

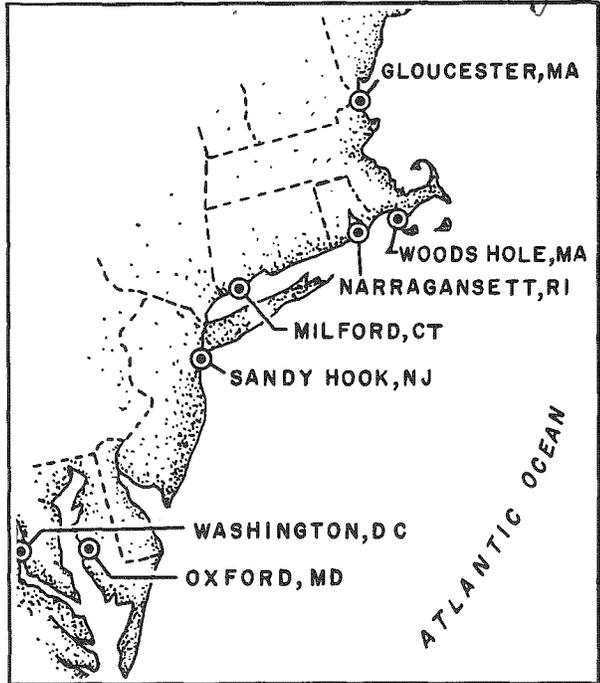
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NEWS

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APRIL 1979

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US DEPARTMENT OF COMMERCE
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FOR ENVIRONMENTAL MANAGEMENT CARL J. SINDERMANN
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NATIONAL SYSTEMATICS LABORATORY DIRECTOR DANIEL M. COHEN
ATLANTIC ENVIRONMENTAL GROUP DIRECTOR. MERTON C. INGHAM

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CENTER DIRECTORATE

Fisheries Utilization Office

As a result of a study conducted by members of the NEFC's Resource Utilization Division, over 100,000 lb of fresh fish fillets, bearing the USDOC's "U.S. Grade A" mark of seafood quality, now leave the Port of Gloucester, MA, every week for retail markets of the two largest food chains in the country as well as for those of smaller food chains. While the addition of 100,000 lb per week does not represent a substantial increase in the per capita consumption of seafoods in the US (increase is 0.05%), the number is nevertheless important. It is a growing number which supports the idea that there is a demand for quality, and there are indications that it will grow to significant levels.

The outstanding comment made by supermarket managers is that whereas seafoods normally had a high percentage of complaints before they handled the high quality seafoods, the complaints have now ceased and instead they are receiving compliments on their seafoods and sales have gone up significantly.

Special Scientific Investigations Office

Arthur Posgay tracked down and worked up several samples of shells read for growth rates by other authors, and researched and prepared documentation for the International Council for the Exploration of the Sea (ICES) Working Group on Atlantic Salmon.

Special Technical Projects Office

This month was spent in preparation for the scallop drag and clam dredge studies. Design, specification, and purchasing action was taken on an underwater color television system, videotape recorders and monitors, clam cable, a scallop drag, trawl mensuration cable, and scallop drag hood frames, hoods, and covers.

Other actions involved budgeting and planning for upcoming projects, monitoring vessel technical problems, and providing technical assistance to various organizations and individuals.

RESOURCE ASSESSMENT DIVISION

Resource Surveys Investigation

April has been a busy month for the Resource Surveys Investigation. On 6 April, Part I of the spring bottom trawl survey was completed when R/V Delaware II went into Bayonne, NJ. Tom Azarovitz was the Chief Scientist and the area of operation was from Cape Fear, NC, to Sandy Hook, NJ. Part II of the survey was conducted during 11-20 April also aboard the Delaware II. The area surveyed was from Sandy Hook, NJ, east and north into the Gulf of Maine and to the Canadian border. Malcolm Silverman was the Chief Scientist. Part III of the survey was completed on 9 April aboard R/V Albatross IV. Henry Jensen was Chief Scientist and Georges Bank was the area surveyed. The final segment of the survey (Part IV) began on 12 April and is scheduled to end on 12 May. Linda Despres is Chief Scientist. The Gulf of Maine, Scotian Shelf, and Georges Bank will be visited by the Albatross IV on this final leg of the 1979 spring bottom trawl survey.

The survey was originally scheduled to be completed on 26 April, but recurring electrical breakdowns aboard the Albatross IV, some bad weather, and the need to increase the number of stations on Georges Bank, necessitated rescheduling of Parts III and IV of the bottom trawl survey and the upcoming sea scallop survey aboard the Albatross IV.

On 17 April, the Delaware II participated in the Large Area Marine Productivity Experiment (LAMPEX).

During Part II of the bottom trawl survey, the new trawl mensuration package was tested. The system functioned well and should see wider use during future surveys.

Warren Handwork finished rigging the new 8-ft sea scallop survey dredges. Warren has also been preparing gear to be used by Ron Smolowitz in the forthcoming sea scallop gear experiments.

Jim Crossen continued working with Jack Suomala of the Massachusetts Institute of Technology's (MIT) Draper Laboratories on the joint American and Soviet hydroacoustic symposium to be held in June. The meeting to be held at the Draper Laboratories will be attended by hydroacoustic experts from at least 12 countries, including Australia, Canada, Federal Republic of Germany (FRG), Mexico, Norway, Peru, Poland, Republic of South Africa (RSA), United Kingdom (UK), Union of Soviet Socialist Republics (USSR), Yugoslavia, and the US.

Fishery Biology Investigation

Shellfish

John Ropes continued to work on revision of three manuscripts returned from in-house review.

John Ropes, Loretta O'Brien, Ambrose Jearld, and Brad Brown were at the University of Maryland Eastern Shore (UMES) for a working session with Dr. Thomas Hopkins and his assistant who are aging surf clams. This visit was to discuss and observe aging determinations being made on samples of surf clams collected off Ocean City, MD. Dr. Hopkins and his assistant were introduced to a new chondrophore sectioning technique developed by John Ropes and Loretta O'Brien. The intention is to have the UMES group utilize this technique after refinement by the Fishery Biology Investigation. Some suggestions for clarifying data in reports on the surf clam project were discussed and have been incorporated in UMES' most recent progress report. In general, the quality of work on this project has shown steady improvement since its beginning and the techniques of cutting shells and making age determinations are becoming more routine. Several samples of shells were brought to the Woods Hole Laboratory to prepare thin sections for validation of UMES techniques.

John worked with Fran Pierce and Curt Crosby of the Maine Department of Marine Resources who spent 3 days using the equipment in our shellfish lab to cut sea scallop shells. The shells were easily sawed with little or no fracturing, but examination of the cut edges revealed no clear age lines for large or small shells. A report from Maine is forthcoming on this effort.

Loretta O'Brien continued to work with Dr. Arthur Merrill on a sea scallop research project. She also participated in the Albatross IV spring bottom trawl survey.

Age and Growth

Vi Gifford completed aging 40 samples of redfish caught commercially during the first quarter of 1969. She also completed the first aging of 440 redfish samples caught commercially during the second and third quarters of 1969.

Kris Kantola and Vi Gifford worked together on the aging of the following pollock samples: 1978 commercial (451 fish aged), Delaware II Cruise No. DE 78-06 (270 fish aged), Delaware II Cruise No. DE 78-05 (18 fish aged), and Albatross IV Cruise No. AL 78-09 (42 fish aged). These pollock data have been summarized and put on age sheets. Cruise data were sent to the Automatic Data Processing Unit (ADP) for keypunching.

Judy Penttila worked with Tom Hotz and Bruce Estrella aging Atlantic cod samples from Delaware II Cruise No. DE 78-06 and Albatross IV Cruise No. AL 76-09. Atlantic cod age data for Albatross IV Cruises No. AL 76-09 and 78-04, and for Delaware II Cruise No. DE 78-06 have been summarized and put on age sheets. Judy also prepared summaries of available survey and commercial age data for Atlantic cod, haddock, pollock, redfish, and yellowtail flounder. She has been involved as well in preparing a series of slides showing processes used in aging, scale impressing, otolith sectioning, etc.

Finfish

A new stay-in-school person, Beth Shiffman, joined us this month and has begun work on our bluefish aging project by impressing scales.

Laurie Savelkoul completed aging and summarizing red hake from the 1978 fall bottom trawl survey, bringing us up to date on this species.

Cathy Rearden completed aging 1978 fall bottom trawl survey butterfish and continued work on the age sample archiving project with ADP personnel.

Louise Dery spent several days consulting with the Atlantic herring contract worker Jean Chenoweth and put together a report titled "Recent Problems of Aging Sea Herring from the Gulf of Maine." Silver hake from the 1978 fall bottom trawl survey were also aged and summarized.

Sandy Hook Investigation

Darryl Christensen completed and submitted two reports to the Mid-Atlantic Fishery Management Council titled "Age Composition of the 1978 Spring Recreational Catch of Atlantic Mackerel, Scomber scombrus, in the Middle Atlantic Region," and "Composition of Daytime and Nighttime Catches of Bluefish (Pomatomus saltatrix) Made on New Jersey Party-Boats."

John Clifford worked with the Sandy Hook Laboratory ADP Unit to obtain data on summer flounder from the 1975-77 charter-boat and party-boat survey data bank. He also assisted Darryl with the bluefish reports to the Mid-Atlantic Fishery Management Council.

Wally Morse participated on two legs of the spring bottom trawl survey from 20 March to 6 April and from 14 April to 28 April.

Stuart Wilk and Wally Morse submitted a report to the Bureau of Land Management (BLM) titled "Annual Cycle of Gonad-Somatic Indices as Indicators of Spawning Times for Fifteen Species of Fish Collected from the New York Bight, June 1974 to June 1975."

Fishery Analysis Investigation

Paul Wood completed length-frequency analysis of Atlantic cod catches taken in Southern New England and Mid-Atlantic waters during all spring and autumn bottom trawl surveys during 1963-79. Stratified mean number and mean weight per tow were also derived for these cod catches from each area and stratum. Fred Serchuk completed analysis of mean catch per survey tow for each age group for Southern New England and Mid-Atlantic cod, as well as survey length-at-age data for cod from spring cruises during 1970-77. Fred and Paul are currently preparing a report summarizing the current status of Atlantic cod south of Georges Bank.

Paul Wood coordinated and arranged for three sea sampling trips during April: (1) the F/V Sea Siren out of New Bedford, MA, during 7-18 April (Jim Kirkley, sea sampler); (2) the F/V Gale out of Provincetown, MA, on 12 April (Roger Clifford, sea sampler); and (3) the F/V Karen Louise out of Pt. Judith, RI, on 25 April (Paul Wood, sea sampler). Paul is presently collating all sea sampling data collected since December 1977 for a report summarizing the program's activities and results.

Ralph Mayo began final preparation for submission of the 1978 USA STATLANT 21A catch report to the United Nation's Food and Agriculture Organization (FAO) and to the International Commission for the Northwest Atlantic Fisheries (ICNAF). Ralph and Joan Palmer reviewed several manuscripts as referees for published fishery journals.

Liz Bevacqua and Ralph Mayo continued assessment analyses of scup data derived from both research survey and commercial sources.

Rhett Lewis began re-stratification of individual sea scallop survey tow data for the 1975, 1977, and 1978 Georges Bank and Middle Atlantic sea scallop surveys.

Harold Foster and Rhett Lewis participated in the second leg of the spring bottom trawl survey from 28 March to 9 April on the Albatross IV. Steve Murawski participated in the third leg of the spring bottom trawl survey during 10-29 April on the Delaware II.

Fishery Assessment Investigation

Steve Clark and Thurston Burns worked on the pollock assessment, including the 1978 biostatistical analysis. Thurston also updated New England commercial landings of American lobster through 1978 and presented them in various summary formats as well as summarizing the commercial otter trawl catch-per-unit-of-effort indices for lobster through 1978.

Frank Almeida continued work on mesh selection analysis for silver hake and also completed some generalized stock production model estimates of maximum sustainable yield for bluefish. Frank also participated in the spring bottom trawl survey on Albatross IV Cruise No. AL 79-03 (II) during 12-26 April.

Jeffrey Floyd continued measuring morphometric characters on silver hake for the stock delineation study.

Hillary Herring completed all work on the pre-1968 red hake biostatistical analysis except for application of the age data, and began compiling 1978 data for use in the upcoming assessment. Hillary also completed coding commercial length-frequency sample forms for January-March 1979 and began work on the April samples.

Pat Carter updated haddock data on computer files and participated in the spring bottom trawl survey on Delaware II Cruise No. DE 79-04 (II) during 11-30 April.

Emma Henderson continued work on revising a manuscript of the assessment of summer flounder.

Steve Clark was the principal organizer of a Gulf of Maine State-Federal assessment workshop held in Woods Hole during 26-27 April. The purpose of the workshop was to review the assessments of Gulf of Maine species with particular emphasis on the data base and techniques used and on the limitations of the data base. Participants were from Maine, New Hampshire, Massachusetts, Northeast Regional Office, New England Fishery Management Council, and NEFC.

