop, A. irradians, larvae over the past six weeks. Indications early in this period pointed to bacterial problems; recently the problem has been more symptomatic of a toxic phenomenon. Numerous experiments are under way to find the causative agent and to counteract its effects.

Nutrition

Experimental work of the program continues to concentrate on developing a minimal growth medium for algae. The successful growth of species in low vitamin, phosphate and nitrogen concentrations described in the previous report must be repeated in many subcultures to confirm the findings. This is being done; if populations continue at satisfactory levels, experiments with still lower concentrations of the essential nutrients will be conducted. Experiments have also been conducted with veliger oyster larvae in efforts to develop a highly controlled culture system that will produce reproducible results. Findings will be reported when substantial information is available.

Participants at the Region III/NEFC/Shellfish Industry Meeting, 29 April, were shown the facilities of the Investigation and an informal report of the work of the Investigation was presented.

Dr. Ukeles prepared a paper and graphic material to be presented at the ICES Working Group on Mariculture Meeting in Brest, France.

The algal mass culture apparatus that produces food for mollusks is functioning extremely well. During the previous 5 wk all 30 culture carboys were free of bacteria and yielded dense harvests. The total amount of food cultures produced during the previous 4 wk was 1,282 liters of larval foods and 1,278 liters of juvenile foods. Axenic algal cultures of "good" food species were sent to investigators at the following institutions upon their request: University of Southern Mississippi, University of New Hampshire, Universidad del Norte Coquimbo, Chile.

Biology classes from two local high schools and from the University of Massachusetts visited the laboratory and were taken on a tour of the algal culture facilities. Short talks were presented to these groups to explain the work of the Investigation.

Genetics (March and April)

Experimental Oyster Breeding

Work is continuing on hybridization of oysters from different geographic areas. Hybrids of commercial American oysters, *C. virginica*, from Virginia with commercial stock of Long Island (New Haven Harbor specifically) are being studied. Juveniles from a successful interspecies hybrid of the Japanese, *C. gigas*, and American oysters are being followed closely as they pass their early juvenile stage.

The numbers of successful oyster lines created by single crosses for the purpose of intense inbreeding have reached nine. Once matured, these lines will be sib-crossed to measure over generations the effects of such inbreeding.

Similarly, work is progressing on the two-way oyster selection experiment-demonstration. All spat from one of eleven mass-spawned groups have been measured and divided into three groups. One group consisting of a faster-growing portion of the population will be mass-spawned. A second interbreeding group will consist of the slowest growing animals, and a third group will be comprised of randomly selected oysters.

Series of full and half-sib families of oysters are also currently in larval and juvenile culture for more immediate theoretical estimates of the heritability of commercial characters.

Artificial parthenogenesis may have been induced in the latest trial on the bay scallop, Argopecten irradians. Heavily irradiated sperm with chromosomes too damaged to contribute male germ plasma to the zygote is used to provoke development of the egg. Resulting larvae, homozygous for all their genes would be of theoretical, as well as of specialized practical use.

Effect of a Contaminant on Shellfish

Cytogenetic data were collected on a final series of short-term exposures of spawned oyster eggs, zygotes and early embryos of the American oyster to kepone. Data on these experiments and also on zygotes from adults given long-term chronic exposure are now being analyzed. This work is EPA/Gulf Breeze, Florida-supported as a short-term contract.

MESA-supported Studies of Atlantic Mackerel Eggs

A 6-mo report was prepared for MESA summarizing the cytogenetic data on Atlantic mackerel eggs from a 1974 cruise of the Westward sailing vessel into the New York Bight. Formats are in preparation for taping the data. That the impact measured is real is perhaps most convincingly conveyed by the variable development of different-stage eggs over the Bight. The most sensitive early cleavage eggs have appreciable incidences of normal development only at the three best stations in the northeast Bight periphery. As development advances and embryos become increasingly less sensitive to chromosome and mitotic irregularities, the incidences of good development become increasingly higher further in towards coastal regions and towards the most heavily polluted apex. Graphic demonstrations of this phenomenon were prepared for the report to MESA.

Methodologic work has been under way on the preparation of ripe pre-spawned eggs for observations of the unfertilized meiotic chromosome configurations. Such would allow appraisal of pre- as opposed to post-spawning damage to the chromosome configurations of fish eggs in nature and in experiment.

Preparations of egg membranes made in conjunction with preparations of unspawned eggs show the pore pattern of the membrane with ordinary and phase-contrast microscopy.

