



# NORTHEAST FISHERIES CENTER

Gibson

## NEWSLETTER

MAY-JUNE 1982

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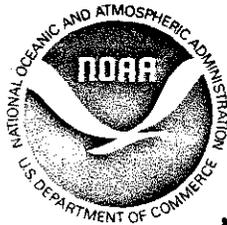
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US DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL MARINE FISHERIES SERVICE



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"NORTHEAST FISHERIES CENTER NEWSLETTER"

The "Northeast Fisheries Center Newsletter" is an informal bimonthly report on Northeast Fisheries Center (NEFC) activities, primarily for NEFC employees. Submissions to this report are prepared by the above administrators, and compiled and edited by Jon A. Gibson, Center Information & Publications Officer.

This report does not constitute a publication and is for information only. All data should be considered provisional. Reference to trade names does not imply endorsement.

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# OPTIMIZING USE OF THE NORTHEAST'S FISHERIES RESOURCES

by

Robert J. Learson

## INTRODUCTION

At one time we thought that the world's fisheries resources were unlimited. In the 1950's and 1960's, however, we saw proof that these fisheries resources were not only limited, but that individual fish stocks could also be depleted. The best example in our region was the depletion of the Georges Bank haddock stock by Eastern European fleets of factory stern trawlers during the 1960's.

Such depletions prompted two questions: (1.) How to optimize the harvest of fisheries resources?; and (2.) How to optimize the use of the harvest? The answer to the first question was passage of the Magnuson Fishery Conservation and Management Act of 1976. The second question remains largely unanswered.

Currently, we lose much of the protein value of our harvest due to inefficient harvesting, inefficient processing, and inadequate markets. With respect to harvesting, our typical gear can miss or lose much of the potential catch (e.g., the typical East Coast scallop drag can miss or lose as much as 92 percent of the scallops in its path, and can damage uncaught individuals). Also, as much as 25 percent of our catch is discarded at sea because the fish are too small or not desired for existing markets--squids, dogfishes, and hakes are good examples.

With respect to processing, which is probably our largest source of protein wastage, we only achieve a 40-50 percent meat yield from finfish, and a 10-20 percent meat yield from shellfish! A large amount of edible protein is either discarded on shore or converted to animal feed.

With respect to marketing, poor quality is the limiting factor. Some harvesting gear, at-sea handling practices, on-shore processing practices, and marketing distribution practices can produce poor quality seafood products. Poor distribution practices, in particular, have been estimated to waste as much as 10 percent of our processed products.

When all this wastage is taken into account, we may well consume less than 30 percent of our current finfish and shellfish harvest. In light of the actual food crisis in some countries and the potential food crisis throughout the world--where seafood protein will become more important, this wastage should not be acceptable.

This wastage, accented by the continuing U.S. trade deficit in fishery products (three billion dollars in 1981!), is the

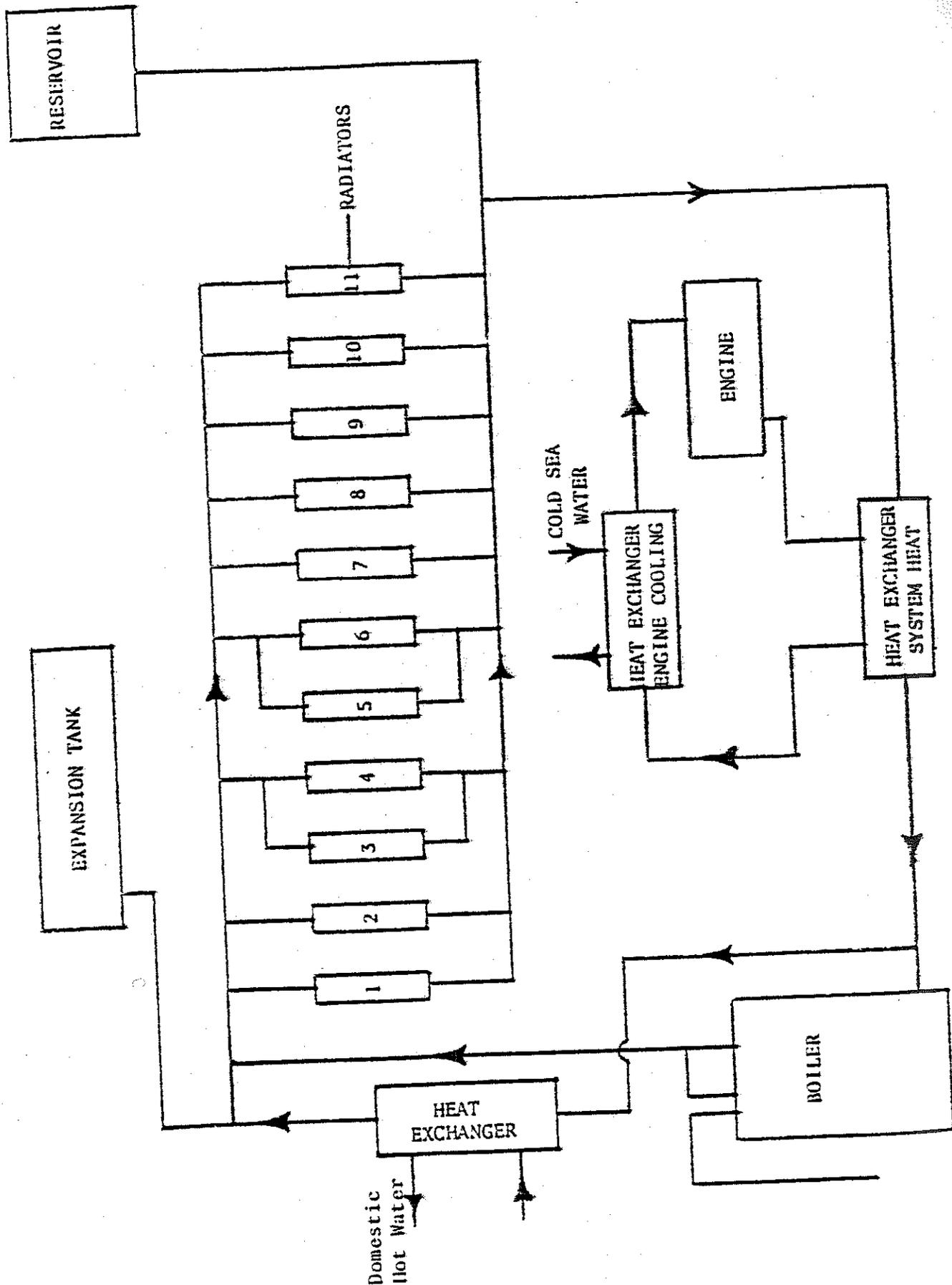


Figure 1. Heating and hot water system for fishing vessel using recovered engine heat.

setting for the Northeast Fisheries Center's (NEFC) Resource Utilization Division's work. The Division, which operates primarily out of the NEFC's Gloucester (Massachusetts) Laboratory and employs 24 permanent and 8 temporary personnel, seeks to optimize the use of the Northeast's fisheries resources by researching the technological problems with resource harvesting, resource processing, product quality, and product wholesomeness. Below we look at the Division's programs addressing those problems.

### FISHERIES ENGINEERING

The Fisheries Engineering Program addresses technological problems with fishing operations, focusing on harvesting gear. Past work includes modification of harvesting gear to improve species and size selectivity and reduce at-sea discards, examination of scallop harvesting gear to design a more efficient, less destructive scallop drag, and design of an on-board heating and hot-water system using recovered engine heat (Figure 1). Present work includes examination of trawl nets and experimentation with modified versions to improve energy efficiency. Future work will include experimentation with at-sea preservation techniques to improve landed quality.

This Program recently moved from the Gloucester Laboratory to the University of Rhode Island's (URI) Narragansett Campus (adjacent to the NEFC's Narragansett Laboratory) to form the NMFS-URI Cooperative Fisheries Engineering Unit. The Program's fisheries engineering specialists brought their 65-ft fishing operations research vessel, the *Gloria Michelle*, with them. They now also have access to URI's tow tank, electronic testing and calibration equipment, and computers.

### FISHERY BIOCHEMISTRY

The Fishery Biochemistry Program addresses chemical and microbiological problems with quality preservation, wholesomeness, and nutrition, focusing on quality preservation of underutilized species. In fact, the main reason why certain species are not fully utilized is that their quality degrades faster than traditionally used species. Present work on quality preservation includes storage of red hake (Figure 2), storage of minced fish, ammonia development in spiny dogfish, and edibility characteristics of different species. This work seeks to increase the use of underutilized species for both export and domestic markets.