Fishery Systems Investigation

Mike Sissenwine continued his work on groundfish and Atlantic herring. He also revived earlier work on an essay concerning concepts of fishery management with special reference to the northeastern US. Mike attended sessions of the ICES Symposium on the Early Life History of Fish held during 2-5 April 1979 in Woods Hole. During these meetings and during the following week Mike participated in detailed discussions of ecosystem modeling efforts in the Northwest and Northeast Atlantic with members of the Ecosystem Dynamics Investigation and Eric Ursin of Denmark, Neils Daan of The Netherlands, and Rodney Jones of the UK. Mike also attended a lecture by Robert May of Princeton University at Harvard on 12 April on theoretical considerations of multispecies fisheries. Following the meeting, there were discussions with Robert May, William Bossert of Harvard, and other faculty. On 26-27 April, Mike chaired a workshop on State-Federal assessment activities for the Gulf of Maine. The workshop was held in Woods Hole. Anne Lange served as a rapporteur for part of the meeting.

Anne continued involvement with the US-Canadian treaty for maritime boundaries. She also prepared a draft updating the squid assessments.

Gordon Waring went to sea on the German Democratic Republic (GDR) R/V Eisbar during the second half of April. Gordon and Margaret McBride continued ongoing assessment work on Atlantic herring and yellowtail flounder, respectively.

Mike Sissenwine participated in a meeting with Congressman Gerry Studds and Douglas Marshall, Executive Director of the New England Fishery Management Council, on 16 April in Woods Hole. During the meeting, Congressman Studds was briefed on the NEFC's research program with particular emphasis on assessments. During April Mike also reviewed a grant-in-aid application and a manuscript for the Fishery Bulletin.

Meetings, Talks, Visitors, Publicity

During 28 March-9 April, Ralph Mayo attended the ICNAF Assessments Subcommittee meeting in St. John's, NF.

On 1 April, Mike Sissenwine presented a talk on "Principles of Fisheries Conservation and Management" at the Massachusetts Marine Educators Association Workshop in Woods Hole.

During 2-5 April, the Division's staff at the Woods Hole Laboratory attended the ICES Symposium on the Early Life History of Fish held at Woods Hole.

During 2-4 April, Steve Murawski and Fred Serchuk attended the 1979 Northeast Division Fish and Wildlife Conference in Providence, RI. Steve presented a paper co-authored with Fred titled "Assessment and Status of Ocean Quahog Populations in the Middle Atlantic."

On 6 and 9-12 April, Mike Sissenwine, Joan Palmer, Brad Brown, and Emma Henderson met with Eric Ursin, Neils Daan, and Rodney Jones to discuss ecosystem models in Woods Hole.

During 8-11 April, John Ropes, Loretta O'Brien, Ambrose Jearld, and Brad Brown were at the University of Maryland Eastern Shore for a working session with Dr. Thomas Hopkins and his assistant who are aging surf clams. Brad Brown presented a graduate seminar on marine fishes.

On 9 April, Emory Anderson and Stuart Wilk attended the Mid-Atlantic Fishery Management Council Scientific and Statistical Committee meeting in Philadelphia, PA.

On 9 April, Paul Wood participated in a meeting of the New England Fishery Management Council's Sea Scallop Oversight Committee in Peabody, MA.

During 10-11 April, Emory Anderson and Stuart Wilk attended the State-Federal Summer Flounder Scientific and Statistical Committee meeting in Philadelphia, PA.

On 12 April, Emory Anderson discussed assessment methods, data, and related problems with a group of students from the University of New Hampshire.

On 12 April, Mike Sissenwine and Brad Brown attended a lecture by Robert May at Harvard University.

On 16 April, Brad Brown, Mike Sissenwine, Emory Anderson, Fred Serchuk, and Steve Clark met with Congressman Gerry E. Studds in Woods Hole, to review assessment techniques and analysis.

On 16 April, Emory Anderson presented a talk about NEFC activities and fisheries assessment/management to a group of people from MIT in Woods Hole.

During 16-27 April, Emma Henderson attended a modeling workshop held at the NWAFC in Seattle, WA.

On 18 April, Emory Anderson met in Woods Hole with Jack Casey of the Narragansett Laboratory and Wayne Witzell of the SEFC's Miami Laboratory to discuss coordinated NEFC-SEFC efforts to estimate current levels of catch of pelagic sharks and prepare assessment advice for use in a fishery management plan for sharks.

During 18-19 April, Mike Sissenwine attended a meeting of the New England Fishery Management Council in Peabody, MA.

During 19-20 April, Ralph Mayo met with NMFS Statistics Division personnel to discuss implementation of the domestic logbook system in Woods Hole.

On 20 April, Emory Anderson and Stuart Wilk gave a lecture on recreational fisheries implications to fisheries management to the advanced fisheries management class at Rutgers University.

On 23 April, Ralph Mayo met with NMFS foreign fishery observers in Woods Hole to review sampling procedures and prepare for an upcoming training session.

During 24-25 April, Emory Anderson and Stuart Wilk attended the State-Federal Striped Bass Scientific and Statistical Committee meeting in Hartford, CT.

On 25 April, Judy Penttila and Ambrose Jearld attended a meeting at the Narragansett Laboratory on the use of pattern-recognition analysis for aging haddock scales.

During 25-29 April, Jim Crossen and Jack Suomala of the MIT Draper Laboratories visited the Canadian Fisheries and Marine Service's St. Andrews, NB, facility to meet with Dr. Buerkle regarding the joint US-USSR hydroacoustic symposium to be held at Draper in June.

On 25 April, Mike Sissenwine attended a meeting to discuss food habits research of the NEFC in Woods Hole.

During 26-27 April, the Division's staff from Woods Hole and Stuart Wilk from Sandy Hook participated in a Gulf of Maine State-Federal Assessment Workshop held in Woods Hole.

On 30 April, Pat Twohig attended a meeting in Norfolk, VA, to discuss a new data logger system.

On 30 April, Mike Sissenwine, Tom Azarovitz, Chuck Byrne, and Brad Brown met with David Borden and Mike Foggarty of the Rhode Island Department of Natural Resources to discuss a special yellowtail flounder survey to be conducted by the State of Rhode Island using commercial fishing vessels.

Hillary Herring was elected to the public relations position on the Federal Women's Program at the NEFC, and is also participating in the Recruitment and Member Affirmative Action Plan Subcommittee of the Woods Hole Laboratory EEO Committee.

Manuscripts

Anderson, E. D. 1979. By-catch of pelagic sharks, swordfish, and other large pelagics in the 1978 foreign trawl fishery in the United States Fishery Conservation Zone in the Northwest Atlantic. NMFS, NEFC, Woods Hole Lab. Ref. No. 79-15. 16 p.

Anthony, V. C., and S. Clark. 1979. A description of the northern shrimp fishery and its decline in relation to water temperature. Pages 119-121 in Climate and fisheries. Proceedings from a Workshop on the Influence of Environmental Factors on Fisheries Production. Univ. of Rhode Island Ctr. for Ocean Mgmt. Stud. Kingston, RI. 29-31 March 1978. (P)

Christensen, D. J., and W. J. Clifford. 1979. Comparison of daytime and nighttime catches of bluefish, Pomatomus saltatrix, made on New Jersey party-boats. NMFS, NEFC, Sandy Hook Lab. Rep. No. SHL 79-04. 17 p.

Christensen, D. J., J. A. Penttila, and L. M. Dery. 1979. Age composition of the 1978 spring recreational catch of Atlantic mackerel, Scomber scombrus, in the Middle Atlantic region. NMFS, NEFC, Sandy Hook Lab. Rep. No. SHL 79-13. 7 p.

Mayo, R. 1979. Gulf of Maine redfish stock assessment data-1978. NMFS, NEFC, Woods Hole Lab. Ref. No. 78-18. 12 p.

Murawski, S. A., and F. M. Serchuk. 1979. Dynamics of the ocean quahog, Arctica islandica, population off the Middle Atlantic Coast of the United States. NMFS, NEFC, Woods Hole Lab. Ref. No. 79-16. 25 p.

Sissenwine, M. P., B. E. Brown, and J. Brennan-Hoskins. 1979. Brief history and state of the art of fish production models and some applications to fisheries off the northeastern USA. In Climate and fisheries. Proceedings from a Workshop on the Influence of Environmental Factors on Fisheries Production. Univ. of Rhode Island Ctr. for Ocean Mgmt. Stud. Kingston, RI. 29-31 March 1978. (P)

Sissenwine, M. P. 1979. The relationship between temperature and production of the Southern New England yellowtail flounder fishery. In Climate and Fisheries. Proceedings from a Workshop on the Influence of Environmental Factors in Fisheries Production. Univ. of Rhode Island Ctr. for Ocean Mgmt. Stud. Kingston, RI. 29-31 March 1978. (P)

MARINE ECOSYSTEMS DIVISION

Fishery Oceanography Investigation

Preparations for scientific meetings and cruises occupied most of our time in April. Red Wright, Ron Schlitz, Steve Ramp, Kathy Bush, and Ron Kirschner have been preparing papers for the Gulf of Maine Conference in Halifax, NS, next month. Ron Schlitz, Steve Ramp, and Kathy Bush have also been preparing papers for the annual American Geophysical Union (AGU) meeting in Washington, DC, next month.

Red Wright and Ron Schlitz began discussions with Dr. Mary Farmer, the Chief Scientist aboard the S/V Westward, about the utilization of the vessel this summer in an attempt to confirm the existence of a gyre on eastern Georges Bank. Ron Kirschner and Tom Laughton prepared the Winkler method dissolved oxygen measurement system for upcoming cruises. Tom Laughton constructed drogues also for upcoming cruises, some to be used aboard the Westward. Derek Sutton designed a clamp which makes it possible to use the rosette with either the STD (salinity, temperature, and depth) or the CTD (conductivity, temperature, and depth) instrumentation. He also designed a pressure case for the diving unit. Tim Cain has made the necessary modifications on the 1.7-liter Niskin bottles enabling them to function on both the STD and CTD. Gil Dering completed preparations of three new releases and vector-averaging current meters (VACMS) for September deployment.

Sam Nickerson, Tim Cain, Dan Patanjo, and Jim King completed salt analysis on the Guildline Salinometer. Sam Nickerson completed analysis of data from bottom trawl survey cruises and Marine Resources Monitoring, Assessment, and Prediction (MARMAP) cruises. This included reading all temperatures from expendable bathythermographs (XBT) and making contoured plots of surface and bottom temperatures and surface salinity values. Derek Sutton reviewed computer records of the third deployment of current-meter moorings in the Northeast Channel during the winter of 1977. Dan Patanjo is compiling station position data to produce computer-plotted cruise tracks for his cruise summary volume, including both NEFC and foreign cruises. Tim Cain and Cindy Chappell are preparing data from USSR R/V Belogorsk Cruises No. 78-01, 78-03, and 78-04 for submission to the National Oceanographic Data Center (NODC).

Plankton Ecology Investigation

A summary of oceanographic data (i.e., salinity, temperature, and dissolved oxygen) collected on USSR R/V Argus Cruise No. 78-04 during 13 April-24 May 1978 has been completed. These data, in the form of surface and 100-m integrated values, will be examined in relation to the distribution of larval and juvenile fishes collected in neuston and bongo net tows.

Jerry Prezioso was involved in a bottom trawl and ichthyoplankton survey on Eisbar Cruise No. 79-01. Plankton was sampled at 58 stations in the Nantucket Shoals, Southern New England, and Mid-Atlantic Bight areas. Jerry is also involved in preparation of reports on the M/V Ocean 250 gasoline spill and the M/V Maria Costa insecticide spill.

A shipment of plankton samples including the Delaware II Cruise No. DE 79-03 MARMAP samples and ICNAF larval Atlantic herring survey samples is in preparation and will be sent to the Polish Plankton Sorting Center in Szczecin, Poland, in early May.

Joe Kane participated in Delaware II Cruise No. DE 79-04 and was responsible for chlorophyll sampling coordinated with the LAMPEX remote-sensing aircraft overflight. Joe is currently preparing a preliminary report of his findings in his work with wet-volume-to-dry-weight relationships for year-round zooplankton samples from the MARMAP survey areas. The scientific community eagerly awaits his report.

Jack Green has been working on a manuscript on bongo net mesh retention studies with Jack Colton.

Donna Busch has been working on plots of ^{14}C productivity/chlorophyll-a ratios versus depth, and sigma-T versus depth for 1978 fall MARMAP cruises. The plots will be included in a second data report on ^{14}C primary production in the NEFC survey area by Jay O'Reilly and Donna Busch.

Biostatistics

Everyone attended the ICES Early Life History of Fish Symposium.

All 1978 zooplankton data files were edited and are now ready for merging. They cannot be merged, however, because a new table segment or card conversion routine must be written for them.

One more FISHSUM, for Albatross IV Cruise No. AL 73-09, was generated and delivered to Greg Lough at the Woods Hole Laboratory.