MESA, Cooperative and Ancillary Work on Egg Membranes

Arrangements were made through Yale's Peabody Museum and K. Sherman of the Narragansett Laboratory, NEFC, to examine the surface of oil-contaminated cod and pollock eggs from the site of the Argo Merchant oil spill. Ann Naplin (Sandy Hook) and Dean Perry (Milford), who first observed the surface contamination, independently, assisted with the scanning EM operation. Spacing, size, and morphology of the pore in the surface membranes of the two species differ. The formalin appears to have fixed the surface membrane sufficiently well for scanning electron microscopy of the egg surface. However, some portions of the surface membrane appeared to be eroded away - adverse action of the fixative, effect of some component of the oil, net damage? Some of the oil contamination observed

in the scanning EM would probably not have been observed with light microscopy leaving open the possibility that real membrane contamination was more extensive than initially observed. The possibility that eggs were contaminated during field collection or that the oil adhered to the membranes only in the process of their fixation has not been eliminated.

Forthcoming MESA Cruise into the New York Bight for Mackerel Eggs for Cytogenetics Taken in Cooperation with Chemistry Samples

Preparations have been made for a 11-16 May cruise into the New York Bight for the purpose of making a second collection of Atlantic mackerel eggs for combined cytogenetic and chemical analyses at the same time samples are collected for water chemistry. Chemical analyses will be for organic compounds and heavy metals. The cytogenetic analyses will be compared to results obtained on the 1974 mackerel collection. It is hoped to collect eggs approaching Martha's Vineyard, along Long Island, in the Bight apex and down the New Jersey coast, as well as in slope waters in the direction of the Toxic Chemical Disposal Site. At each station temperature, salinity, dissolved oxygen, turbidity, and radiance will be measured. Standard neuston and bongo tows will be made for egg collections intended for cytogenetic study. Longer hauls will be made for chemical samples of eggs. Microlayer and surface water samples are also to be taken for chemistry. K. Sherman has made it possible for R. Maurer to work with the genetics and chemistry groups in organizing this cruise. A salinity experiment on planktonic eggs will be conducted in the region of Martha's Vineyard, and mackerel eggs there also treated prior to fixing for karyotype studies on their chromosomes. A special fixation is to be made for scanning electron microscopy of eggs hauled in a particularly polluted and in one of the cleanest areas. Daryl Christiansen of the Resource Assessment Division, NEFC, Sandy Hook Laboratory, is collecting and preserving ripe pre-spawned eggs from mackerel caught on commercial boats.

R. Hennemuth, Assistant Center Director for Northeast Laboratories and Fisheries Management, has made arrangements with the Canadians for additional samples of mackerel eggs, roe, and water to be provided us from the Gulf of St. Lawrence.

Meetings, Talks, Visitors, Publicity

Mr. Sami Youakim of Montreal, Quebec, Canada, visited personnel of this investigation and discussed numerous aspects of bivalve aquaculture.

Mr. Douglas Morgan of Marine Research, Inc., Falmouth, Massachusetts, spent two weeks with the investigation as a culture trainee.

Messrs. Ronald Goldberg and Edwin Rhodes attended the spring meeting of the New England Estuarine Research Society. Mr. Goldberg presented a paper entitled, "The Effects of Supersaturated Seawater on Two Species of Bivalve Mollusks."

Dr. Arlene Longwell, as a member of the Scientific Panel, has participated in two National Academy meetings regarding the current Academy review of aquaculture in the US. A paper was prepared regarding the subject of genetics as a constraint on the commercial success of aquaculture in the US. Additional written materials are now in preparation for forwarding to the Academy Review Committee. A San Francisco meeting of the Genetics Committee, World Mariculture Society, directed at defining the role of genetics in aquaculture was also attended.

Manuscripts

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PATHOBIOLOGY DIVISION

Disease and Environmental Stress Investigation

During April research on fin rot in winter flounder was directed toward the collection of eroded and control fin tissues for use in studies with the scanning and transmission electron microscopes. At the same time, olfactory tissues were processed for histology to provide standards for comparisons with tissues from fish exposed to aquatic pollutants. In cooperation with NMFS and EPA Laboratories at Narragansett, Rhode Island, winter flounder eggs and larvae are being exposed to Bunker "C" fuel oil in order to determine tissue changes which are detectable with the light and electron microscope. Considerable time and effort were spent on the preparation of definitive plans for studying larval and juvenile fish in selected "Ocean Pulse" sampling stations.