A second thrust of this Program, wholesomeness, gathers data and provides information on potentially harmful chemicals in seafoods which could affect the marketability of our fisheries products and the health of human consumers and livestock. This Program, in cooperation with the NEFC's Ocean Pulse Program, presently monitors polychlorinated biphenyls and polynuclear aromatic hydrocarbons in finfish and shellfish tissues throughout

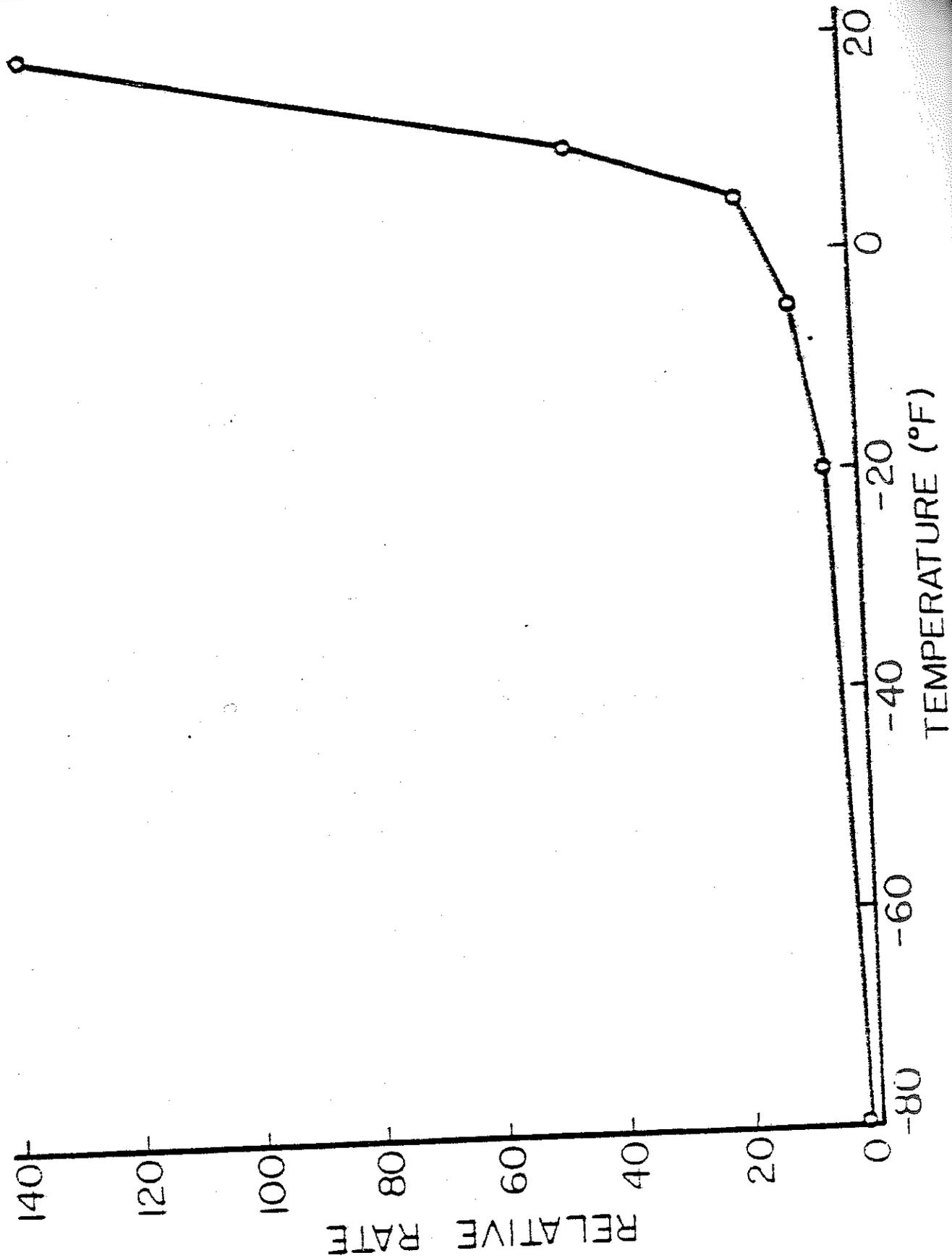


Figure 2. Relative rate of textural deterioration in red hake fillet blocks as a function of storage temperature.

Northeast coastal waters. We monitor these chemicals--which persist in the environment and accumulate in organisms--to develop baseline information for eventually relating marine pollution (e.g., ocean dumping, continental shelf oil exploration and development) with seafood wholesomeness.

A third thrust of this Program, nutrition, develops data and provides information on the amounts of cholesterol and fatty acids in seafoods, primarily shellfish. Historically, physicians and nutritionists have advised patients and consumers, respectively, not to eat shellfish in order to lower their blood cholesterol levels. Recent advances in analytical techniques, allowing more precise measurements of sterols and fatty acids, indicate that much of the previously reported cholesterol data is erroneous, and that many shellfish species contain significant levels of highly polyunsaturated fatty acids which help prevent heart disease.

### PROCESSING AND PRESERVATION TECHNOLOGY

The Processing and Preservation Technology Program addresses technological problems with preserving quality, reducing processing waste, increasing plant efficiency, and developing processes and products for underutilized species. Past work includes meat/bone separation for recovering edible meat from crab and finfish processing waste, mechanical processing of crab meat, a handling protocol for quality fresh fish (Figure 3), and a modified cutting board for increasing fillet yield (Figure 4). Present work includes evaluation of squid processing machinery, testing of potassium sorbate for improving quality, and development of time/temperature tolerance data for assuring quality and edibility characteristics in frozen products.

The harvesting and processing industry have implemented many of the above technological developments, and thus, have increased utilization of our fisheries harvest. In addition, local industry associations and cooperatives, Fishery Development Foundations, and Sea Grant institutions regularly seek this Program's technical advice and assistance on specific problems with quality, processing waste, and underutilized species.

### STANDARDS AND SPECIFICATIONS

The Standards and Specifications Program is a national program charged with the responsibility for formulating all U.S. standards and specifications for fishery products. In particular, the *U.S. Standards for Grades of Fishery Products* are the basis of the USDC Inspection Program, a voluntary product assurance program funded by industry users. The Standards and Specifications Program also develops purchasing specifications for federal users of fishery products, such as the USDA and the military. Further, through memorandums of understanding, this Program also develops commercial item descriptions for federal purchasing of fishery products. Such standards and specifications contribute to the optimum utilization of our fisheries resources by promoting

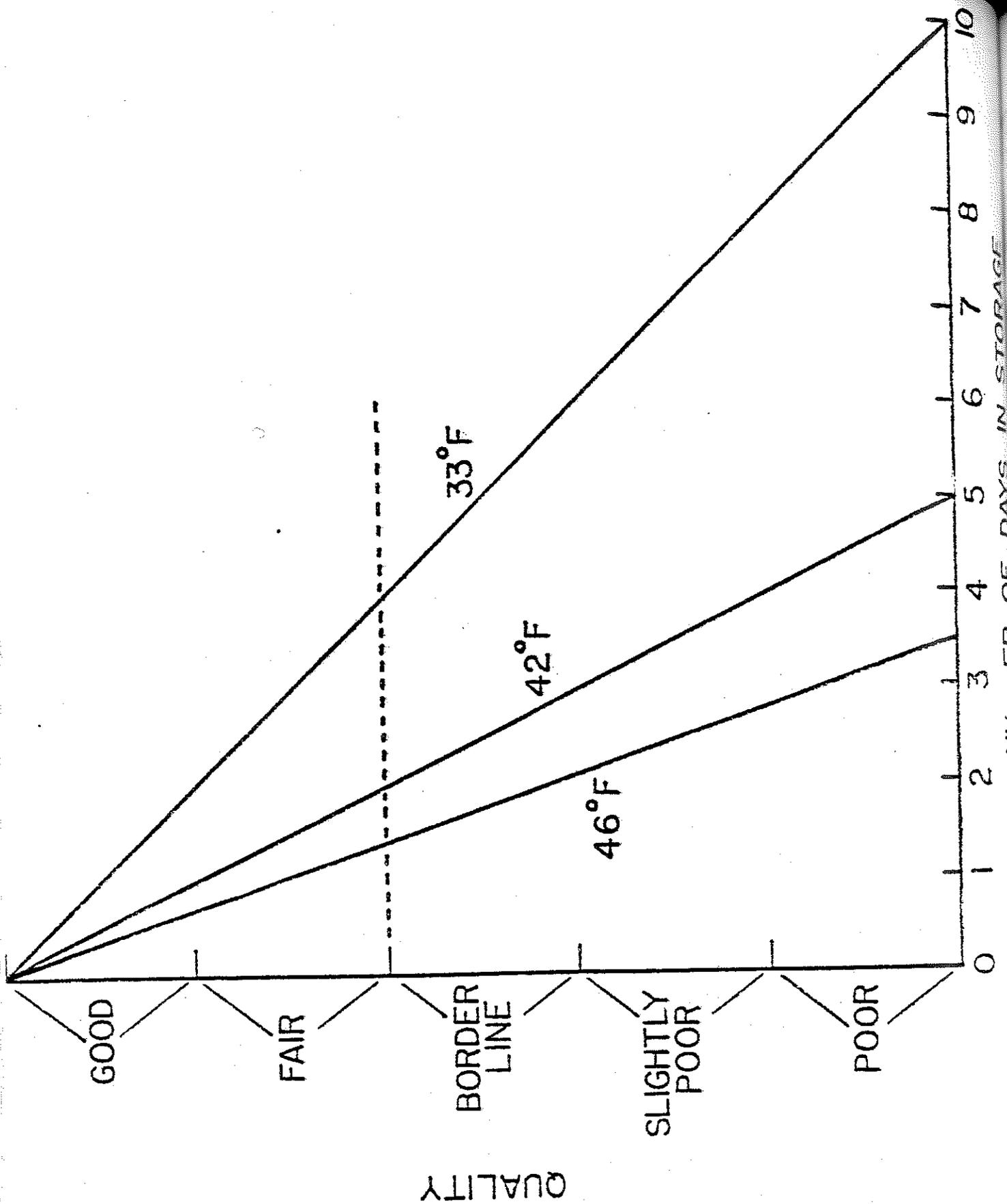


Figure 3. Effect of storage temperature on the fresh quality of fish fillets.