Two meetings were held with Input/Output Computer Services, Inc. (IOCS), personnel to scope out the tasks and reporting requirements for a 4-mo contract renewal.

Interfacing was provided for the Atlantic Environmental Group's (AEG) requests concerning: (1) using First Data Corporation for a BASIC/PLUS program, and (2) a problem with the URUNMERGE module or the table segment it was operating on.

The status of terminals for IOCS was resolved. The status of terminals for other users in Narragansett was explored, but is not yet resolved.

Benthic Dynamics Investigation

Analyses of benthic invertebrate samples from the continental shelf off Southern New England were continued this month. Previous indications of a quantitatively rich and taxonomically varied fauna were confirmed. Two major aspects of this work that were continued during the month were the determinations of biomass and density of each major component of this fauna, plus the analyses of their relationships with water depth and bottom sediment type. Another subject, addressed primarily by Roger Theroux, dealt with the distribution of bivalve mollusks represented in our samples from waters off the US East Coast.

Work on the food habits of fishes continued with emphasis on flatfish and juvenile haddock. A laboratory report on the food habits of flatfish, based on the 1969-72 data base, was prepared by Rich Langton. Title of the report is "Food Habits of Nine Species of Pleuronectiform Fishes from the Northwest Atlantic." The report on the food of 15 Northwest Atlantic gadiform fishes, by Rich Langton and Ray Bowman, was accepted for publication as a NOAA Technical Report NMFS SSRF. Bowman presented a poster report on juvenile haddock food habits at the recent ICES larval fish symposium. Various members of the Investigation attended the symposium. Rich Langton met with Drs. Erik Ursin, Niels Daan, and Jan Beyer during the meetings and the following week as well, to discuss food habits and modeling research. Preparations for the collection of fish stomachs by the State of Maine on its inshore bottom trawl survey have been completed. Maine will conduct an inshore survey and collect young-of-the-year (YOY) fish for stomach analyses, using the same procedures used by the State of Massachusetts.

Ray Bowman and Jim Towns participated on the spring bottom trawl survey cruise during March and April.

Ecosystem Dynamics Investigation

Following conclusion of the ICES larval fish symposium, the NEFC modeling group held a series of meetings in Woods Hole on multispecies modeling. On Friday, 6 April, the group met with Erik Ursin (Denmark), Niels Daan (The Netherlands), Rodney Jones (UK), Kevin Kane (Harvard University), and Robert Pedrick (NMFS, Washington), to discuss general approaches to the development of nonlinear multispecies models and in particular the development of recruitment and feeding functions. The approaches of the NEFC group were briefly described and compared with those of the other investigators. During the following week, Dr. Ursin presented two comprehensive lectures, one on the elements of his multispecies fish stock assessment model and one on the application of single-species and multispecies models to assessment of North Sea stocks. In addition, a number of in-depth discussions were held on recruitment and feeding functions, including a description by Jan Beyer (Denmark) of his queuing theory of feeding and digestion in fish. Ed Cohen presented a summary of our activity to date in exploring ways of estimating daily rations using Mike Pennington's and Niels Daan's feeding equations, and partitioning rations by prey type. The function used by Ed Cohen is basically similar to that used in the Andersen-Ursin and Steele ecosystem models, but lack of digestion rate data made it difficult to convert mean gut content data to daily ration estimates. Dr. Niels Daan formulated a method by which empirical data on stomach contents may be used together with theoretical feeding functions to estimate feeding rates. Ed Cohen, Jan Beyer, Niels Daan, and Rich Langton explored the possibility of using queuing theory to model the digestion process in individual fish. The week's activities were concluded on Friday evening, 13 April, with a seminar at Harvard University by Robert May (of Princeton University) on theoretical ecological considerations relative to exploited animal populations, and afterwards a general discussion of multispecies modeling and fishery management with Professor Bossert at Harvard.

Dr. Ursin reviewed the structure of the NEFC model in detail with Wendell Hahm and made a number of useful suggestions for evaluating our model. Wendell Hahm and Ed Cohen wrote a computer program for the Sigma 7 computer at the Woods Hole Oceanographic Institution, which incorporates the key elements of the Andersen-Ursin model in abbreviated form. This mini-model is now being used as

a learning device to clarify and compare the nature of the control functions of the Ursin and NEFC models.

Ed Cohen went to Seattle, WA, the last week in April to participate in the month-long workshop there evaluating the NWAFC's ecosystem models, with Dr. Ursin and Dr. Daan, as well as other modelers from NMFS (including Emma Henderson of NEFC).

Marv Grosslein spent several days at the Sea Grant Office in Albany, NY, reviewing charts and maps for the New York Bight Atlas on fishes; final editing of this monograph is now in progress and every effort is being made to finish the monograph as soon as possible.

Mike Pennington, together with Pete Berrien and Ann Naplin, completed a report on effects of subsampling plankton samples on the precision and accuracy of various estimators. Also, Mike worked with Rich Langton on analysis of feeding rhythm of clams.

Recruitment Processes

The ICES Early Life History of Fish Symposium, held in Woods Hole during 2-5 April, was the main focus of our attention early in the month -- an event which has been many months in preparation. Greg Lough (with George Bolz, Marv Grosslein, and Dave Potter) presented a paper at the symposium summarizing our recent analysis of the ICNAF larval Atlantic herring (caught with 0.505-mm mesh) data base (see "Manuscripts" section). George Bolz (with Greg Lough and Dave Potter) presented a talk and a poster session on Georges Bank/Nantucket Shoals ichthyoplankton from the same data base. Since the symposium, George Bolz and Dave Potter are continuing their analysis of the 1972-77 ICNAF ichthyoplankton. George Bolz also is working on completing the growth curve of larval Atlantic herring based on otolith aging techniques. Greg Lough is preparing materials from the fall 1978 larval Atlantic herring patch study to present at the Second Workshop on the Oceanography of the Gulf of Maine and Scotian Shelf, to be held in Halifax, NS, during 14-17 May 1979.

Roz Cohen has completed editing of nine cruises for data on zooplankton caught with 0.333-mm mesh during the 1974-75 larval herring seasons (in corroboration with the Narragansett Data Processing Group) and has made an outline of the kinds of analyses and reports we plan to work on in the near future as soon as the entire 1971-77 ICNAF data base is available. Roz Cohen and Janet Murphy have continued to work on the larval herring gut content - condition factor processing and analysis. In addition, Janet Murphy has identified the zooplankton from several MOCNESS (Multiple Opening-Closing Net and Environmental Sensing System) hauls made during the patch study, so that Marv Grosslein can give some preliminary information on the plankton communities associated with the Georges Bank frontal region for the Gulf of Maine workshop.

Bob Livingstone has continued to work on the reproductive biology of Georges Bank haddock, completing manuscript sections on spawning by size and depth zone, and relationship between maturity factors and gonad - total body weight. He also has been involved with providing color slides of maturity stages of various species to Vaughn Anthony's (Maine Department of Marine Resources) inshore survey group.

Dana Temple (Co-op student) participated in the spring bottom trawl survey on Delaware II Cruise No. DE 79-04 (II) during 11-30 April. David C. Potter attended the 7th Annual East Coast Benthic Ecology Meeting at the University of New Hampshire in Durham, NH, during 20-22 April. Roz Cohen and George Bolz attended several EEO Committee meetings in Woods Hole during April 1979. Greg Lough participated in the ICES Larval Fish Working Group in Woods Hole on 6 April 1979, and presented preliminary results of the fall 1978 larval Atlantic herring patch study.

Ichthyoplankton Investigation

Several members of this Investigation presented papers or posters at the ICES Early Life History of Fish Symposium in Woods Hole. Pete Berrien's presentation on egg production and spawning stock estimate of Atlantic mackerel was well received. Poster presentations were given by: Pete Berrien and Mike Fahay on the early development of the tilefish; Anne Naplin and Cindy Obenchain on the eggs and early larvae of a Northwest Atlantic snake eel, Pisodonophis cruentifer; Cindy Obenchain on the distribution and abundance of fish eggs and larvae in the New York Bight during 1974-76; and Art Kendall and Dave Gordon on the daily growth of Atlantic mackerel larvae.

Tom Morris, Tom McKenney, and Bill Brennan joined the scientific party on Albatross IV, while Doris Finan joined the group on Delaware II, to take plankton samples during the spring bottom trawl survey. Their last-minute participation in the traditional spring survey provided us with an opportunity to sample the eastern part of Georges Bank and the Gulf of Maine, both of which we missed because of bad weather in March. We are collecting samples off Southern New England from the Eisbar, and John Sibunka is involved with pre-cruise preparations for our spring survey which will begin early in May.

Wally Smith, John Sibunka, and Doris Finan joined a working group meeting at the Milford Laboratory. Others included Red Wright and his physical oceanographers from the Woods Hole Laboratory, and Jay O'Reilly, Donna Busch, and personnel from both the Sandy Hook and Narragansett Laboratories responsible for chlorophyll mapping and primary productivity measurements. This was the second such meeting in as many years to discuss the status of our collective effort, as well as to further the coordination and cooperation during our surveys.

Larval Physiology and Biochemistry Investigation

Research is still in progress on activity level, larval metabolic rate, daily mortality rates during the first 3 wk of larval life, and individual larval feeding rates as influenced by larval size and age. Estimates of routine metabolism using standard manometer equipment (Warburg respirometers) are being compared with estimates of the maximum potential activity of the respiratory electron transport system (RETS) as determined by the tetrazolium reduction method. The relationship between these two estimates of metabolic rate are being studied from hatching through metamorphosis.

The entire Investigation staff spent the first week of the month in attendance at the Symposium on the Early Life History of Fish at Woods Hole, MA. Four presentations were made by Investigation personnel at the symposium and are listed at the end of this Division's report.

Geoff Laurence attended an ICES Working Group meeting in Woods Hole on the distribution of larval fishes.

Apex Predators Investigation

Efforts in aging sharks continue. The trial data base for mako sharks (17 fish ranging in length from 74 to 328 cm) was completed and a preliminary estimate of age/length was derived from vertebral readings. These will be correlated with length-frequency and tag/recapture data in an attempt to validate tentative annuli.

Over the years an inventory of 26 vertebrae from recaptured sharks has accumulated mostly from blue sharks. Processing of sections of these vertebrae was started and will be completed in May.

Due to several responses to our request for white shark sightings in our recent newsletter, a "shark sightings file" was initiated in April to record observations from our cooperative sport and commercial fishermen.

Scalloped hammerhead embryos were sent to Dr. Wourms of Clemson University for a joint study of this seldom encountered species.

Progress toward a pictorial guide to sharks was made and a preliminary format was established.

Chuck Stillwell participated in a cruise aboard the commercial longliner F/V Darana R off the coast of North Carolina. Examination of stomachs from blue sharks showed that 65% (11 out of 17) contained food remains, suggesting a relatively high rate of predation on a variety of fish species and cephalopods. The percentage of stomachs with food was approximately five times that of stomachs from sharks taken at tournaments during the summer in the New York Bight (Southern New England area). Results agreed favorably with stomachs collected in the late summer - early fall from the shelf area south of Martha's Vineyard and eastward.

Preliminary analysis of our data for determining a condition factor for blue sharks over a seasonal period showed a general decrease in condition when the standard or isometric equation [$K = 10^5(W/L^3)$] was used. However, when using an allometric form of the above equation [$K = 10^5(W/L^b)$] we found that mature males and subadult females improved in condition from spring to fall. Improvement in condition of mature males was substantiated when mean liver weights were used to determine a condition factor for the size group. This suggests that a sufficient ration is consumed by at least one segment of the blue shark population over the summer months to provide nutritive energy for maintenance as well as a surplus for lipid storage in the liver.

A format including the parameters and respective codes for ADP analysis of the apex predator food habits has been created. Data from field log sheets are now being transcribed for keypunching by Woods Hole Laboratory ADP personnel. Once the data are on tape, we will attempt to utilize the summarization programs now being used by the Woods Hole Laboratory food habits researchers.

Further progress has been made in the updating and in-house management of the shark tag data bases. Our new programmer Mary Russel has been writing a series of programs that will aid us in the verification and summarization of our data.

Jack Casey attended the ICES Early Life History of Fish Symposium and Wes Pratt attended and lectured on sharks at the 23rd Annual Sea Rovers Convention in Boston, MA. Chuck Stillwell and Nancy Kohler attended a food habits meeting held at the Woods Hole Laboratory on 25 April. Brief summaries of the accomplishments or work being done at the present time by each task were presented. Much of the day's discussions revolved around modeling of the energy budget of Georges Bank and how each task could contribute to the model.