Comparative Pathobiology Investigation

A pre-importation examination of mollusks from Mexico showed that the pismo clam, Tivela stultorum, was parasitized by unidentified larval nematodes (4%), and by vegetative stages of a sporozoan-like organism (4%). Histological findings have been summarized and reported to concerned individuals. Oysters, clams, crabs, and fish were processed for histological studies during the month of April; 1,531 sections were cut and 1,716 stained slides were prepared for various investigations.

Work on an atlas of the normal histology of the blue crab has shown that acute osmotic stress may be detected microscopically in the podocytes of the gills, and by changes in the epithelia of the antennal gland. The biochemical basis for tissue abnormalities may concern temperature-dependent inability of the crabs to become increasingly ammonotelic at low salinities. Writing is now in progress to describe the normal histology of the gut. A preliminary analysis of observations on rock crabs collected during the past 3½ yr has provided some insight as to the optimal seasons for collecting clean gills, and gills with maximal tissue pathology. Examinations of approximately 1,000 crabs have shown that the winter molting habit of males in the New York Bight Apex provides maximum numbers of clean gills, while examination in late fall, prior to molting, provides optimal numbers of discolored or blackened gills.

Cooperative research with the US Department of Agriculture and FDA has shown that an important nematode of clams and scallops may have an incorrect generic name. Studies with ordinary light microscopy and with the scanning electron microscope have shown that certain key taxonomic characters require re-description. Results of the new studies will be summarized at the annual meeting of the American Society of Parasitologists in August.

Aquaculture: Diseases of Larval Mollusks

Biochemical characterizations of DNA from marine vibrios have shown the guanine-cytosine ratios are outside the range that is acceptable for classical Vibrio strains. Pending the outcome of additional studies, the results indicate that the strains either belong to a new genus of bacteria, or that DNA isolation procedures are in need of further refinement.

Experiments with a seawater purification unit (Aquafine UV-unit) have shown that abnormalities in fertilized oyster eggs may be influenced by the rate at which seawater flows through the unit. The slower the rate of flow the greater the degree of abnormality. A pathogenic species of Vibrio present at a concentration of 10^5 bacterial cells/ml was removed successfully by using the Aquafine unit.

Meetings, Talks, Visitors, Publicity

Four scientific papers were presented at the Crustacean Health Workshop, Galveston, Texas, during 20-23 April: Blogoslawski, Brown, and Steward, "The use of ozone in crustacean disease prevention"; Sawyer and MacLean, "Histological studies on phagocytic nodules in tissues of rock crabs, Cancer irroratus and lobsters, Homarus americanus"; MacLean and Sawyer, "Protozoan and metazoan parasites of rock crabs, Cancer irroratus, and American lobsters, Homarus americanus"; Sawyer and Bodammer, "Discoloration and fouling of gills of the rock crab, Cancer irroratus".

Visitors to the laboratory included Dr. J. Alderman, NAFF, Fish Disease Laboratory, Weymouth, England and Dr. J.-R. Bonami, Universitedes Sciences Techniques du Languedoc, Labortoire de Pathologie Comparee, Place Eugene Bataillon, 34-Montepellier, France.

Manuscripts

Blogoslawski, W. J. Ozone as a disinfectant in Mariculture. I.C.E.S. Mariculture Working Group, Brest, France, 10-13 May. (S).

Blogoslawski, W. J. Detoxification of marine poisons by ozone gas. 2nd World Congress of the International Ozone Institute, Paris, France. 2-6 May. (S).

Blogoslawski, W. J. 1976. Marine application of ozone water treatment. Forum on Ozone Disinfection, Ed. by E.G. Fochtman, R. G. Rice and M. E. Browning. International Ozone Institute, Syracuse, N.Y., pp. 266-276. (P).

Johnson, P. T. 1977. A viral disease of the blue crab, Callinectes sapidus: Histopathology and differential diagnosis. J. Invertebr. Pathol. 29(2): 201-209. (P).

Sawyer, T. K., S. A. MacLean, W. Coats, M. Hilfiker, P. Riordan, E. B. Small. Species diversity among sarcodine protozoa from Rhode River, Maryland, following tropical storm Agnes. In: The Effects of Tropical Storm Agnes on the Chesapeake Bay Estuarine System. The Johns Hopkins Univ. Press, Baltimore & London, November 1976. (P).

NATIONAL SYSTEMATICS LABORATORY

Pelagic Fishes

Worked on descriptions of two previously unrecognized species of Scomberomorus (Spanish mackerels).

Benthic Fishes

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

Crustaceans

Completed a draft of a manuscript describing a new species of spider crab from the Gulf of Mexico. Continued preparation of a guide to the temperate water decapod crustaceans of the US east coast.