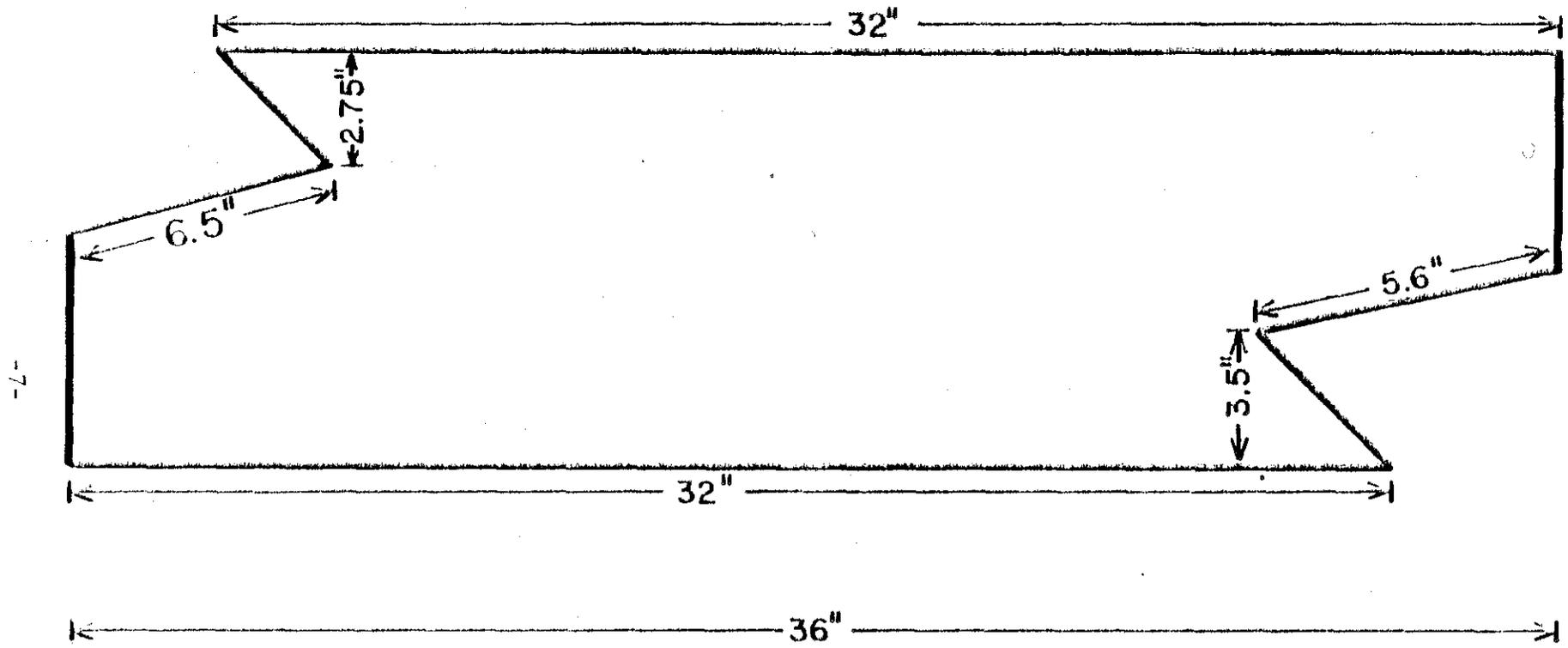


Figure 4. Modified cutting board for improved fillet yield. For best results, the board is mounted at a 12° upward angle towards the cutter.

quality improvement (Figure 5), establishing standards and specifications for underutilized species and products (e.g., squid, minced fish blocks), and promoting underutilized species as menu items for the USDA and military.

#### PROGRAM COORDINATION

Each Division program is a separate entity, but contributes essential information to the other programs. For instance, biochemical information on quality, safety, and nutrition contributes to the development of processing and preservation technology, and processing and preservation information contributes to the development of product standards and specifications.

The Division's programs are thus integrated to deal with the major issues of optimum utilization. Efficient vessels and harvesting gear lead to more quality product at less cost with reduced at-sea discards. Improved handling systems lead to greater landed weight, better landed quality, and better processing yields. Recovery of processing waste leads to more quality protein, a broader product base and expanded foreign and domestic markets. Quality improvement leads to better consumer value and market expansion.

All this is achievable without significantly increasing harvesting effort, *just making better use of what we now catch.*

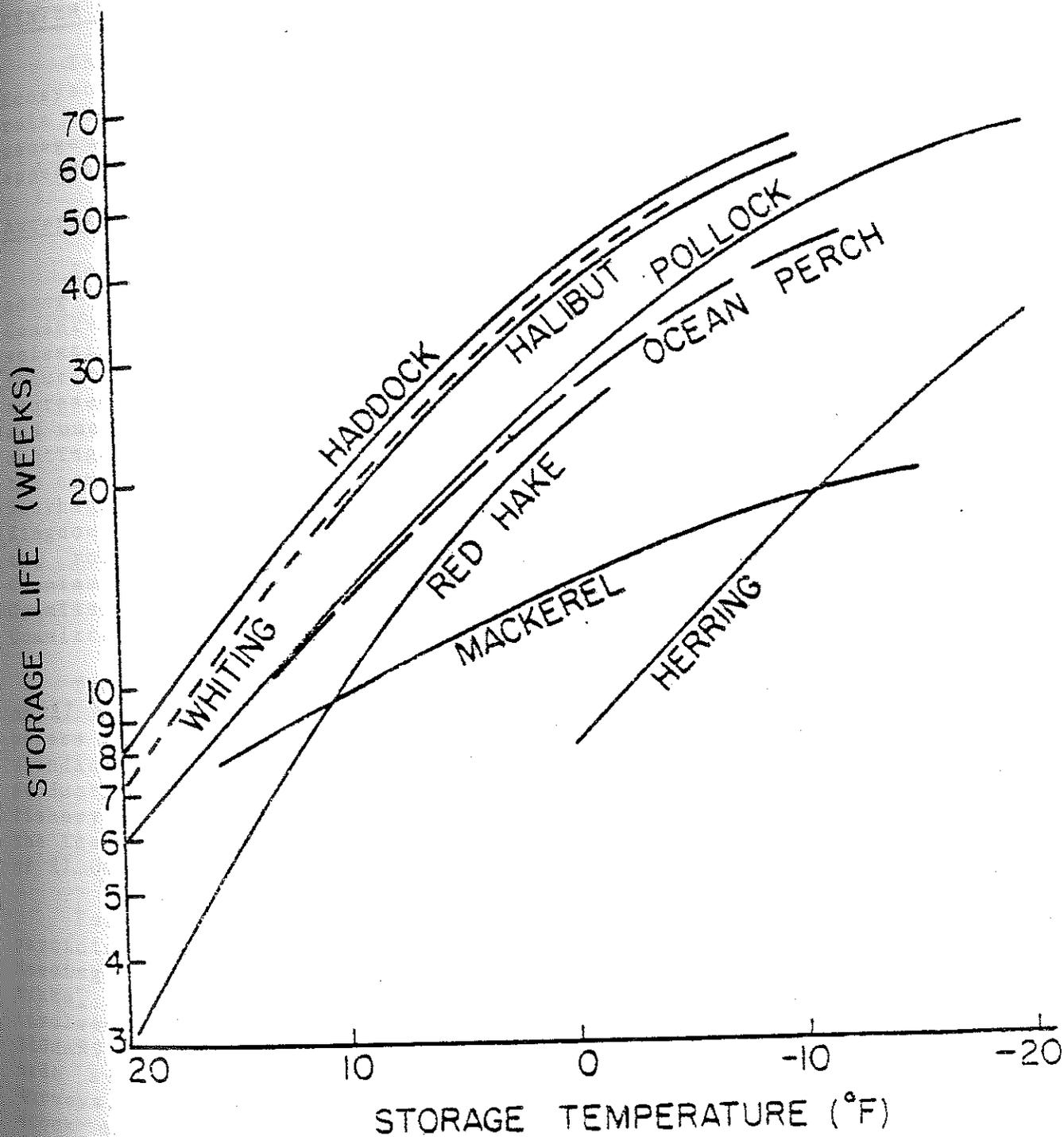


Figure 5. Effect of storage temperature on the shelf life of various fish species.