Meetings, Talks, Visitors, Publicity

Kenneth Sherman of the NEFC's Narragansett Laboratory and Reuben Lasker of the SWFC's La Jolla Laboratory were co-convenors of the Early Life History of Fish Symposium held 2-5 April at Woods Hole, MA. The symposium involved many

people in the Division--including the secretarial staff -- and scientists from 21 countries. A number of these scientists visited the Narragansett Laboratory during the period 6-13 April including: Kenneth Tighe (Ichthyological Associates, Inc.); J. McLaughlin (Monroe, CO); Dr. Lindsay Meller (Marine Research Laboratory of St. Petersburg, FL); Dr. Niels Daan (The Netherlands); Dr. Jan E. Beyer (Denmark); Dr. Erik Hoffman (Denmark); Dr. Erik Ursin (Denmark); Dr. Ole Hagstrom (Sweden); Dr. Richard Berry (Miami, FL); Dr. W. F. Hettler (Beaufort, NC); Dr. Antonio Dicenta (Spain); Dr. Hans Ackefors (Sweden); Dr. John H. Wickstead (Plymouth, UK); Dr. Daniel Woehrling (Nantes, France); and a group from NWAFC's Auke Bay Laboratory, including Dr. Jim Olsen, Dr. Dick Straty, Dr. J. K. Karinen, and Dr. Richard Haight).

On 23 April, Robert Marak was visited by Dr. Ted Smayda, Dr. Ted Durbin, Dr. Anne Durbin, and Peter Verity.

A meeting on image scanning was held at the Narragansett Laboratory on 25 April and was attended by Perry Jeffries, Brad Brown, Lou Bivins, Ken Sherman, Bob Marak, and Ray Maurer.

On 30 April, the Narragansett Laboratory had four visitors from Malaysia: Dr. Radzuan bin Abdul Rahman, Captain Mohamed Ibrahim bin Mohamed, Dr. Leo Fredericks, and Dr. Abdul Sasekumar.

Jack Green attended a meeting of the food habits task group at the Woods Hole Laboratory on 25 April.

Lorrie Sullivan, Robert Marak, Jack Green, Donna Busch, Chris Powell, Red Wright, Tom Laughton, and Dan Patanjo attended a meeting at Milford to review progress and update at-sea sampling on MARMAP surveys.

Julien Goulet attended a 3-wk course on the IBM Corporation's computer language "JCL." Cindy Jones has been concentrating on standardizing SYMON (a three-dimensional program) plots of American sand lance abundance and on analysis of variance for those data.

Carolyn Griswold gave a talk on "The Effects of the Ocean Barge 250 Gasoline Spill on a Marine Ecosystem: A Regional Approach," to the Northeast Fish and Wildlife Conference during 1-4 April in Providence, RI.

The weekly in-house seminar presented by the House Committee of the Narragansett Laboratory was given on 20 April by John Hoey of the University of Rhode Island's Graduate School of Oceanography on "Biphenyls in Apex Predators."

Manuscripts

- Berrien, P., and M. P. Fahay. 1979. A description of the egg and larval development of the tilefish, Lopholatilus chamaeleonticeps. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./SD:Poster 9.
- Berrien, P. O., A. Naplin, and M. R. Pennington. 1979. Atlantic mackerel, Scomber scombrus, egg production and spawning population estimates for 1977 in the Gulf of Maine, Georges Bank, and Middle Atlantic Bight. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./DS:9.
- Beyer, J. E., and G. C. Laurence. 1979. Modeling growth and mortality of larval herring (Clupea harengus). Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./M:6.

- Bolz, G. R., R. G. Lough, and D. C. Potter. 1979. Autumn and winter abundance and distribution of ichthyoplankton on Georges Bank and Nantucket Shoals, 1974-1976, with special emphasis on dominant species. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./DA:Poster 1.
- Buckley, L. J. 1979. Biochemical changes during ontogenesis of cod (Gadus morhua L.) and winter flounder (Pseudopleuronectes americanus) larvae. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./SD:10.
- Kendall, A. W., Jr., and D. Gordon. 1979. Growth rate of Atlantic mackerel (Scomber scombrus) larvae in the Middle Atlantic Bight: a preliminary look. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./SD:Poster 4.
- Kirschner, R. A. 1979. April 1979 temperature transects of the Gulf of Maine. NMFS, NEFC, SOOP Rep. No. 79-04.
- Kirschner, R. A. The temperature and salinity structure in the Gulf of Maine. Annales Biologiques. (S)
- Langton, R. 1979. Food habits of nine species of pleuronectiform fishes from the Northwest Atlantic. Unpubl. MS.
- Langton, R., and R. Bowman. Food of fifteen Northwest Atlantic gadiform fishes. NOAA Tech. Rep. NMFS SSRF. (A)
- Laurence, G. C. 1979. Modelling--an esoteric or potentially utilitarian approach to understand larval fish dynamics. Chairman's Overview, Modelling Session, Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979.
- Laurence, G. C., B. R. Burns, T. A. Halavik, and A. S. Smigielski. 1979. Implications of direct competition between larval cod (Gadus morhua) and haddock (Melanogrammus aeglefinus) in laboratory growth and survival studies at different food densities. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./FM:3.
- Livingstone, R., Jr., and M. R. Pennington. 1979. The reproductive biology of the Georges Bank haddock (Melanogrammus aeglefinus L.): fecundity. NMFS, NEFC, Woods Hole Lab. Ref. No. 79-09.
- Lough, R. G., G. R. Bolz, M. D. Grosslein, and D. C. Potter. 1979. Abundance and survival of sea herring (Clupea harengus L.) larvae in relation to environmental factors, spawning stock size and recruitment for the Georges Bank area, 1968-1977 seasons. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./DS:7.

- Naplin, N. A., and C. L. Obenchain. 1979. A description of eggs and early larvae of the snake eel, Pisodonophis cruentifer (Ophichthidae), with comments on egg stages collected in the plankton. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./DA:Poster 17.
- Obenchain, C. 1979. Distribution and abundance of fish larvae in the New York Bight from July, 1974 to July, 1976, with a statistical analysis of their occurrence with respect to one another. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./DA:Poster 11.
- Saila, S. B., and R. G. Lough. 1979. Mortality and growth estimation from size data - an application to some Atlantic herring larvae. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./M:14.
- Sherman, K., R. Maurer, R. Byron, and J. Green. 1979. Relationship between larval fish communities and zooplankton prey species in an offshore spawning ground. Early Life History of Fish Symposium held at Woods Hole, MA, during 2-5 April 1979. ICES/ELH Symp./DA:Poster 26.

MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

MURT personnel have continued the analyses of Ocean Pulse data from Jeffreys Ledge in the Gulf of Maine. Several manuscripts are in preparation on: (1) geology and biology of Oceanographer Canyon; (2) biology and geology of Georges Bank and Mid-Atlantic Bight submarine canyon heads; (3) calibration of a clam dredge and its effect on substrate and bottom fauna; and (4) tunic coloration in a population of Halocynthia pyriformis, a sessile tunicate, from the Gulf of Maine.

The National Ocean Survey (NOS) and the R/V Pierce completed a bathymetric survey of the Jeffreys Ledge Ocean Pulse station under the direction of Lt. Charles Gross. Richard Cooper conducted a diver inspection of dive units in Seattle, WA, and Auke Bay, AK. Cooper served on a panel to review proposals from academia for NULS-II (National Underwater Laboratory System) program funding from NOAA.

DIVISION OF ENVIRONMENTAL ASSESSMENT

Behavior of Marine Fishes and Invertebrates Investigation

Studies examining the influence of thermal edges on the distribution of bluefish are continuing. In experiments to date, the lower temperature limit for juvenile bluefish exposed to a thermal gradient appeared to be about 12°C. An additional series of experiments were performed to examine whether this limit would be influenced (i.e., lowered) by motivational factors such as the presence of food. Fish were deprived of food for several days and exposed to a vertical temperature gradient. Food was then introduced into various portions of the gradient below 12°C, and the response of the fish recorded. Observations to date indicate that juvenile bluefish will enter and feed in temperatures lower than those which they had previously avoided, in some cases entering water down to 8°C while in pursuit of food. Data from these experiments will be analyzed to determine the lowest limit and be compared to acute lethal temperatures.

Biological Oceanography of Stressed Environments Investigation

Large Area Marine Productivity Experiment (LAMPEX)

The first of a series of Large Area Marine Productivity Experiments (LAMPEX) to test the feasibility of mapping chlorophyll-a and total suspended solids concentrations in surface waters of the continental shelf from Cape Hatteras to the Canadian border was conducted jointly by the National Aeronautics and Space Administration's (NASA) Langley Research Center's Marine Environments Branch, and our Division of Environmental Assessment during 17-21 April as part of the Ocean Pulse Program. Twenty-one federal, state, and private institutions from North Carolina to Maine participated. These included Cape Fear Technical Institute, Virginia Institute of Marine Science, Hampton Institute, Virginia Marine Science Consortium, University of Delaware, New Jersey Marine Science Consortium, New Jersey Department of Environmental Protection, Rutgers University, US Environmental Protection Agency (USEPA), Brookhaven National Laboratory, Atlantic Oceanographic and Meteorological Laboratories, MESA (Marine Ecosystems Analysis Program) New York Bight Project, Suffolk County (NY) Department of Health Services, State University of New York at Stony Brook, New York Ocean Science Laboratory, University of Rhode Island, EG&G, University of Massachusetts, Bigelow Laboratory for Ocean Science, Maine Department of Marine Resources, and the NEFC's Sandy Hook, Milford, Woods Hole, and Gloucester Laboratories.

The objectives of this joint research were: (1) initially to advance the development of improved systems and techniques for monitoring and assessing regional marine resources and environmental quality; (2) to increase our understanding of regional marine ecosystem processes; and (3) ultimately to provide an extensive, synoptic, integrated, and timely data base for application to problems of ocean resource and environmental management. Under the program, NASA was responsible for the remote sensing systems, data collection, and reduction. The NMFS was responsible for the organization, collection, and reduction of sea-truth data to calibrate the remote sensors.

During this particular experiment (17-21 April), NASA accomplished its remote sensing using two aircraft, a NASA U-2 flown at 19.7 km (65,000 ft) with an ocean color scanner (OCS) and Mitchell-Vinton cameras using aerial color and multispectral film (Craig Ohlhorst, Principal Investigator), and a NASA C-130 flown at 3.0 km (10,000 ft) with a multispectral scanner (Modular Multispectral Scanner M2S) and Zeiss mapping camera using aerial color film (Dr. Robert Johnson, Principal Investigator). The sea-truth data were collected at 19 locations depicted in Figure 1. Additionally, Landsat satellite imagery for these same locations and approximate times will be examined by Dr. Vic Klemas of the University of Delaware in an attempt to interrelate Landsat, U-2, and C-130 data based on sea-truth observations.

NASA U-2 inflight observations suggest successful, cloud-free coverage of a 14-mi wide swath along the coast between 19 and 21 April from Oregon Inlet, NC, to the Canadian border including Long Island Sound, but not Georges Bank.

NASA C-130 inflight observations on 17 and 19 April suggest successful quantitative coverage where concurrent sea-truth was available from Chesapeake Bay to Cape Cod, except for the coastal zone of New Jersey off Barnegat Inlet and Long Island at Fire Island Inlet where cloud cover prevented data collection. Cloud and light conditions hindered or prevented data collection north of Cape Cod and over Georges Bank.