Talks

Dr. Bruce Collette presented lectures on his research in Tektite II at Gettysburg College and the University of Delaware.

Manuscripts

Cohen, D. M. 1977. Swimming performance of the gadoid fish Antimora rostrata at 2400 m. Deep-Sea Res. 24: 275-277. (P).

ATLANTIC ENVIRONMENTAL GROUP

Ocean Monitoring and Climatology Task Group

Personnel from the AEG and MFG initiated the first XBT/CPR Ship of Opportunity transect across the Gulf of Maine (Gloucester to Cape Sable) on board the M/V Caribou Reefer. The transect is to be used in conjunction with existing XBT transects (Bar Harbor or Portland to Yarmouth) in monitoring temporal and spatial temperature changes in the Gulf of Maine. This new transect continues the cooperative SOOP efforts between the NEFC and AEG begun in June 1975.

The routine annual publication (1971-1975) of all Ship of Opportunity (SOOP) transects as SSR-F's by AEG personnel will end with the CY1975 transects. The NODC has agreed to pick up this effort beginning with the January 1976 transects and publish a "data availability announcement" on an annual basis. This will allow AEG personnel more time to devote to detailed analysis of the SOOP transects and other data sources pertaining to special oceanographic features revealed by the transects.

Ocean Dumping Task Group

The new biweekly monitoring transect between New York Harbor and Deepwater Dumpsite 106, to acquire temperature, salinity and zooplankton data from the tugs going to the dumpsite, was conducted only once during April due to repairs being made on the barge, Sparkling waters. Expendable bathythermograph (XBT) data and surface water temperature and salinity data from this transect are presently being quality controlled and portrayed for analysis. A malfunction of the Hardy continuous plankton recorder (CPR) did not allow completion of a successful zooplankton sampling transect. This effort will be attempted again during the next transect to the dumpsite.

The summary report of baseline conditions at Deepwater Dumpsite 106 was completed during the early part of April and submitted to the Ocean Dumping program office. The report is composed of individual papers concerning the geological, meteorological, physical, biological, and chemical baseline studies which have been carried out thus far. Also included is a special section containing data on contaminant inputs and characteristics and their presence in the sediments and various species of marine animals.

Work is continuing in preparation for the scheduled experimental cruise to Deepwater Dumpsite 106 during July 1977. Both continuous salinity, temperature and depth profiling units (STD) are being readied for this effort.

Meetings, Talks, Visitors, Publicity

Mert Ingham attended a one-day workshop at the University of Rhode Island on 4 April 1977 dealing with the BLM-sponsored environmental studies on Georges Bank.

Steve Cook, Woody Chamberlin, and Mert Ingham attended a three-day informal workshop at Woods Hole Oceanographic Institution on 12-14 April concerning the physical oceanography of the Gulf of Maine and adjacent seas.

Mert Ingham attended a one-day NMFS-MESA conference on 26 April at the Sandy Hook Laboratory dealing with the preparation of a definitive report on the development of the anoxic bottom layer off New Jersey last summer.

Reed Armstrong participated in a planning conference during 26-28 April in Galveston, TX for the upcoming field investigations in the vicinity of the Buccaneer Oil Field to be conducted jointly by the Galveston Laboratory and AEG.

Mert Ingham attended a one-day meeting of the Working Group developing a cooperative program to study atmospheric forcing in the Middle-Atlantic Bight held at the NOAA National Climatic Center in Asheville, North Carolina, on 29 April.

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. (A).

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

Program planning, manuscript preparation, and analysis of accumulated field data were primary activities throughout the month of April.

Meetings

Dr. Richard Cooper and Joseph Uzmann attended a meeting on Ocean Pulse planning at the Milford Laboratory on 20 April.

Manuscripts

Uzmann, J. R., R. A. Cooper, R. B. Theroux, and R. L. Wigley. 1977. Synoptic comparison of three sampling techniques for estimating abundance and distribution of selected megafauna: Submersible vs. Camera sled vs. Otter trawl. Marine Fisheries Review. (S).

EXTENDED JURISDICTION LIAISON OFFICE

Meetings of the New England and Mid-Atlantic Fishery Management Councils were held on 13 and 14 April (same days at separate locations). These were attended by K. Smith and E. W. Bowman, respectively, and reports of the meetings were circulated to the Center Director, Laboratory Directors, and Center members of the Scientific and Statistical Committees of the Councils. A public hearing on the Herring Preliminary Management Plan was attended by K. Smith on 19 and 20 April. The New England Fishery Management Council's staff was assisted in assembling reports and data for use in preparation of the Council's Herring Management Plan.