## CENTER DIRECTORATE

The following item was submitted as part of the Marine Ecosystems Division's report. However, because of the significant role which the U.S. will play in the future international management of the Antarctic's resources and environment, that item appears here.

### Antarctic Ecosystems

Interest in the living resources of the Antarctic is growing among the 14 signatory nations to the new Commission for the Conservation of Living Marine Resources of the Antarctic. The scientific basis for management of the Antarctic ecosystem was the focus of three recent meetings where Ken Sherman served as NMFS representative: two in Japan, 27-28 May and 31 May-3 June, and one in Australia, 5-12 June. The principal scientists at the meetings in Japan wore their academic hats. In Australia, most of the same experts (i.e., Hempel of the European Economic Community, Sahrhage of the Federal Republic of Germany, Laws of the United Kingdom, Hureau of France, and Matsuda and Nasu of Japan) assumed the role of scientist in support of the newly established Commission. This unique role combination of academic and Commission scientists should evolve into a strong Scientific Committee in support of the Commission.

The first meeting was a BIOMASS Colloquium, convened in Tokyo on 27 and 28 May at the Japanese Polar Research Institute. The papers at the Colloquium stressed the zonal discontinuity in krill abundance and the importance of the ice edge in the annual production cycle of krill. The Japanese reported that their fishery is developing around the advancing and retreating edges of the ice-edge front. At the meeting, the Japanese reported catches of 27 000 metric tons in 1979 and 37 000 metric tons in 1980.

Following the Colloquium in Tokyo, most of the same participants reassembled in Nikko, Japan, for the BIOMASS Meeting of Specialists on the Southern Ocean (31 May-3 June). At Nikko, the results of the Working Parties and Technical Groups involved in planning and implementation of the First International BIOMASS Experiment (FIBEX) were reviewed. New information was made available on krill biomass based on the FIBEX acoustic surveys. The values based on variance levels around mean standing stock estimates of subareas off the Antarctic continent ranged from 200 million metric tons to 600 million metric tons. Additional refinement of these values will be forthcoming from a series of FIBEX data workshops planned for 1982-83. The overall objectives of BIOMASS and FIBEX (i.e., the second such experiment) were reviewed and modified. The Group of Specialists agreed that the major objective of BIOMASS for the mid-1980's will focus on the biological (e.g., predator-prey) and physical processes

controlling the abundance of krill. FIBEX will be organized to examine the initiation of annual krill production at the ice edge at three locations around the continent. Also, studies of krill superswarms in contiguous water will be part of the program, with emphasis on obtaining a better understanding of acoustic target strength in relation to krill biomass and microecology.

The first meeting of the Scientific Committee of the Commission for the Conservation of Antarctic Living Marine Resources was held at Hobart, Australia, during 5-12 June. Most of the deliberations of the Scientific Committee were held informally under temporary Rules of Procedure. Significant groundwork was prepared for intersessional activities of Working Groups to move forward on obtaining information on fishing activities, standardizing logbooks, and initiating an inventory of studies and available information among member countries.

## RESOURCE ASSESSMENT DIVISION

### Resource Surveys Investigation

The NOAA R/V *Delaware II* returned to Woods Hole on 8 May following completion of the fourth and final leg of the 1982 spring bottom trawl survey. This included the northern edge of Georges Bank, the Scotian Shelf, and the Gulf of Maine. Chuck Byrne served as Chief Scientist.

The first leg of the 1982 sea scallop assessment survey was conducted during 1-11 June 1982 aboard the NOAA R/V *Albatross IV*. This leg included the area between Cape Hatteras and Hudson Canyon. Chuck Byrne served as Chief Scientist.

Jim Crossen and Andy Thoms continued preparations for the upcoming surf clam-ocean quahog assessment survey scheduled to start on 26 July.

Tom Azarovitz, Loretta O'Brien, Liz Bevacqua, Eva Montiero, Don Flescher, and Sue Wigley spent considerable time in preparation of draft material in support of the U.S. position in the World Court case involving the East Coast maritime boundary issue with Canada.

Don Flescher continued work on his collection of East Coast marine fish photographs, including contribution of a number of these photographs to the National Fisheries Academy archives in Leetown, West Virginia.

### Fishery Biology Investigation

#### March-April

Kris Andrade completed the aging and reporting process for 1094 haddock samples from the fall bottom trawl survey on *Delaware II* Cruise No. DE 81-06, and for fourth quarter 1980 commercial

redfish samples, as well as prepared Foreign Fishery Observer Program age samples for aging.

Vi Gifford summarized the aging results from first and second quarter 1981 commercial redfish samples. Vi instructed Blanche White in reading haddock scales, and checked Doris Jiminez's contract aging of fourth quarter 1981 commercial Atlantic cod samples.

Blanche White prepared 1384 of last year's commercial sea scallop shell samples for aging. She sectioned 1034 redfish otoliths and logged incoming samples from *Delaware II* Cruise No. DE 82-02. Blanche also aged some of the fourth quarter 1981 commercial haddock samples.

Leslie DeFilippis began sectioning red hake otoliths from the 1982 spring bottom trawl survey and impressed 1982 commercial summer flounder scale samples.

Louise Dery processed Atlantic mackerel samples from Polish R/V *Kanaryjka* Cruise No. 82-01, completed a small U.S.-Polish age comparison study for the 1981 fall bottom trawl survey, and also aged some red hake samples. She assisted Sherry Sass in ring counts of larval winter flounder otoliths. A small amount of time was spent in March studying growth patterns on adult winter flounder scales for age validation consultant work with Penny Howell of the Connecticut Department of Environmental Protection on 18 March.

An otolith inventory was completed by Louise Dery for Dr. Saul Salla of the University of Rhode Island, and information on the growth of Atlantic herring and hakes was compiled for Ambrose Jearld. Louise also assembled references on backcalculation, age validation, and other aspects of age and growth for Ambrose Jearld.

Sherry Sass continued work on a study of otolith development during the first year of growth in winter flounder. Jacob Richardson assisted in maintaining and monitoring summer flounder larvae in the Woods Hole Aquarium. John Ropes continued preparation of acetate peels of ocean quahog shells from Georges Bank for aging.

Methods used at the Woods Hole Laboratory for preparing surf clam and ocean quahog shells for aging were demonstrated to and photographed by Mildred A. Kosick of Peter Silveri Associates, Inc., of New York for use in an article on the uses of Buehler's Isomet diamond saw.

#### May-June

Vi Gifford and Kris Andrade aged and summarized commercial samples of redfish for the first and second quarters of 1979. Vi also checked Doris (Jiminez) Brennan's aging of commercial samples

of Atlantic cod for the first quarter of 1982. Vi was also involved with Henry Jensen, Ambrose Jearld, and Ira Palmer on scallop aging problems.

Kris Andrade aged and summarized first quarter 1982 commercial samples of haddock. Kris also continued her training on redfish aging from Vi Gifford.

Blanche White became Mrs. Otis Jackson in June. (Otis works for the Woods Hole Laboratory Automatic Data Processing Unit.) Blanche logged incoming cruise survey samples, sectioned approximately 1000 redfish otoliths, and impressed approximately 800 haddock scales. She also worked with Ira Palmer in gathering and recording sea scallop length-frequency data, and updated scallop sample inventories.

Ira Palmer plotted sea scallop length-frequency distributions by area for 1977-82 scallop surveys.

Mark Costa participated on the first leg of the 1982 scallop survey, impressed yellowtail flounder scales, and assisted with several phases of scallop aging work. He also participated in weekly larval American lobster surveys with Ira Palmer and completed sectioning of red hake otoliths from the 1982 spring bottom trawl survey with Leslie DeFilippis and Alicia Kelly.

Annette Mitchell and Jacob Richardson processed Atlantic herring and Atlantic mackerel samples from the 1982 winter and spring bottom trawl surveys.

John Trautman and Detra Greene inventoried silver hake, Atlantic cod, and pollock otolith samples for the Georges Bank, Gulf of Maine, and Scotian Shelf area.

Louise Dery completed aging of Atlantic mackerel otoliths from cooperative surveys with Poland and verified Atlantic herring otolith aging by Jean Chenoweth from the 1982 winter bottom trawl survey. Louise also assisted Massachusetts Division of Marine Fisheries personnel with preparation of striped bass scales for aging.