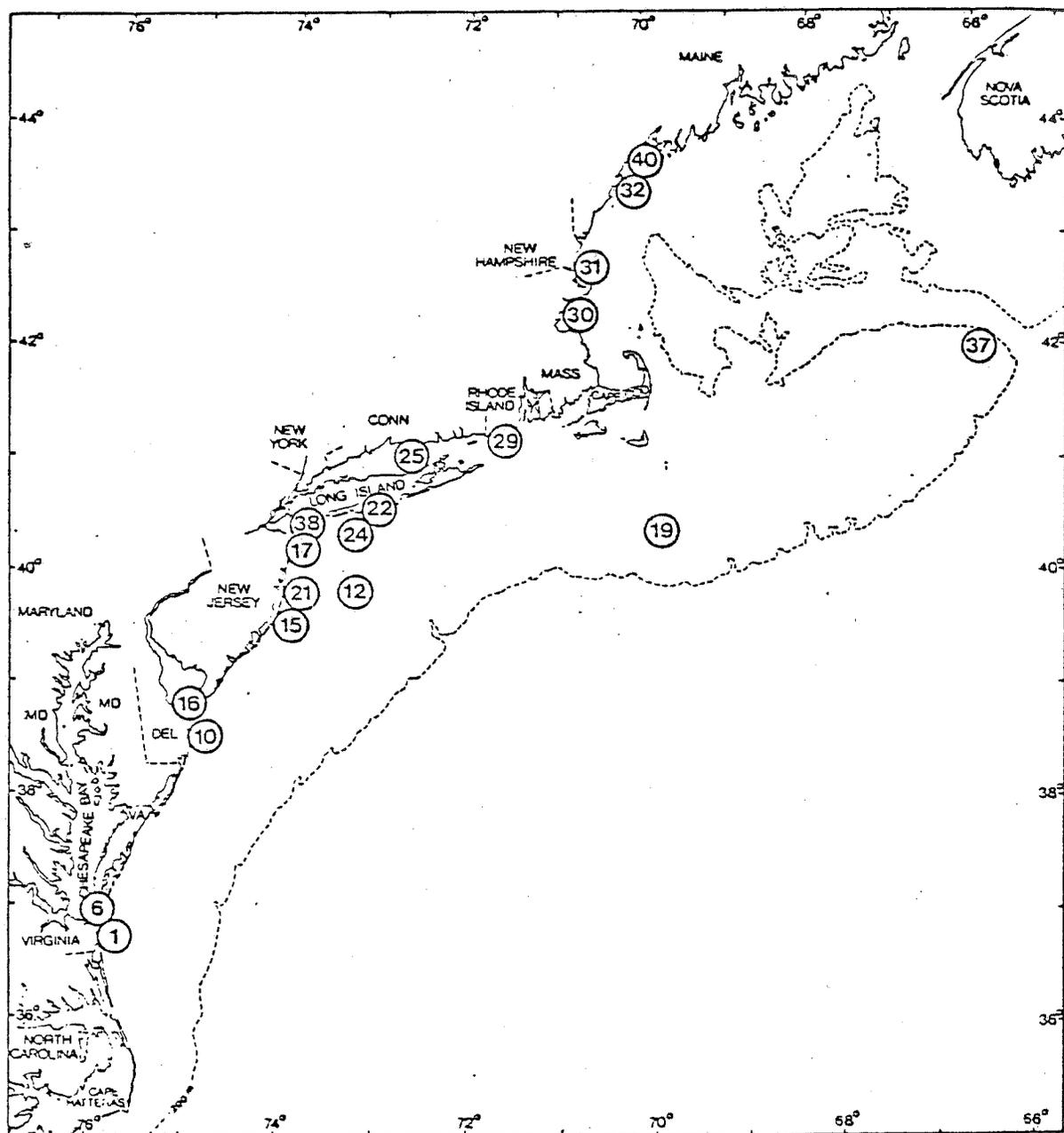


Figure 1. Locations where sea-truth data were collected. Locations 1, 6, 10, 12, 15-17, 21, 22, 24, and 38 were sampled on 17 April. Locations 17, 19, 29-32, 37, and 40 were sampled on 19 April.

Initial data reduction and preliminary analyses will take approximately 1 mo for the sea-truth data, 2 mo for the aerial photography, and 3-6 mo for the multispectral scanning data.

One hundred twenty-nine samples of whole-water, preserved phytoplankton samples were obtained from the R/V Advance II Cruise AD 79-01, an Ocean Pulse spring environmental monitoring cruise during 18-27 April. Samples were obtained from surface, 10 m, 20 m, 30 m, and bottom from each of 26 stations and will be examined by Myra Cohn and Harold G. Marshall of Old Dominion University in Norfolk, VA, to determine numbers and kinds of phytoplankton present. Work is proceeding on samples obtained during the Belogorsk cruise of 5 October-3 November 1978. These data are to be used as part of the Ocean Pulse baseline for phytoplankton.

Bill Phoel furnished a report for the Ocean County (NJ) Prosecutor's Office concerning a torso found washed up on a New Jersey beach. Surface and bottom currents, wind data, and the coroner's estimate of time in the water were used to approximate the torso's point of origin.

The preparation of papers to be presented at the International Symposium on the Effects of Nutrient Enrichment in Estuaries and the annual meetings of the American Society of Limnology and Oceanography is nearly completed.

The first draft of an Ocean Pulse report on the in situ metabolic determination of stress in starfish at the Pigeon Hill station in the Gulf of Maine has been completed.

Drs. John Mahoney and James Thomas reviewed a paper, "Effects of Diel Variation in Photosynthesis, and Incubation Time Upon Primary Productivity Measurements in New York Harbor," for Dr. Gary Kleppel of the Louis Calder Conservation and Ecology Study Center of Fordham University.

Coastal Ecosystems Investigation

Much of our effort involved planning and carrying out the spring Ocean Pulse environmental monitoring cruise aboard the chartered Advance II. The cruise took place during 18-27 April, with Frank Steimle as Chief Scientist and Chuck Idelberger handling the benthic sampling. Forty-eight stations between Nantucket Shoals and Cape Hatters were sampled. The full suite of Ocean Pulse measurements (including physiology, biochemistry, contaminants, bacteriology, benthic community structure, and energetics collection) was made at 18 stations. At 15 stations we made ^{14}C primary productivity estimates; chlorophyll, nutrient, and phytoplankton community structure samples were taken at most stations. The Advance II was one of over 20 vessels collecting sea-truth samples to relate to remote (aircraft and satellite) measurements of chlorophyll and suspended solids throughout the Northeast continental shelf environment, as part of the pilot Large Area Marine Productivity Experiment. Dave Radosh served as a communication coordinator, and Greg Parker helped transfer samples from the collecting laboratories to the Sandy Hook Laboratory for analysis.

Ann Frame completed her manuscript on new species of haustoriid amphipods from the New York Bight, and finished (with Bob Reid and Andy Draxler) a second draft of a paper characterizing the water column and benthos of Long Island Sound. Clyde MacKenzie and Frank Steimle each worked on several manuscripts. Sukwoo Chang was chiefly involved in developing a guidebook for biometric activities associated with the Ocean Pulse Program.

Environmental Chemistry Investigation

Several members of the Environmental Chemistry Investigation participated in the April Ocean Pulse survey aboard the Advance II. Vincent Zdanowicz collected 120 sediment samples for heavy metal analyses and prepared approximately 140 tissue samples (mostly rock crab, sea scallop, and flounder) for metal analyses. Jim Duggan and Jay O'Reilly measured the abundance of chlorophyll-a in netplankton and nanoplankton size fractions of the phytoplankton community. Approximately 680 determinations of chlorophyll-a were made on shipboard. Andy Draxler collected approximately 173 samples of filtered and unfiltered seawater which will be analyzed at the Sandy Hook Laboratory for major nutrients (i.e., nitrate, nitrite, phosphate, and silicate). Ammonium concentrations in seawater samples were measured spectrophotometrically aboard ship. Seawater samples were also filtered and frozen for dissolved organic carbon analyses. Measurements of daily primary productivity in several phytoplankton size fractions were made at 15 stations by Jay O'Reilly.

Several Investigation members spent much of April preparing for the joint NMFS/NASA LAMPEX study. Field kits (equipment and instructions) for chlorophyll analyses were distributed to LAMPEX participants. On 19 and 20 April, Chris Evans, Sue Barker, and Bill Hogelin completed chlorophyll determinations on samples sent to Sandy Hook Laboratory by LAMPEX participants. Data were completed and a report is being prepared.

Analyses for heavy metals in sediments collected during the Ocean Pulse September survey were completed.

Twenty additional samples (mussels, surf clams, sediments) were collected and sent to the NWAFC for hydrocarbon analyses as part of our MESA contract.

Ruth Waldhauer, Al Matte, and Andy Draxler made considerable progress with a manuscript dealing with nutrient distributions in the heavily sewage-impacted Raritan-Lower Hudson estuary.

On 10 April, Jay O'Reilly and Chris Evans participated in a MARMAP workshop held at the Milford Laboratory designed to discuss and evaluate several aspects of the NEFC ichthyoplankton-oceanography-productivity field program.

Physiological Effects of Pollutant Stress Investigation

Physioecology

Work continued this month on the study of long-term effects of silver on slipper limpets. Ambient seawater is 9°C and adults have begun to produce egg masses once more. Young adults have continued to produce egg masses and release larvae. Two separate groups of larvae exposed to 10 ppb silver have crawled out of their shells. Daily observance of these larvae has shown that the animals have kept growing and some of the larvae have undergone metamorphosis. It has not yet been determined whether the larvae that set have regenerated a shell. A third larval release from F₁ adults exposed to 10 ppb silver has continued to grow normally. To date, only one F₁ control pair has produced larvae.

A second diluter was set up to expose the F₁ generation of young slipper limpets. These animals were held at 25°C in 15-liter buckets over the winter. The young adults and juveniles have been exposed to 0, 1, 5, or 10 ppb silver over their entire lives.

Oyster larvae respiration studies continued this reporting period. Our microrespirometers failed to work more than they worked.

An attempt to spawn surf clams conditioned at 12°C for 3 wk was unsuccessful.

Blue mussels collected from a local beach were successfully spawned in the laboratory on two different occasions. The larvae are now being reared to metamorphosis at 17-18°C. One group of larvae reached an average size of 0.19 mm within 13 days after fertilization.

The results of a 10-day experiment to determine the effects of silver on embryos and larvae of the American oyster were unsatisfactory and the experiment will be repeated next month.

The remainder of the month was spent preparing two diluters for future exposure work.

We have been attempting to analyze for silver in seawater, but have had difficulty in analyzing concentrations as low as 5 ppb and have not been able to do samples at 1 ppb at all. We are now developing a new procedure for silver analysis that appears capable of measuring samples at the 1-ppb level and perhaps even lower. A recent comparison between the new method and our previous method gave varying results. Additional work is needed before a final method is produced.

Chemical research activities now occupy five rooms on the second floor of the annex building of the Milford Laboratory. In several weeks these activities will be consolidated and will thus need to occupy just two of the rooms. Some time was spent this month in planning this consolidation as well as designating the equipment and supplies to be shipped to the Sandy Hook Laboratory.

Biochemical Effects

This month has been largely spent on the continuing analysis of tissues from the winter flounder exposed to lead at 50 ppb for 60 days with a subsequent 2-day holding period in low-salinity seawater (17 ‰).

Liver data show significant depression of delta-aminolevulinic acid dehydratase activity in lead-exposed (ambient salinity) animals, with no change in this effect after 2 days at low salinity. Kidney data suggest some loss of ligand sensitivity. Kidney PK and LDH, however, were unchanged in fish after 60 days of exposure to lead (ambient salinity), but both enzymes were depressed at low salinity, as compared with low-salinity control fish. In contrast, cadmium-induced elevation of MDH activity at ambient salinity was somewhat lessened after 2 days at low salinity. Analysis of the hearts is in progress.

A manuscript, "Ecological Effects of Environmental Stress," was prepared for a forthcoming MESA symposium.

Anaerobic Bacteriology/Metabolism

Identification attempts of anaerobic cultures (not perfringens types) from samples obtained from a recent field collection are continuing.

A follow-up study on toxic oyster supernatants (cooperative experiment on heated American oysters being conducted with the SEFC's Charleston Laboratory) was performed to attain background information on the so-called nonspecific deaths (not due to botulinum) in mice due to the injection of the supernatants.

A preliminary screening experiment was initiated on the distribution of anaerobic bacteria in American oysters and mussels (from Long Island Sound) as part of Ocean Pulse activities and a cooperative effort with a graduate student from the University of Bridgeport.

Ocean Pulse Activities

Personnel from the Physioecology, Physiological Effects, Biochemical Effects, and Anaerobic Bacteriology/Metabolism Subtasks participated in an Ocean Pulse cruise aboard the Advance II during 17-27 April.

Meetings, Talks, Visitors, Publicity

Mr. John McInnes presented a poster on "Response of the Embryos of the American Oyster, Crassostrea virginica, to Heavy-Metal Mixtures" at the Northeast Fish and Wildlife Conference in Providence, RI, during 1-4 April.

On 7 April, Dave Radosh, Tom Wilhelm, and Bob Reid attended a New Jersey Academy of Science meeting in Lawrenceville, NJ, where they presented talks on benthic recovery from the 1976 hypoxia, the feasibility of splitting benthic samples, and the benthos of the Baltimore Canyon Trough, respectively.

Dr. Thomas traveled to the NASA Langely Research Center on 10 April to confer with Dr. Robert Johnson and make final arrangements for LAMPEX overflights during 17-19 April.

On 11 April, Bob Reid spoke to the Belmar, NJ, Kiwanis Society on environmental problems and studies in New Jersey coastal waters.

Dr. Thomas attended a MESA Synoptic Investigation of Nutrient Cycling workshop on 19 April at Lamont-Doherty to review a draft compendium report in preparation for producing a final report.

Dr. John Graikoski attended a local branch meeting of the American Society of Microbiology on 20 April at the University of Connecticut.

Bob Reid described the benthic macrofauna portion of the Ocean Pulse Program at the annual East Coast Benthic Ecology meeting held in Durham, NH, on 21 and 22 April.

Dr. Anthony Calabrese hosted Mr. Kyoichi Kawaguchi, Chief of Planning and Coordination of Fisheries Research for the Japan Fishery Agency, on 23 April.

On Monday, 9 April, Dr. John Pearce met with Drs. Paul Lefcourt and Hans Krump of the USEPA. They are interested in the developing ICES oil spill response plan which is being prepared jointly with input from representatives of several ICES member nations. The USEPA is especially interested in the studies of the effects of dispersant application following onshore and offshore oil spills.

On 10 April, Dr. Pearce chaired a special review committee set up to examine and evaluate proposals submitted to the New Jersey Department of Environmental Protection (NJDEP) in regard to establishing grants to academia, industry, and various governmental agencies for studies of oil spills and the effects of oil pollution. The review committee, consisting of 15 individuals from the academic and government community reviewed 42 proposals of which 12 were recommended for funding through grants from NJDEP. The majority of the proposals related directly to Ocean Pulse activities, especially those which have to do with estuarine studies in Raritan Bay and Delaware Bay as these relate to the formal offshore assessments and monitoring activities conducted by the Ocean Pulse Program.

On 11 and 12 April, Dr. Harald Rosenthal, from Biologische Anstalt Helgoland in Hamburg, FRG, visited the Sandy Hook Laboratory. He talked with various scientists at the laboratory and worked with Dr. Pearce in planning the upcoming Helgoland symposium scheduled for late September 1979. The principal topic of the symposium this year has to do with measuring environmental pollution and developing management techniques for habitat protection.

On 15 April, Mr. Joseph Forns, consultant to the NOAA Spilled Oil Research Team, visited the Sandy Hook Laboratory to advance further the preparation of the USEPA-NOAA oil spill response document which has evolved from workshops held at Philadelphia, PA, in August 1979, and at Santa Barbara, CA, in December.

On 16 April, two Polish scientists, Dr. B. Lubieniecki and Mr. M. Zawadski, visited the Sandy Hook Laboratory to meet with scientists conducting research in environmental protection and disease and aquaculture of marine organisms. The scientists were at Sandy Hook through 17 April.

On Monday, 23 April, Dr. Judith van Buren, Director of the Monmouth (NJ) Museum, visited with Dr. Pearce in order to get background information for establishing a yearlong special exhibit concerned with the New Jersey coastal environment and the various problems of environmental deterioration and pollution which are affecting the coastal zone. Members of the Monmouth Museum special panel accompanied Dr. van Buren in order to look at displays that were earlier established for the Oceans Festival held at the Coney Island (NY) Aquarium in 1976.

On 25 April, Dr. Robert Able, Sea Grant Director for the New Jersey Marine Sciences Consortium (NJMSC), met with Dr. Pearce to discuss programs in habitat protection and environmental monitoring. The NJMSC is interested in interfacing its various programs with ongoing environmental research activities at the Sandy Hook Laboratory.

Manuscripts

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Radosh, D. J., and R. N. Reid. Impacts to benthic macrofauna and recolonization following 1976 hypoxia off New Jersey. *Bull. N.J. Acad. Sci.* (Abstr.). (S)

Reid, R. N., A. B. Frame, T. E. Wilhelm, and D. J. Radosh. Sediments and benthic macrofauna of the Baltimore Canyon Trough off New Jersey. *Bull. N.J. Acad. Sci.* (Abstr.). (S)

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Steimle, F. W., and C. J. Sindermann. 1978. Review of oxygen depletion and associated mass mortalities of shellfish in the Middle Atlantic Bight in 1976. *Mar. Fish. Rev.* 40(12):17-26. (P)

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Wilhelm, T. E., and F. W. Steimle, Jr. Effectiveness of three aliquot samples in splitting benthic macrofauna. Bull. N.J. Acad. Sci. (Abstr.). (S)

AQUACULTURE DIVISION

Spawning and Rearing of Mollusks Investigation

We continued to have good success spawning laboratory-conditioned bay scallops. Two spawnings in April produced 18 and 16 million eggs, respectively. Development to straight-hinge stage averaged about 30%. Larval growth rates were normal and the first group has begun metamorphosis. It appears that we will obtain a reasonable number of post-set scallops from this group; these animals will become the stock we use in our summer work.

An experiment to determine the survival of bay scallops at low temperatures and low salinities (for example, a spring runoff in an estuary) was performed. We intend to monitor mortality in the animals exposed to various temperature-salinity combinations for some time to determine latent mortality, but to this point survival has been dramatically better than in an experiment performed earlier at higher temperatures. For example, at 5°C some survival was noted at exposures for as long as 48 hr at 0 ‰ salinity, whereas at 22°C there was no survival at even 4-hr exposures to 10 ‰ salinity.

Adult surf clams collected from 8°C Rhode Island waters were ripened for spawning at 15°C in less than 2 wk. Phytoplankton levels were elevated during the ripening period due to a spring diatom bloom. Gametes collected from the spawning were fertilized and developed to the straight-hinge stage at an unusually high survival rate of 95%. Larvae from this spawning are being reared to provide clams to be used in field planting studies this summer.

To study the nutrition of bivalves in natural seawater, data are being compiled in an attempt to relate the levels of chlorophyll-a and phaeophytin pigments to in vivo fluorometric readings. The levels of fluorescence of seawater have been shown to be proportional to the amount of plant pigment present and the rate of growth of bivalves.

Aquacultural Genetics Investigation

Selective Breeding of the American Oyster

An annual census of the American oysters constituting the mass selection experiment for juvenile growth rate, the family selection experiment for meat yield, and the larval selection experiment for larval growth rate is completed. Parental stock (1976 year class) for the mass selection experiment as of spring 1979 consists of 6,711 three-year-old oysters, a 39% loss from a year earlier. There are 2,557 oysters in the fast selected line, 2,007 oysters in the slow selected line, and 2,147 oysters in the control line. The F₁ generation (1978

year class) of this experiment consists of 5,367 one-year-old oysters, 24,026 oysters in the high line, 20,000 oysters in the low line, and 6,341 oysters in the control line. Further selection on the 1978 year-class oysters will be done in the fall of 1979.

The parental stock (1977 year class) of the family selection experiment for meat yield is made up of 30 families with a total of 13,488 oysters. This is a 52% loss from the 1978 count. Loss was spread out through all families; only two family lines were lost completely. There are 16 families (6,658 oysters) in the high-yield selected line and 14 families (6,830 oysters) in the low-yield selected line. These animals are currently being bred to produce the F₁ generation of this experiment.

The larval selection experiment consists of spat collected on a daily basis from seven families of the 1977 year class. All spat were labeled as to day of set. This year's oysters that set early during the setting period are being mated to other early setters. Oysters that set late in the setting period are being similarly mated among themselves. There are 580 oysters in this experiment; 182 early setting oysters from five families and 398 late setting oysters from seven families.

Experimental Hybridization and Inbreeding of Oysters

Salinity, temperature, and bacterial tolerance trials were conducted with hybrid and non-hybrid larvae of American and Japanese oysters. Preliminary results suggested that larvae of the local American oyster controls generally survived better under normal culture and environmental conditions (temperature and salinity) of this local area. At a low temperature of 10°C, eggs and larvae of the Japanese oyster (*Crassostrea gigas*) appeared to develop better and so did the hybrid with that oyster as the female. None of the egg and larval groups survived as well at 35°C. Some undeveloped eggs were apparent along with larvae in several advanced hybrid cultures, a condition consistent with and supported by cytogenetic examination of early stages of these hybrid crosses. Many of the eggs were still in metaphase I of meiosis 1 hr after fertilization. Salinity experiments were more difficult to assess, as sometimes eggs and larvae of both species seemed to fare better at low salinities of 10-12 ‰ than at the normal salinity. The lower salinity may have been intolerable to an alga that has produced a recent bloom and possible toxic substance, which has interfered with normal development and survival of larvae under usual culture conditions. No significant differences were observed between groups in bacteria-exposed cultures.

In hybridization studies at the geographic level, larvae resulted from a backcross initiated between F₁ hybrids of Virginia and Long Island parents and local Long Island oysters. Larvae from crosses made to obtain F₂ full-sib progeny are being used to compare with these for survival and growth. Several of these family lines for inbreeding have conditioned successfully and are being crossed now.

Cytological and Cytogenetic Studies of Fish Eggs

A poster (and abstract) display ("Cellular, Mitotic, Chromosomal, and Embryologic Development of Early-Stage Fish Eggs from Plankton Collections in Relation to Pollution and Earliest Life History," by A. Longwell and J. B. Hughes) was prepared and presented at the ICES-sponsored Symposium on the Early Life History of Fish at Woods Hole in April.

A. Longwell spent time working on a 47-page, 14-photomicrograph report ("Cytologic, Cytogenetic, and Embryologic Conditions of Early-Stage Atlantic Mackerel Eggs in Sea Surface Waters, Natural and Unnatural Stress Factors, Researching and Monitoring Biological Effects of Ocean Pollution," by A. Crosby Longwell and J. B. Hughes) and on recommendations of the Genetics Panel of the ICES Workshop on Monitoring Biological Effects of Pollution in the Sea.

An abstract ("Cytologic, Cytogenetic, and Embryologic State of Atlantic Mackerel Eggs from Surface Waters of the New York Bight in Relation to Pollution," by A. Crosby Longwell and J. B. Hughes) is in preparation for a June symposium on the New York Bight.

• Comments and recommendations stemming from the Genetics Panel meeting during the ICES Workshop on Monitoring Biological Effects of Pollution in the Sea are in preparation by A. Longwell.

The survey of the chorion state of Atlantic mackerel eggs sampled at 15 New York Bight sites in 1978 is now well underway.

Meetings, Talks, Visitors, Publicity

Two thousand 10-mm surf clams were supplied to Mr. Chris Andrews of Cotuit (MA) Oyster Company. Their growth will be evaluated in a culture system comprised of trays suspended in a natural salt pond. Mr. Andrews spent 2 wk in training in aquaculture procedures at the Milford Laboratory.

Ms. S. Stiles conducted tours of the Milford Laboratory for two groups of 25 students each from Troup Middle School in New Haven CT. Mr. Warren Landers hosted a class from Suffolk County Community College in Riverhead, NY.

Visitors this month included Dr. Ake Granmo of the Swedish Department of Environmental Protection, Mr. Kyoichi Kawaguchi of the Japan Fishery Agency in Tokyo, Dr. Vladimir Kasyanov of the USSR's Far East Science Center in Vladivostok, and Mr. and Mrs. Ko Prins from Yerseke, Holland.

Manuscripts

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PATHOBIOLOGY DIVISION

Comparative Invertebrate Pathology Investigation

Histologic materials were examined and service sample reports were prepared for six areas in the United States, namely: American oysters from Massachusetts, Rhode Island, and New York; Japanese oysters and European oysters (Ostrea edulis) from two hatcheries in California; European oysters from Maine; scallops and hard clams from Massachusetts; and abalone from Alaska. No unusual pathology, parasites, or micropathogens were observed in these samples. However, from

recent and past microscopic examinations of histologic slides, we recognize that major disease and parasite problems are beginning to become more severe with the indiscriminate transfer of shellfish. Apparently, some molluscan hatcheries in the US are routinely utilizing open or untreated seawater in their spawning, nursery, and grow-out systems, thereby enhancing the potential for infection or infestation of animals intended for transplantation. Furthermore, regulations and policies related to the movement of exotic species remain unclear. In attempts to clarify some aspects of molluscan transports within the US and abroad, members of the staff have participated in ICES working group meetings and workshops, and held conferences with other Federal and State officials and their representatives. Considerable time was spent in preparing documents for these meetings and workshops.

Thin sections of tissues from normal American lobsters and others infected with Aerococcus are in the process of study. A previously unreported result of gaffkemia is abnormal lipid storage by hemocytes, developing hemocytes still in the hemopoietic tissue, and certain cells associated with the myocardium. The latter do not appear to be myocardial cells, and further investigation may show that they are the so-called "satellite cells" that are associated with both cardiac and skeletal muscle in crustaceans. Of unknown function, satellite cells also occur in vertebrate striated muscle.

The final draft of the chapter on crustacean viruses, rickettsiae, etc., prepared for "Biology of the Crustacea" is now being typed. "Histology of the Blue Crab" has been submitted to an invertebrate physiologist for review.

Over 1,600 tissue blocks were sectioned and approximately 500 stained slides of various fish, crustacean, and molluscan tissues were prepared by the histology lab for microscopic examination.

Fish Pathology Investigation

A redirection of priorities to maximize participation in the Ocean Pulse Program has been initiated. Cytological (light and electron microscopic) studies of selected species of larval fish will focus on the morphological and biochemical changes that occur during the "critical time period." At this time, larvae have utilized their intrinsic food source (i.e., yolk) and must obtain an extrinsic one. This normally involves predation and effective utilization of food.

Principal efforts, at first, will include an examination of modifications that take place in both the sensory and digestive systems as correlated with increasing effectiveness in food gathering behavior and conversion. In addition to studies of larvae undergoing normal development, special attention will be given to larvae with naturally appearing teratological and/or metabolic defects. Such defects may be present in larvae that fail to develop in an environment where food is abundant (i.e., laboratory culture).

The research activities planned include experiments using heavy metal contaminants known to have adverse effects on sensory tissues. It will be of particular interest to note whether the presence of the contaminant delays or precludes specific morphogenetic events, results in the cytopathological disruption of certain tissues, or enhances the development of teratological defects.