Sherry Sass aged and summarized butterfish samples from the 1981 summer and autumn bottom trawl surveys and continued studies on winter flounder otolith formation with Annette Mitchell. This included refinement of techniques for preparing postmetamorphosis otoliths for age reading, and attempts to correlate changes at metamorphosis with markings on older otoliths. Sherry also worked on a manuscript on winter flounder otolith formation and participated in the final leg of the 1982 spring bottom trawl survey during 27 April-7 May.

Brenda Fields audited and summarized previous aging work on winter flounder samples from 1976 bottom trawl surveys and compared results with those from previous studies. Brenda also

aged and summarized summer flounder samples from the 1981 summer survey and reviewed several papers on aging methods with Ambrose Jearld.

David Pyoas completed preparation of Georges Bank samples of ocean quahogs for production of acetate periodicity of age peels, and assisted with aging work.

John Ropes continued work on a manuscript documenting annual periodicity of age lines in ocean quahogs. Electron microscopy work on the microstructure of growth lines and growth increments by Dr. Douglas S. Jones of the University of Florida supports previous NEFC interpretations of annual growth lines. John also completed a manuscript on preparation of acetate peels from ocean quahog valves for aging, and a manuscript on the occurrence of horseshoe crabs [*Limulus polyphemus* (L.)] in NEFC surveys with C. N. Shuster, Loretta O'Brien, and R. K. Mayo.

Gary Shepherd completed a literature search on between-area growth differences for redbfish, Atlantic mackerel, witch flounder, American plaice, and spiny dogfish. He also completed a brief review of information on stock separation using aging structures and a draft manuscript on age and size composition of weakfish. He also continued aging and data analysis for surf clams, and participated in the final leg of the 1982 spring bottom trawl survey during 27 April-7 May.

### Fishery Assessment Investigation and Senior Assessment Scientists

#### March-April

Brad Brown spent considerable time on activities related to moving Resource Assessment Division staff from Woods Hole to Falmouth. In April, he and Steve Clark devoted considerable time to preparing material for the U.S.-Canada maritime boundary issue.

Emory Anderson coordinated the Atlantic mackerel survey conducted by two Polish trawlers during 21 January-16 April in the Mid-Atlantic region. He also synchronized the move from Woods Hole to Falmouth, interacting with the New England Telephone Co., with Bob Cannon from the NMFS Northeast Regional Office, with Roger St. Hilaire, the Woods Hole Laboratory Administrative Officer, with the Homeport office complex owners, and with the moving company.

John Boreman reviewed manuscripts for the *Fishery Bulletin*, the *Transactions of the American Fisheries Society*, the Sea Grant Program, and the Sandy Hook Laboratory, in addition to his ongoing striped bass research.

Fred Serchuk completed the 1982 sea scallop assessment report covering Georges Bank, Mid-Atlantic, and Gulf of Maine resources. Fred also completed two NEFC staff studies on: (1.)

growth, shell height-meat weight relationships, and yield-per-recruit relationships of Northwest Atlantic sea scallop populations; and (2.) stock fluctuations unique to Georges Bank. He developed the sampling design and biological sampling protocol for the 1982 sea scallop survey. Fred formulated the biological considerations related to development of a "braking mechanism" in the Interim Groundfish Plan, and developed a list of biological and fishery indicators of possible use in assessment of risk evaluation for groundfish species covered in the Plan. Fred also summarized the relevant assessment information for use in background documents for the American memorial in the U.S.-Canada maritime boundary issue.

Anne Lange, Steve Murawski, and Judy Penttila were involved in analyses of our commercial fishery data base and preparing documents related to the U.S.-Canada East Coast maritime boundary issue.

Steve Murawski continued to work on a mixed-species simulation model based on technological interactions among groundfish and other trawl fisheries off the Northeast Coast. He also planned the sampling strategy for the upcoming surf clam-ocean quahog survey.

Bob Rak spent considerable time analyzing commercial sea scallop landings for determining catch-per-unit-of-effort data.

Papers and documents pertaining to American lobsters, bluefin tuna, and butterfish were reviewed, respectively, by Mike Fogarty, Anne Lange, and Gordon Waring.

Activities for the entire group were disrupted during 22 March-2 April when the staff prepared for their relocation from the leased building at the Marine Biological Laboratory in Woods Hole to the Homeport office complex in Falmouth, Massachusetts.

During March and April, Fred Serchuk provided data and information as follows: (1.) on 3 March for Fred Payne of the NMFS Central Office in Washington, D.C., background information on relationship of sea scallop larval dispersal with surface current patterns; (2.) for Bins Magelberg of the Gloucester Corporation in Lynn, Massachusetts, additional information on the calico scallop fishery; (3.) also on 3 March for Jim Costakes of the New Bedford Seafood Producers Association, calico scallop fishery data; (4.) on 8 March for William Alwardt, a commercial fisherman from Oak Bluffs, Massachusetts, information on surf clam resources off Nantucket, Massachusetts; (5.) on 9 March for Earl Barlow of American Farmers of the Sea in Swansboro, North Carolina, background data on sea scallops; (6.) on 22 March for Dave Wallace, Jr., a consultant, background information from NEFC surf clam and ocean quahog research surveys; (7.) for Dave Pierce of the Massachusetts Division of Marine Fisheries, information on market category distribution of recent Atlantic cod landings; (8.) on 12 April for Wally Wojtosinski of Wally Sea Products in Boston, Massachusetts, sea scallop information; and (9.) on 13 March for

Steve Freeze of the Mid-Atlantic Fishery Management Council, 1981  
Mid-Atlantic sea scallop landings data.

### May-June

The major activity of Senior Assessment Scientists and Fishery Assessment Investigation staff during May and June concerned preparation of material in support of the U.S. position in the World Court case involving the East Coast maritime boundary issue with Canada. Brad Brown, Emory Anderson, Steve Clark, Anne Lange, Steve Murawski, and Fred Serchuk prepared material on the distribution, biological characteristics, and status of species-stocks important in the Georges Bank-Scotian Shelf area.

Several staff members were involved with review and critical evaluation of the current status of the North Atlantic bluefin tuna resource. This review was part of a coordinated NMFS response to recent criticism of biological analyses and advice used to set quotas on bluefin tuna under the International Commission for the Conservation of Atlantic Tunas, or ICCAT.

Brad Brown continued work on a chapter of a forthcoming book by NEFC and Woods Hole Oceanographic Institution (WHOI) scientists on Georges Bank. Brad's chapter is concerned with fishery resources in the Bank region. Brad and Mike Sissenwine devoted a significant amount of time to logistical problems created by the recent move of several Senior Assessment Scientists and Fishery Assessment Investigation members to the Homeport office complex in Falmouth, Massachusetts (5 mi away). Brad also initiated work on papers on fishery resource trends for the upcoming World Ocean Conference. Mike Sissenwine prepared a proposal with Marine Ecosystem Division personnel and scientists from WHOI for submission to the Bureau of Land Management. Proposed research involves collection of fish stomach contents and benthic community data required to evaluate food preferences of demersal fishes.

Steve Clark, Ralph Mayo, and Adam Green completed a draft 1982 assessment document for Georges Bank and Gulf of Maine haddock. Steve reviewed three quarterly completion reports on northern shrimp research vessel surveys and data processing by the State of Maine under Atlantic States Marine Fisheries Commission (ASMFC) Contract No. 81-2. He also reviewed a revised completion report by the State of Maine under ASMFC Contract No. 81-2 entitled "Sampling of the Northern Shrimp Fishery in Maine," and two manuscripts submitted for inclusion in the proceedings of the workshop on sampling commercial marine fish and invertebrate catches, held in February in Ottawa, Canada. Steve also solicited and submitted titles for U.S. contributions to the International Council for the Exploration of the Sea's Shellfish Committee meeting at the 70th Statutory Meeting in October in Copenhagen, Denmark. Steve and several other staff members spent considerable time reviewing revisions to NEFC computer software used to analyze survey data.

Emory Anderson prepared a cruise report of Polish Atlantic mackerel survey activity during January-April, and conducted an analysis of the effect of deferring uncaught butterfish catch quotas from one year to the next.

John Boreman continued preparation for a coastwide striped bass monitoring program for Fiscal Year 1983, involving expenditures of \$415 000, among seven states, NMFS, and the U.S. Fish and Wildlife Service. John also revised Woods Hole Laboratory Reference Documents No. 82-35 and No. 82-40 on river herring (alewives and blueback herring) and American shad.

Fred Serchuk analyzed and summarized results for Atlantic cod and Gulf of Maine sea scallops from the 1982 spring bottom trawl survey. The 1982 scallop survey sampling design was revised to include additional stations in the Gulf of Maine. Fred also developed commercial sampling requirements for Atlantic cod, American plaice, and sea scallops, and summarized commercial sampling data for cod, plaice, and scallops collected during January-March 1982. Fred also analyzed and summarized results of the first leg of the 1982 scallop survey, assembled scallop growth-rate data, and provided NMFS Northeast Regional Office personnel with information on the status of Northwest Atlantic cod populations. He also reviewed the following reports: (1.) two Division draft assessment reports, (2.) two manuscripts submitted for publication in the *Fishery Bulletin*, and (3.) one manuscript submitted for publication in the *Journal of Shellfish Research*.