The research will be conducted in conjunction with Dr. G. Laurence and his staff at the Narragansett Laboratory and will be performed under carefully controlled conditions. It is hoped that the data may eventually be useful in interpreting observations made on larval fishes from the natural environment.

Microbial Ecology Investigation

The seasonal and cumulative incidence of "black gill" in rock crabs was calculated from data obtained from Ocean Pulse stations in the New York Bight apex and in Sandy Hook Bay and Lower Raritan Bay during 1973-78. The total number of crabs from all collections was 2,335 and approximately 5% (122) of them had the black condition. The lowest incidence (0.5-2%) occurred during January-March which coincided with molting activity of adult males. The highest incidence was approximately 9% and coincided with intermolt stages of growth. All crabs from the Bight apex were caught within a radius of 5-6 mi of Ambrose Light and were, in close proximity to known sewage disposal sites. Published reports on concentrations of various pollutants in the Bight are being reviewed to determine metal levels, bacterial counts, and fecal sterol (coprostanol) in or near the stations that were sampled for rock crabs. Field studies supported by the MESA New York Bight Office have been completed and findings are in the process of being analyzed to determine the statistical significance of gross and microscopical observations.

Mr. Earl J. Lewis participated in an April USEPA cruise to the Ocean Pulse station in the Philadelphia-Camden sewage dumpsite area. Foul weather hampered trawling operations for most of the cruise, but 27 rock crabs were caught for histological and heavy metal studies. A total of 612 crabs have been obtained from the area and the sample size is almost large enough for statistical analyses on the incidence of "black gill" in a second sewage disposal site. Fifty-two sediment grabs were sampled in triplicate for growth studies of Acanthamoeba. Several indicator species of Acanthamoeba routinely have been isolated from sewage-impacted sediments in the Bight apex and in the Philadelphia-Camden site. Bacteria are the only known natural food organisms for Acanthamoeba which suggests that recognized bacterial-loading in the dumpsites is related to the frequency with which positive cultures are obtained from the sediments. Quantitative estimates on the numerical abundance of amoebae in known amounts of sediment are needed to determine whether sediments harbor both encysted and trophic stages of protozoans.

Larval Diseases of Mollusks Investigation

A common practice among investigators working with cells of the immune system of mollusks and other animals is to wash the cells by pelleting in a centrifuge followed by resuspension in physiological solutions. Viability of cells is determined by testing the ability of the cells to exclude certain stains, such as trypan blue or erythrosine B. By using another measure of cell function, namely the ability to attach to plastic cell culture dishes, we have found that oyster hemocytes may be affected by even low centrifuge speeds. Significant cell losses and reduction in the percentage of cells capable of attachment were found; both effects increased with increased time of holding in pellets.

Experiments are being conducted to determine how long the toxic metabolite produced by a pathogenic Vibrio can last before breaking down. This is necessary so that isolation and characterization procedures can be carried out before the potency of the toxin is lost. Thus far, experiments indicate that under refrigeration the metabolite breaks down quickly. A portion of the filtrate now being concentrated will be held in a freezer to determine whether the life span of the metabolite can be extended by freezing.

A cruise aboard the R/V Shang Wheeler to shellfish beds in Norwalk, Bridgeport, Stratford, and New Haven, CT, was conducted on 4 and 5 April. Surface, bottom water, and sediment samples were bacteriologically plated for individual colony counts and separation of the predominant flora. One hundred thirty isolates were recovered and challenged against oyster embryos in five separate experiments. The data are still being analyzed.

During this period, 12 ozone-UV quarantine runs were completed in cooperation with the Aquacultural Genetics Investigation.

Additionally, paralytic shellfish toxin isolation and purification cooperative research with Fairfield University continued with mouse bioassay confirmation of high pressure liquid chromatography-separated peaks.

Meetings, Talks, Visitors, Publicity

Dr. Rosenfield and Mr. Farley attended the ICES workshop meetings at Weymouth, UK, and visited laboratories at Plymouth and Swansea during 2-9 April; Dr. Rosenfield met with staff of the NMFS Office of Utilization and Development regarding quality and safety standards on 16 April in Washington, DC; on 19 April he met with State and Federal representatives in Kittery, ME, to discuss programs on marine fish and shellfish disease control, habitat protection, and related matters; on 26 April he met with the Laboratory Director of the Sandy Hook Laboratory to discuss NMFS fellowships and postdoctoral programs with representatives from Cornell University and the University of Pennsylvania; and on 28 April Dr. Rosenfield attended a dedication of the National Fish Health Research Laboratory at Leetown, WV.

Ms. Sharon MacLean attended the Atlantic Estuarine Research Society meeting in Rehoboth, DE, on 26 and 27 April.

Dr. Dan Cohen, Director of the National Systematics Laboratory, presented a seminar at the Oxford Laboratory on 24 April titled "A Visit to the Peoples Republic of China with Comments on Marine Biology and Aquaculture."

Visitors to the Oxford Laboratory during the month of April were: Mr. Roland Paine, NOAA Office of Public Affairs in Washington, DC; Dr. Kyoichi Kawaguchi of the Japan Fisheries Agency in Tokyo; Ms. Margaret Pike of Billings, MT; Mr. Chris Powell of the Narragansett Laboratory; Mr. Don King, Mr. Hubert Spielman, and others from the Department of State Office of Environmental Affairs in Washington, DC; and Ms. Nancy Lomax of the Center for Environmental and Estuarine Studies in Cambridge, MD, conferred with the Oxford Laboratory staff on 25 April concerning her plans of establishing crustacean cells in culture.

Manuscripts

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Sawyer, T. K. Species diversity among marine protozoa in sediment from a sewage disposal site. *J. Protozool. (Abstr.)*. (S)

Ziskowski, J. J., T. A. Valentine, Jr., and R. A. Murchelano. A bent fin ray condition of winter flounder, Pseudopleuronectes americanus (Walbaum), from Sandy Hook and Raritan Bays, New Jersey, and Lower Bay, New York. *Copeia*. (A)

RESOURCE UTILIZATION DIVISION

Fisheries Engineering Investigation

The R/V Rorqual was operational on 1 April as scheduled. The vessel successfully made two short trips to break in the engine and to make a practice run in preparation for the LAMPEX cruise. Unfortunately, a new oil pump, installed just before the LAMPEX cruise, proved faulty, forcing the vessel to return to port before actual sampling could begin. An alternate vessel was obtained and sampling was successfully carried out during the latter part of the scheduled flight period.

A major portion of our time this month has been spent preparing to study sea scallop gear and gear-related scallop behavior. Completed are the design, construction, and installation of new gallows frames and the reinstallation of the winch removed while the vessel was stationed at the Sandy Hook Laboratory. In progress is work on mounting deck blocks, the winch, and hydraulic system, and the construction of additional berthing.

Additionally, a commercial vessel was rerigged and outfitted to fish our small beam trawl. One cruise was made which was inconclusive due to a bad tear-up.

A paper is in progress titled "Fisheries Engineering in the Northeast" to be submitted to the Marine Technology Society Journal.

Dan Baker traveled to the Milford Laboratory to participate as a member of a team to evaluate the bids received relating to specifications for the salinity-monitoring system to be installed in the laboratory seawater system.

Resource Development and Improvement Investigation

New Product Development

Joe Mendelsohn and Kurt Wilhelm traveled to the US Army North American Research and Development Command (NARADCOM) at Natick, MA, to discuss replumbing our retort to make it more compatible for heat-processing retort puches. Dr. Shulz's assistant made some suggestions on the types of valves needed and the best way to introduce the water, steam, and air into the retort.

A meeting was held with Ray Stawicki and Seth Young of Geosource, Inc., in Houston, TX, to discuss the application of their processing machinery to fish. Although their equipment is built for processing foods other than fish, some of the principles employed could be useful in processing fish. The principle behind their sorting equipment is that large items have high resistance to air flow. This could be used for sizing fish.

Storage Effects

Joe Mendelsohn and Vin Ampola set up the Hunter L. colorimeter and became acquainted with its calibration and operation. The color of samples of frozen, thawed, and cooked haddock was determined. From the results, the instrument appears to be operating properly.

Large Area Marine Productivity Experiment (LAMPEX)

Several investigation members were involved in water sampling as part of a joint NASA/NMFS project designed to coordinate films taken from the air with corroborating data taken along the same course from seagoing vessels. The water was sampled for chlorophyll and suspended solids.

Surf Clams

A search was conducted for a site for depuration and live storage of an anticipated 20 bu of yearling surf clams. The clams, from the Milford Laboratory, will be available this summer for our use.

Shucked yearling surf clams stored for 8 mo at -20°C are equally acceptable to taste panelists as fresh steamed and/or fried surf clams. Surf clams fast-frozen in the shell 8 mo ago are significantly lower in flavor and odor than the fresh control.

We welcome on board Sandra Anderson, a Northeastern University Co-op student, who will be helping with the surf clam program until August.

Cholesterol

Literature searching continues; a gas chromatograph has been ordered; a license has been submitted for use of ^{14}C -labeled cholesterol; and thin-layer plates should be arriving any day.

Storage of Blue Mussels

This study continues. Work on the manuscript on this topic raised some questions that deserve researching.

Crayfish

A feasibility study of crayfish processing using the roller meat extractor demonstrated that it is possible to extract the tail meat with equipment which is currently being used for crab processing. The tail sections of 3.27 kg of live crayfish were broken off for processing. The tails represented 27.1% of the live weight. When roller-extracted and steam-cooked for 1.5 min, the recovery was 15.0% of the live weight or 55.5% of the tail weight. The cooked

tails had a shrimp-like appearance, being white, curled, and without the intestinal vein. Handpicked crayfish tails were red and straighter. The commercially handpicked yield is about 16.5%. The crayfish bodies were fed into the Baader 696 meat/bone separator. The recovery was 57.4% of the body weight. The resulting product is light brown in color and has a thick, soupy consistency. It appears to have potential as a chowder base.

Rock Crabs

Artificial crab meat lumps were made from the meats (extracted on the Baader 696 meat/bone separator) of blanched and fully cooked rock crabs. The meats were mixed together in a 1:1 ratio, and lumpmeats were made using the steam-cook and alginate techniques. The steam-formed lumpmeats fell apart while being tapped out of the mold. The alginate-formed meats were packed in cans, topped off with a 2% salt solution, sealed, pasteurized, and stored at 34°F. Two weeks later, the meats were examined. They had held their shape very well, but the lumpmeats had darkened to a gray color and lacked the flavor of rock crab meat.

Blue Crabs

In preparation for forthcoming blue crab work, the Fish House has been cleaned out, with the tanks cleaned of clam shells and filled with fresh seawater.

Krill

Additional information received by John Kaylor this month on krill necessitates some revisions in the paper being prepared. The revised paper is expected to be completed by the end of May.

Species Identification

In the past, John Kaylor has identified fish of various species for the US Food & Drug Administration (FDA). As a result of one identification, John was approached by FDA to be the chief witness in a court case involving the substitution of Greenland halibut for imported true sole. He spent a considerable amount of time with the FDA lawyer on the case only to have the defendant sign a consent decree at the very last minute.

Papers in Progress

The second draft of the paper on the evaluation of the whiting (silver hake) prototype heading and cleaning machine is being rewritten as suggested by the reviewer.

The first draft of a paper on new minced fish products with commercial potential has been started.

The first draft of a manuscript on squid technology has been edited and submitted to the program leader for comments.

The first draft of "The Slipper Limpet (Crepidula fornicata) and Its Potential as a Food Resource" by K. A. Wilhelm, M. A. Perry, and R. J. Learson is being circulated for review.

Product Quality, Safety, and Standards Investigation

Product Quality

Precooked (blanched) breaded sticks of South American hake prepared from fillets which had received various treatments were examined after 44 wk at 0°F. The treatments included control, erythorbate dip, defatting, and combined erythorbate dip and defatting. The control and erythorbate-dipped samples were scored unacceptable in flavor; the defatted samples were borderline; and the combined erythorbate-defatted samples were rated fair. All samples were rated fair to borderline in texture with no significant difference due to treatment.

The study on the Torrymeter evaluation on whole, iced American plaice was completed. Results will be reported later.

Seven hundred fifty pounds of red hake were filleted, skinned, and made into frozen blocks as part of the cooperative study with the University of Massachusetts on the New England Fisheries Development Program (NEFDP) contract; "Profile of Frozen Red Hake."

A meeting was held with students and faculty members of the Food Science Department of Essex Agricultural Institute to discuss and formulate plans for an exhibit at the annual open house to be held by the Institute. The theme to be presented will be red hake, one of the few remaining truly underutilized finfish species in this area. We prepared 60 lb of frozen skinless fillet blocks which the students will convert into various products for their exhibit.

Eight collaborators have agreed to participate in the Association of Official Analytical Chemists (AOAC) collaborative study of a method for identifying fish species by isoelectric focusing. Fresh fish from 14 species were obtained, filleted, skinned, and frozen in poly bags for use in the study. These samples will be sent out to collaborators as soon as the Ampholine PAGplate gels arrive from LKB Instruments.