Bill Overholtz finished a draft of his doctoral dissertation, entitled "Long-term Temporal Perspectives for the Demersal Fish Assemblages of Georges Bank with Implications for Management and Modelling." He also initiated work on multispecies assessment problems with Wendy Gabriel of the University of Massachusetts.

Judy Penttila continued preparation of a paper on Atlantic cod growth and its changes through time, for the Annual Meeting of American Fisheries Society in September.

Mike Fogarty reviewed manuscripts submitted to the *Transactions of the American Fisheries Society*, the *North American Journal of Fisheries Management*, and a NMFS State-Federal Program job completion report.

Steve Murawski continued work on a manuscript dealing with yield-per-recruit models for mixed-species fisheries. He also completed analyses for the Regional Fishery Management Priorities Committee and reviewed manuscripts submitted to the *Canadian Journal of Fisheries and Aquatic Sciences* and the *Fishery Bulletin*. He also initiated work on development of dynamic sampling designs for bivalve mollusks with Chris Gledhill.

Robert Rak participated as Watch Chief during the first leg of the 1982 sea scallop survey during 1-11 June. He also tabulated sample data for shell length-meat yield relationships.

Eileen Klopfer initiated work on converting and upgrading computer graphics software.

Information services provided during this reporting period included: (1.) on 14 May, Fred Serchuk provided information on sea scallops to Robert Boroer of Clipper Sea Foods; (2.) on 24 May, Fred Serchuk provided Adrian Nasek of Capitol Research Company in Los Angeles with assessment information on Atlantic cod stocks; (3.) during 24-27 May, John Boreman participated in a technical panel of the Hudson River Foundation; (4.) on 28 May, Fred Serchuk provided information on Gulf of Maine sea scallops to a staff aide of Maine Congressman David Emery; (5.) on 23 June, Fred Serchuk provided Jack Dunnigan, the Deputy Director of the New England Fishery Management Council, with information on Gulf of Maine sea scallops; (6.) on 23 June, Fred Serchuk provided Tom Thompson of Poladini Seafood Company in San Francisco with information on marketing of sea scallops; (7.) on 23 June, Fred Serchuk provided Merrill Leffler of the Maryland Sea Grant Office with information on deepsea red crab; and (8.) on 24 June, Gordon Waring arranged for collection of spiny dogfish specimens for Dr. Forrest of the National Institutes of Health.

#### Publications

ANDERSON, E. D. Review: Study of the sea. The development of marine research under the auspices of the International Council for the Exploration of the Sea. Trans. Am. Fish. Soc. (S)

ANTHONY, V. C. The calculation of  $F_{0.1}$ : a plea for standardization. Northw. Atl. Fish. Org., Sci. Council. Res. Doc. 82/VI/64. (P)

BOREMAN, J. A simulation of striped bass eggs and larval development based on temperature. Trans. Am. Fish. Soc. (S)

CLARK, S. H., OVERHOLTZ, W. S.; HENNEMUTH, R. C. Review and assessment of the Georges Bank and Gulf of Maine haddock fishery. J. Northw. Atl. Fish. Sci. 3:1-27;1982. (P)

COHEN, E. B.; GROSSLEIN, M. D.; SISSENWINE, M. P.; STEIMLE, F.; WRIGHT, W. R. Energy budget for Georges Bank. Can. Spec. Publ. Fish. Aquat. Sci. 59:95-107;1982. (P)

MURAWSKI, S. A.; LANGE, A. M.; SISSENWINE, M. P.; MAYO, R. K. Definition and analysis of otter trawl fisheries off the northeast coast of the United States. J. Cons. Int. Explor. Mer 40(3). (A)

ROPES, J. W. The Atlantic Coast surf clam fishery, 1965-1974. Mar. Fish. Rev. (A)

SISSEWINE, M. P.; BROWN, B. E.; PALMER, J. E.; ESSIG, R. J.; SMITH, W. Empirical examination of population interactions for the fishery resources off the northeastern USA. Can. Spec. Publ. Fish. Aquat. Sci. 59:82-94;1982. (P)

SISSEWINE, M. P.; COHEN, E. B.; GROSSLEIN, M. D. Structure of the Georges Bank ecosystem. Rapp. P.-V. Reun. Cons. Int. Explor. Mer. (S)

WARING, G. T. Age, growth and mortality of the little skate, *Raja erinacea*, off the northeast coast of the USA. Int. Council. Explor. Sea, Comm. Mem. (S)

### Reports

BOREMAN, J. Potential impact of the State/Federal recommendations for striped bass management on the commercial fisheries in Rhode Island. Woods Hole Lab. Ref. Doc. No. 82-05;1982.

SERCHUK, F. M.; WOOD, P. W., JR.; RAK, R. S. Review and assessment of the Georges Bank, Mid-Atlantic, and Gulf of Maine Atlantic sea scallop (*Placopecten magellanicus*) resources. Woods Hole Lab. Ref. Doc. No. 82-06;1982.

### MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

No report received. The March-June reports will be included in the July-August issue.

### MARINE ECOSYSTEMS DIVISION

#### Ichthyoplankton Investigation

The spring MARMAP I (Marine Resources Monitoring, Assessment, and Prediction Program) survey ended on 11 June after sampling 141 of 160 planned stations. Coverage was complete except for the northwest corner of the Gulf of Maine. Concentrations of eggs and early-stage larvae of Atlantic mackerel and yellowtail flounder were found off Long Island and Southern New England. Heavy zooplankton volumes and concentrations of larval bothid flatfish, probably Gulf Stream flounder and/or smallmouth flounder, occurred throughout coastal waters off the Middle Atlantic States. However, Atlantic cod and haddock larvae were scarce to absent on Georges Bank in May, a time of year when their numbers have been at or near peak levels since 1977. Survey plans for the immediate future have been completed. We will participate in the July-August sea scallop and surf clam-ocean quahog surveys. By piggybacking on these resource assessment surveys, we will collect ichthyoplankton samples in the Middle Atlantic, Southern New

England, and Georges Bank subareas during the important summer spawning season.

Two papers targeted for the International Council for the Exploration of the Sea were completed and forwarded for in-house review, prior to mailing to the Committee Chairperson. Wally Morse wrote a paper on the increase in the spawning biomass of sand lance off the northeastern United States as determined from larval production. Wally's estimates indicate a 50-fold increase in the spawning biomass during the mid-1970's when the population was centered off Southern New England. Myron Silverman prepared a paper on the distribution and abundance of silver hake larvae off the northeastern United States during the 4-yr period between 1977 and 1980. His data consistently show that the principal larval concentrations are centered on the southwestern part of Georges Bank and off Southern New England, with peak spawning occurring in July and August. Larval transport is negligible and larvae tended to remain near their spawning grounds.

Mike Fahay completed his guide to the identification of fish larvae in the western North Atlantic and forwarded it to the Northwest Atlantic Fisheries Organization for publication. The guide provides a detailed taxonomic description on the early life history of 280 taxa of marine fishes off the eastern seaboard of North America.

### Larval Dynamics Investigation

#### Experimental Studies

Lab studies with larval sand lance were completed. The data collected include incubation times and growth rates of sand lance larvae at 2°, 4°, 7°, and 10° C. Feeding experiments with sand lance at 0, 0.2, 0.5 and 1 plankton per milliliter were conducted at 2°, 4°, 6°, 7°, and 10° C. Biochemical composition, including RNA-DNA ratio, was also determined. These data are presently being compiled and analyzed. About 60 mature Atlantic mackerel were caught off Block Island, Rhode Island, and transferred to the aquarium at the Narragansett Laboratory. It is hoped that these fish will spawn in the tank, given the proper temperature and photoperiod. At the time of capture, the males were running ripe and females were predominantly in stages II and III. The fish refused food for a period of about 2 wk, but appear to have overcome the initial trauma of capture and captivity and are actively feeding.

One hundred sixty-eight samples of sand lance larvae collected on *Albatross IV* Cruises No. AL 82-01 and AL 82-02 were analyzed for standard length, dry weight, RNA, DNA, and protein content. The samples consisted of 155 larvae between 10 and 35 mm which were analyzed individually, and 13 samples made up of larvae less than 10 mm which were pooled by size. The number of larvae per sample ranged from 2 to 21. The mean RNA-DNA ratio was 5.51; it was 5.60 for larvae >10 mm and 4.57 ± 1.17 for larvae <10 mm.

Based on lab studies, a larvae with an RNA-DNA ratio of  $<3.0$  is considered to be in poor condition. The mean RNA-DNA ratio of sand lance larvae collected in 1981 was somewhat higher ( $6.60 \pm 1.18$ ). While the lowest value observed in 1981 was 4.2, the lowest RNA-DNA ratio observed in 1982 was 1.4. About 4% of the individual larvae collected in 1982 appeared to be in poor condition (RNA-DNA ratio  $<3.0$ ).

### Population Processes

May and June were devoted primarily to cruise activities. The interdisciplinary study of larval fish and prey microdistribution, *Albatross IV* Cruise No. AL 82-05, was conducted during 10-21 May. Virtually no fish eggs or larvae were collected on Georges Bank within the 100-m contour. Reasons for this unusual situation are being investigated. A second warm-core ring (WCR) study was conducted during 18 June-2 July on *Albatross IV* Cruise No. AL 82-07, which focused on WCR No. 82-B off Delaware. Greg Lough, George Bolz, Phil LeBlanc, Peter Donnelly, and Hal Merry participated on this cruise.

Several lab reports also were completed: on ICNAF (International Commission for the Northwest Atlantic Fisheries) zooplankton data, by R. Cohen and G. Lough; on vertical distribution of recently-hatched Atlantic herring larvae and zooplankton, by Lough and Cohen; and on shipboard identification of zooplankton, by Lough and D. Potter. George Bolz continued working on the Atlantic cod-haddock growth manuscript. Dave Potter spent considerable time replaying MOCNESS (multiple opening-closing net and environmental sensing system) data tapes from the 1978 larval Atlantic herring patch study to derive volume-filtered estimates. He also constructed a MOCNESS net release indicator to allow the operator to know when a net has actually been released after it fully opens. Peter Donnelly has been analyzing and summarizing the HIAC particle-size data collected in spring 1981 and 1982. Dave Potter has been helping Peter with computer programming routines to produce plots of particle size versus depth. Phil LeBlanc has continued to process ichthyoplankton and zooplankton from the spring 1981 and 1982 larval dynamics cruises.

### Apex Predators Investigation

The number of shark tournaments in the Northeast has increased this year, particularly during June. From 50 to 150 boats participated for prizes of up to \$26 000 per tournament. Project personnel attended and obtained size data and biological samples from 224 sharks at six tournaments in the following locations: Bayshore, Moriches, and Freeport, New York, and three at Brielle, New Jersey. Wes Pratt and Nancy Kohler also dissected a 630-lb juvenile white shark at Freeport on 19 June, and a 36-lb white shark was obtained at Montauk, New York, in June. The latter individual is one of the smallest white sharks on record.

Additional size data on 76 large sharks taken at three Florida tournaments were obtained for us by tournament directors.

Narragansett Laboratory Automatic Data Processing Unit personnel attended a 6-day training session pertaining to the use of the PDP 11/70 computer and the DATMAN data management system. We have since converted two data bases and four general purpose programs to the new system. Four coastal maps of the Northwest Atlantic were digitized using the PDP 11/70, and several maps have been plotted to analyze longline catch and effort. Data from six tournaments, 600 tag cards, and blue shark vertebrae have been entered into the computer.

Nancy Kohler collected food habits data from 49 sharks from the two shark fishing tournaments which were held on Long Island, New York. Five species were examined, including blues, shortfin makos, sandbars, duskies, and tigers. Overall, only 39% of the stomachs contained food. Squid, primarily shortfin squid (*Illex illecebrosus*), was the predominant food in the blue shark stomachs and occurred in small volumes. The makos, as expected, had fed on bluefish.

Chuck Stillwell participated on a short cruise aboard the R/V *Geronimo* from the St. Georges School in Newport, Rhode Island. The objective was to test the feasibility of tracking blue sharks with tethered floats to study patterns and rates of movement, and then retrieve the sharks for food digestion studies. The technique worked extremely well and will be employed on a weeklong cruise in the area of the dumping ground south of Martha's Vineyard in August.

During May and June, 22 tags were returned from 10 species, primarily blue and sandbar sharks as well as one swordfish. The longest distance traveled was by a blue shark that was tagged off Martha's Vineyard and recaptured off the coast of Africa (3000 mi). Other blue sharks tagged off the Northeast Coast were recaptured off Cuba, Barbados, and Columbia.

A tagged blue shark at liberty for 1 yr was returned by a commercial longliner. The captain also brought in samples of shark stomachs and several small shortfin makos (60-70 cm) which are young of the year and among the smallest we have seen.

Another interesting recapture came from a sandbar shark at liberty for nearly 8 yr. The shark was tagged off Long Island and recaptured near Panama City. The fishermen brought the entire shark to the NMFS Panama City Laboratory and Director Eugene Nakamura made arrangements to have it shipped to Narragansett for dissection. While at liberty, the shark grew an estimated 6 cm/yr (from 102 to 152 cm), which supports our earlier growth estimates for this species.

The spring newsletter was prepared in May and mailed to 2000 cooperative shark taggers during the first week of June. Pratt

had a photo exhibit as part of the University of Rhode Island's Sea Grant Seascope Educational Program on 15 and 16 May.

Work continued on the age-and-growth manuscripts. Summary papers for publication in the Age and Growth Workshop volume should be ready by mid-August.

### Ecosystem Dynamics Investigation

Marv Grosslein, Cabell Davis, Ed Cohen, and Roger Theroux spent most of their time preparing information for the U.S.-Canada maritime boundary issue.

Ray Bowman made a preliminary analysis of site-specific feeding information gathered during a winter cruise, *Delaware II* Cruise No. DE 81-08. Stomach content information on approximately 30 species caught in three depth zones has been summarized. Ray also finished a final draft of the paper, "Evaluation of the Results of Analyses of the Stomach Contents of Silver Hake (*Merluccius bilinearis*) Aboard Ship and in the Laboratory Ashore."

Tom Morris completed distribution charts for seven species of flatfish in preparation for publication of an International Council for the Exploration of the Sea document on their comparative mouth morphology.

Bill Michaels prepared tables listing prey consumed by 17 fish species sampled during the 1973-76 period. He also revised "A Guide for the Identification of Major Prey" to be used when examining the stomach contents of fish at sea.

Andrea Swiecicke and James Myette, summer employees working with Ray Bowman, summarized feeding information for yellowtail, winter, and fourspot flounders. The variability in feeding between and within stations is being examined for each species.

Charlie Wheeler continued his routine observations and recording of surface temperature during May and June. Water temperature in Buzzards Bay was abnormally low in June resulting in retarded development of larval American lobsters. No stage IV young were taken by the middle of the month, and very few larvae had progressed beyond stage I at that time. The effect of the recent cold, rainy weather on the 1982 year class of lobsters in the Bay can only be surmised at the moment. Trapping at Sippewissett Marsh in June showed a very low abundance of *Carcinus* spp. crabs, very similar to the situation last year. There is no evidence yet of recovery from the severe winter conditions of 1981.

John Hauser continued work on developing programs for the analysis and mapping of benthic data.

Mike Pennington and Wendell Hahm began an analysis of the effects of parameter variability on the outputs from the ecosystem model GEORGE.

### Cruise Participation

Ray Bowman participated on the last leg of the spring bottom trawl survey. Bill Michaels and Andrea Swiecicki assisted Charlie Wheeler on the R/V *Phalarope II*. Bill also participated on a HOCNESS survey on *Albatross IV* Cruise No. AL 82-05.

### Fishery Oceanography Investigation

During May, the Investigation completed the first warm-core ring cruise (*Albatross IV* Cruise No. AL 82-04) of the year, having surveyed the entrainment features of WCR's No. 82-A and No. 82-B. In addition, an array of seven current-meter moorings was set in the mouth of the entrainment feature of WCR No. 82-B. The second ring cruise of the year began on 17 June and will be completed on 2 July. WCR No. 82-B is again the target of study.

A MARMAP survey on *Delaware II* Cruise No. DE 82-03 was also completed in May and June. Tom Laughton, Catherine Jewell, Dan Patanjo, and Dana Densmore performed the hydrographic sampling.

The Investigation also contributed to the development of a source document for the Georges Bank maritime boundary issue between the United States and Canada.

### Plankton Ecology Investigation

Throughout May and June, Carolyn Griswold has been in contact with Massachusetts fishermen and State of Maine biologist John Hurst regarding the bloom of siphonophores in the Gulf of Maine. She alerted the *Delaware II* through Tom Azarovitz to note the presence of the net-fouling jellyfish during the spring bottom trawl survey in the Gulf of Maine, and has been examining spring MARMAP samples for these organisms.

From 18 May to 5 June, Carolyn conducted research on siphonophores aboard WHOI's R/V *Knorr*. These colonial planktonic coelenterates (jellyfish) are suspected of causing extensive damage to the nets of fishermen in the Gulf of Maine last autumn and winter. Using scuba gear and a tether system developed for blue-water diving, she collected siphonophores and other gelatinous plankton for shipboard identification and experiments. As one of the total complement of six women divers on board, she participated in the first all-women blue-water dive at a station in the Gulf Stream. Other stations were occupied in the Sargasso Sea, a warm-core ring, and the shelf waters off Southern New England.

In May, Carolyn Griswold reviewed a manuscript for the American Fisheries Society's *Fisheries* magazine.