Work has continued on a gas-liquid chromatography (GLC) method for simultaneous analysis of volatile amines. A change from a 6-ft to a 9-ft (x 2 mm ID) column packed with untreated Chromosorb 103 resulted in a much better separation of methylamine, dimethylamine, and trimethylamine. Recoveries of these three amines from spiked samples of whiting have averaged 80-100%. Detection of these amines using propylamine as an internal standard is very good allowing us to determine individual amines ± 0.5 mg/l.

Product Safety

Workup of retail samples of finnan haddie and smoked cod have been completed. Samples fortified with N-nitrosamines at the 2.5 and 5-ppb levels have also been worked up.

A 25-m x 0.01-inch glass capillary column was installed in the Perkin-Elmer 910 GC. Optimum gas flows for the analytical column, precolumn, and purge were determined. Column conditions were optimized. The column is attached to an inlet splitter and is operating very well. The column achieves very highly efficient separations for volatile N-nitrosamines and at less time than the conventional packed column.

Irradiation of individual N-nitrosamines in isooctane solvent was completed. The dose levels selected were 250K, 500K, and 1,000K rads. The solutions have been analyzed by GC.

The N-nitrosamines studied were dimethyl, diethyl, dipropyl, dibutyl piperidine, pyrrolidine, and morpholine. The purpose of the study is to see whether a significant reduction of N-nitrosamines occurs by irradiation. Results of the experiment indicate that this does happen. We plan to extend it to fishery products. Even a 50% reduction in fishery products would be quite significant because most products analyzed to date have been quite low in nitrosamines.

Don Gadbois is in the process of collaborating with Dr. Krull of Thermo Electron Corporation on writing a review paper on nitrosamines. Also, a technical paper on nitrosamines in fish products will be written by Don. The two papers will be submitted to the Journal of Agriculture and Food Chemistry.

Don worked on forming a project advisory committee for polychlorinated biphenyls (PCB). He solicited proposals from Analytical Biochemistry Laboratories, Hazelton Laboratories, and Biomeasure on a proposed method of analysis for PCB residues in fish tissues. He ordered an electron capture detector, software, and an automatic injector for the Sigma-1 GC in connection with the PCB work.

Product Standardization

On 5 and 6 April, John Ryan, Fred King, and Joseph Carver participated in a meeting of a task force preparing a position paper on the role of the Standardization Program in NMFS. Jim Brooker of the Washington Office, Phil McKay, Chief Inspector of the Northeast Inspection Office, and Don Mahar of the Pascagoula (MS) Inspection Laboratory are also members of the task force. John Ryan is responsible for preparing a rough draft of the paper by 30 April 1979.

On 16 April, John Ryan and Joseph Carver participated in an informal meeting with specifications development personnel of NARADCOM. The need for early development of USDOC voluntary standards for battered portions, oysters, and clams was stressed by the military. A report by the Defense Personnel Support Center indicating a cumulative saving of \$5 million accrued in the purchase of fish sticks and portions as a result of the transfer of seafood inspection to USDOC was discussed.

This month's Codex (international standards development) activity includes preparation of US comments for the proposed standards and codes of practice to be presented at the 13th Session of the Codex Committee on Fish and Fishery Products in Bergen, Norway, during 7-11 May.

Thanks to improving weather conditions, we were able to provide a variety of fresh fish samples each week for the comparative edibility study at NARADCOM.

On 20 April, Fred King participated in an informal review of progress being made under a contract with NARADCOM titled "Consumer and Instrumental Edibility Measures for Grouping Fish Species." In addition to several NARADCOM scientists, the participants included two representatives of the National Food Processors Association (formerly the National Cannery Association), a staff attorney for the Community Nutrition Institute, and two representatives of the NMFS Washington Office. The visitors were highly impressed by the progress made on a difficult problem.

Technical Assistance

Division personnel provided information and technical assistance in the following areas: resources for fish cooking demonstration; Sea Grant activities in New England; eels; minced fish; sand eels; aquaculture; fishing safety; fish plant sanitation; sanitation and quality control; safety placards; career

opportunities in NMFS; white crappie; walleye; skates; "cod worms"; recipes for cod steaks; langostinos versus Norway lobster; spiny lobster versus American lobster; freezing of lobsters; verify another "golden haddock"; handling of squid; histamine in scombroid fish; physical and sensory similarities of gadoid fish from a fast-food chain; the Iwema meat/bone separator; instructions for grading fish portions, cod fillets, and fish blocks; use of freshwater drum for producing fish blocks for use in commercial fish portions; promising underutilized species for use in commercial fast-food operations; moisture content of skate in fish portions; utilization of fish blocks made from discarded napes; composition of fish; comments and suggested changes on a "Japanese Code of Practice for Cephalopods" standards; data on the freezing preservation of blue crab meat; information on the biochemical spoilage indices of squid; information on preventing discoloration in squid.

Meetings, Talks, Visitors, Publicity

Mike Allsup gave a slide presentation of his Antarctic trip (krill expedition) to the Food Science Department of Essex Agricultural Institute, the NEFC Board of Directors meeting at the Milford Laboratory, and to the Ad Hoc Scientific Committee meeting on krill at Washington, DC.

Dr. Raul Trucco, Technical Director of the Argentinian National Institute of Industrial Technology, spent several days at the Gloucester Laboratory as part of a 5-wk visit to this country. He was interested in learning of current fisheries research and industry practices.

Mary O'Donoghue of the Massachusetts Cooperative Extension Service visited the Gloucester Laboratory to seek assistance for a fish display at the Plymouth Fishermen's Festival.

Neil Potash also visited the Gloucester Laboratory to gather information on the types of NMFS positions in the Gloucester area.

Manuscripts

Krzymowek, J., and K. Wiggin. Seasonal variation and frozen storage stability of blue mussels. J. of Food Science. (S)

NATIONAL SYSTEMATICS LABORATORY

Benthic Fishes Investigation

A preliminary listing was prepared of species in several argentinoid and gadoid families to be included in a United Nations Educational, Scientific, and Cultural Organization (UNESCO)-sponsored "Checklist of Fishes of the Eastern Tropical Atlantic." A note was prepared discussing usage of the common names "hake" and "whiting." Work continued on a systematic revision of the toadfish genus Batrachoides.

Pelagic Fishes Investigation

Work continued on the systematics of the Spanish mackerels and of Indo-West Pacific marine half-beaks.

Crustaceans Investigation

A revision was completed of the homolid crab genus Latreillia. Studied were brachyuran crabs caught in deepsea hot water vents along the Galapagos rift zone. A note was worked on describing unusual occurrences of lobsters (Homarus) and four species of tropical Callinectes in North Carolina coastal waters.

Meetings, Talks, Visitors, Publicity

D. Cohen attended the ICES larval fish symposium in Woods Hole and presented a talk at the Oxford Laboratory on marine biology in the People's Republic of China.

Visitors included Dr. Walter Ivantsoff of Sydney, Australia, who is studying atherinid fishes, and Dr. Robert Rau from the Philippines.

Manuscripts

Cohen, D. M. Notes on the morid fish genera Lotella and Physiculus in Japanese waters. Jap. J. Ichthy. (S)

Collette, B. B., and J. L. Russo. 1979. An introduction to the Spanish mackerels, genus Scomberomorus. Proc. Spanish Mackerel Colloquium. (P)

ATLANTIC ENVIRONMENTAL GROUP

Ocean Monitoring and Climatology Investigation

Pronounced offshore extension of cold shelf water continued off the Middle Atlantic shelf during April. The offshore limit moved shoreward during the first part of April, but by the third week was again around 90 nautical miles (nm) beyond the normal position, particularly off the southern Middle Atlantic Bight. Rapid disappearance of shelf water surface temperatures $<10^{\circ}\text{C}$ in early April and the patchiness of the offshore shelf water in the latter part of the month, indicate that this water overlays the slope water in a shallower layer than was observed a year ago during March and April. South of Southern New England and Georges Bank, the shelf water was confined almost entirely to the shelf by the presence in the slope water region of Gulf Stream eddies and associated warm slope water. Off Nova Scotia, however, the shelf water extended abnormally far offshore throughout the month, and off southeastern Georges Bank, in the last half of April, shelf water discharged southward in two "rivers", about 10-15 nm wide, that crossed the slope water and were entrained by the Gulf Stream.

Six XBT transects were obtained by the cooperative Ship of Opportunity Program (SOOP) during April, two in the Gulf of Maine, one across the Southern New England Shelf along the 71°W meridian, two across the shelf and slope off New York, and one in the Gulf of Mexico. A contractual arrangement has been initiated with the Bigelow Laboratory to provide logistical support for the monthly XBT transect between Portland, ME, and Yarmouth, NS.

Continuous plankton recorder (CPR) transects were obtained from ships of opportunity in the Gulf of Maine, the shelf and slope off New York, and northeastward from Chesapeake Bay. The Gulf of Maine and New York tows also successfully

utilized temperature recorders mounted in the CPR's, yielding a continuous trace of water temperature at the 10-m depth.

Ocean Dumping Investigation

Plans were initiated during April to conduct a radio direction-finding (RDF) drift buoy experiment beginning on or about 8 May 1979. Six buoys will be deployed from the NOAA R/V Whiting after it leaves New York City enroute to Deepwater Dumpsite (DWD) 106. The six buoys will be tracked from Sandy Hook, NJ, and Cape Henlopen, DE, for approximately a 10-14 day period. This experiment will supplement other drift buoy work conducted during late 1978 and early 1979.

Meetings, Talks, Visitors, Publicity

On 6 April, Jim Bisagni attended an NOS Ocean Dumping and Monitoring Division staff meeting in Rockville, MD, to discuss future plans and equipment needs.

Mr. Bob Pedrick of the Fisheries Assessment Division in Washington, DC, visited AEG from 9 April until 13 April.

On 11 and 12 April, Steve Cook traveled to Portland, ME, to install an XBT system on board the M/V Marine Evangeline and to brief personnel from the Bigelow Laboratory on its use and on the SOOP Program.

Grayson Wood visited the NOAA Engineering Development Laboratory in Rockville, MD, from 16 to 18 April.

Steve Cook participated in an Effective Supervision course in Rockville, MD, from 16 to 20 April.

On 16 April, Jim Bisagni departed Norfolk, VA, aboard the Mt. Mitchell to take part in a research cruise to DWD 106 (16-25 April 1979). Objectives of the cruise were to locate and sample relatively old Edgemoor (acid-iron) waste plumes to the southwest of DWD 106. Other experiments included vertical shear measurements and continuous sampling for iron using a system developed by the University of Rhode Island Graduate School of Oceanography.

Dr. Hans Ackefors of Sweden visited with Mert Ingham on 23 April.

Manuscripts

Armstrong, R. S. Environmental assessment of an active oil field in the northwestern Gulf of Mexico. Current patterns and hydrography. Final report. (S)

Austin, H. M., and M. C. Ingham. 1979. Use of environmental data in the prediction of marine fisheries abundance. In Climate and fisheries. Proceedings from a Workshop on the Influence of Environmental Factors on Fisheries Production. Univ. of Rhode Island Ctr. for Ocean Mgmt. Stud. Kingston, RI. 29-31 March 1978. (P)

Bisagni, J. J. July 1977 physical oceanographic studies at Deepwater Dumpsite 106. Deepwater Dumpsite 106 Assess. Rep. (S)

Celone, P. J., and J. L. Chamberlin. Anticyclonic (warm core) eddies off the northeastern United States during 1978. Annales Biologiques. (S)

- Cook, S. K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, NJ, USA, in 1978. *Annales Biologiques*. (S)
- Cook, S. K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, NJ, USA, in 1977. *Annales Biologiques*. (A)
- Crist, R. W., and J. L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1978. *Annales Biologiques*. (S)
- Crist, R. W., and J. L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1977. *Annales Biologiques*. (A)
- Gunn, J. T. Variation in the shelf water front position in 1977 from Georges Bank to Cape Romain. *Annales Biologiques*. (A)
- Ingham, M. C., and D. R. McLain. Sea-surface temperatures in the northwestern Atlantic in 1978. *Annales Biologiques*. (S)
- Ingham, M. C. Marine environmental conditions off the coast of the United States, Jan. 1977 - March 1978. *Mar. Fish. Rev.* In press.
- Jossi, J. W., and R. R. Marak. MARMAP survey manual. Contribution to NOAA fisheries technology shipboard manual. 43 p. (S)
- Mizenko, D., and J. L. Chamberlin. Gulf Stream anticyclonic eddies (warm core rings) off northeastern United States during 1977. *Annales Biologiques*. (A)
- Mizenko, D., and J. L. Chamberlin. Gulf Stream anticyclonic eddies and shelf water at Deepwater Dumpsite 106 during 1977. *Deepwater Dumpsite 106 Assess. Rep.* (S)
- Murray, T. E. A summary of waste inputs to Deepwater Dumpsite 106 during 1976 and 1977. *Deepwater Dumpsite 106 Assess. Rep.* (S)