Carolyn critically reviewed and commented on the "natural boundaries" document developed by the NEFC. She prepared a proposal for joint work targeted for the end of this summer with the Manned Undersea Research and Technology Program, and sent it to Dick Cooper for his approval.

Image-analysis processing of krill samples taken during the First International Biomass Experiment in the Antarctic on the Scripps Institute of Oceanography's R/V *Melville* Cruise No. *Vulcan* 7, was completed in June by Jerry Prezioso and Patricia Michalik who is working at the Narragansett Laboratory for the summer. Sample processing with the Bausch & Lomb (B&L) system will be compared with routine microscope processing to evaluate the efficiency of image analysis as a means of dealing with large numbers of samples with relatively simple species compositions. Jerry coauthored a report with Carolyn Griswold on the distribution of cephalopods of the Northwest Atlantic.

Jack Green began analysis in June of pump-sample data from Soviet R/V *Eureka* Cruise No. 80-02 and *Albatross IV* Cruise No. AL 81-03. In May, Jack participated in the process-oriented study on *Albatross IV* Cruise No. AL 82-05, using a new high-volume pumping system to take point samples of zooplankton. The system was designed to alleviate problems arising from the integrative sampling done by nets moving through the water. In addition to providing information on microscale variability of larval fish prey distributions, the pump causes minimal damage to the organisms.

Donna Busch participated in the process-oriented cruise with the Larval Dynamics Investigation on *Albatross IV*, revised a manuscript presented at the Kiel Symposium on Biological Productivity of Continental Shelves in the Temperate Zone of the North Atlantic (for publication in the International Council for the Exploration of the Sea's *Rapports et Proces-Verbaux des Reunions*), and reviewed several manuscripts and documents for the Marine Ecosystems Division Chief.

### Image Analysis

On 13 May, Ray Maurer gave a tour of the Narragansett Laboratory to Gilles Charrouette of the Fisheries Institute in Rennes, France. Gilles will be working with the NMFS/URI Cooperative Fisheries Engineering Unit through the summer, testing models of the Isaacs-Kidd midwater trawl. On 15 May, Gilles brought several pieces of netting to the image lab to determine if twine diameter could be measured. We found that by using the area and area percentage measurements, porosity could be determined in a fraction of a second. We also discussed the possibility of

making the same measurements from photographs of nets being towed. The same approach may be used to quantify clogging quickly.

Ray traveled to the Milford Laboratory on 17 May to discuss the feasibility of processing samples of sperm with the image-analysis system. Slides of sperm, prepared using several different methods, were compared for contrast and definition.

On 18 May, Ray instructed Greg Tracy of the University of Rhode Island's Marine Ecosystems Research Laboratory in the use of the image-analysis system. Greg is using the system to determine size variability of veliger larvae of the hard clam (*Mercenaria mercenaria*) as they develop in tanks.

On 25 May, George Hirschorn and Greg Small of the NMFS Northwest and Alaska Fisheries Center visited the Narragansett Laboratory. After a tour of the facility, Ray Maurer demonstrated the B&L Image System. Discussions later in the day included John Pijanowski of the NOAA Office of Ocean Technology and Engineering Services and focused on difficulties with present aging techniques and how to apply digital analysis to solve the problem. For instance, they find less variability in their scale-aging process using area measurements instead of the traditional distance between rings.

Mr. James Gallagher of the Naval Underwater Systems Center and Ferren MacIntyre visited the image analysis lab on 29 June to discuss the feasibility of determining the density and size frequency of small round targets.

### Biostatistics

The entire months of May and June were spent on preparing data and analyses for the NMFS staff study in support of the U.S. position concerning the Georges Bank boundary.

### Publications

BUCKLEY, L. J. Effects of temperature on growth and biochemical composition of larval winter flounder (*Pseudopleuronectes americanus*). Mar. Ecol.-Prog. Ser. 8(2): 181-186; 1982. (P)

COHEN, R. E; LOUGH, R. G. Prey field of larval herring (*Clupea harengus* L.) on a continental shelf spawning area. (MARMAP Contrib. No. MED/NEFC 81-10). Mar. Ecol.-Prog. Ser. (S)

MORSE, W. Spawning stock biomass estimates of sand lance, *Ammodytes* sp., off northeastern United States, determined from MARMAP plankton surveys, 1974-1980. Int. Counc. Explor. Sea, Comm. Mem. 1982/G:59;1982. 11 p.

SILVERMAN, J. J. The distribution and abundance of silver hake, *Merluccius bilinearis*, larvae off northeastern United States, 1977-1980. Int. Counc. Explor. Sea, Comm. Mem. 1982/G:58;1982. 12 p.

SMITH, W. G. Sand lance population explosion continues off northeastern United States. Am. Inst. Fish. Res. Biol. Briefs 11(2);1982. p. 2. (P)

### Reports

COHEN, R. E.; LOUGH, R. G. Zooplankton distribution and abundance in the Georges Bank-Nantucket Shoals area during the autumn-winter larval Atlantic herring surveys (1973-1977). (MARMAP Contrib. No. MED/NEFC 82-12) Woods Hole Lab. Ref. Doc. No. 82-12;1982. 533 p.

LAURENCE, G. C. Nutrition and trophodynamics of larval fish--review, concepts, strategic recommendations and opinions. MARMAP Contrib. No. MED/NEFC 82-50;1982. 23 p.

LOUGH, R. G.; COHEN, R. E. Vertical distribution of recently-hatched herring larvae and associated zooplankton on Jeffreys Ledge and Georges Bank, October 1974. (MARMAP Contrib. No. MED/NEFC 82-53) Woods Hole Lab. Ref. Doc. No. 82-10;1982. 91 p.

LOUGH, R. G.; POTTER, D. C. Rapid shipboard identification and enumeration of zooplankton samples. (MARMAP Contrib. No. MED/NEFC 82-53) Woods Hole Lab. Ref. Doc. No. 82-26;1982. 21 p.

## RESOURCE UTILIZATION DIVISION

### Processing and Preservation Investigation

#### Frozen Fish

We welcome Dan D'Entremont for the summer. Dan will be working with Joe Mendelsohn.

The study to determine the shelf life of frozen "U.S. Grade A" haddock held in the Vendo freezer-dispenser is completed. After 12 mo of frozen storage, the product was found to be "U.S. Grade B" by a U.S. Department of Commerce (USDC) inspector and borderline to fair (5.3) by the Gloucester Laboratory taste-test panel.

The study to determine the storage stability of "U.S. Grade A" frozen fish fillets stored at 0° and -20° is completed. The sensory evaluations by the Gloucester Laboratory taste-test panel showed that the frozen samples (starting with "U.S. Grade A" frozen fish) stored at -20°F for 12 mo were rated as borderline

(5.4) to fair (6.2). All these samples were rated by a USDC inspector as below "U.S. Grade A." The samples stored at 0° were also scored as borderline (5.3) to fair (6.5) by the sensory panel. All the 0°F-stored samples were also below "U.S. Grade A."

### fish Bleeding

A new experiment to determine the effect of bleeding on storage stability and sensory characteristics of yellowtail flounder was begun. Joe Mendelsohn joined the Massachusetts Division of Marine Fisheries' inshore bottom trawl survey team aboard the Gloucester Laboratory's R/V *Gloria Michelle* to obtain samples for the experiment. A portion of the flounder was bled immediately after being caught and stored in ice while the remaining flounder were kept in ice as a control. All fish were brought back to the lab for iced storage and sensory evaluation. A portion of both the unbled and bled flounder was filleted and stored in ice while another portion of both the bled and unbled flounder was stored whole in ice. The whole fish were filleted at the time of evaluation.

The results show that the raw bled fillets were rated higher on each examination over the unbled fillets during the 13-day iced storage period. On the 13th day, the bled fillets were rated as fair to good, while the unbled fillets were judged as borderline to fair. The bled, cooked fillets were rated as fair to good on the 13th day of storage, while the unbled cooked fillets were rated as borderline to fair.

The sensory evaluation of the fillets cut from iced, whole-stored, bled, and unbled flounder showed results similar to the iced stored fillets. The raw fillets cut from bled whole flounder scored about 1/2 a point higher at each examination than the fillets cut from unbled fish. The sensory evaluations of the cooked fillets from the bled and unbled whole-stored flounder were similar. On the 13th iced storage day, both samples were rated as fair (6.1). On the 17th iced storage day, both samples were scored below borderline.

### Weight and Length Changes in Cod During Iced Storage

One storage test to determine if there are any weight or length changes in gutted scrod Atlantic cod stored in boxes with ice was completed. After an 11-day iced storage period, the scrod cod lost an average of 0.9 oz on an average fish weight of 3 lb, for a net weight loss of about 2%. After the same 11 days in ice the fish gained an average of 0.13 inches on an average fish length of 21 inches, for a net length gain of about 0.6%. A second experiment to determine the weight and length changes during iced storage of scrod cod is in progress.

### Sorbate Preservation

The second of three experiments on the preservative effect of potassium sorbate (KS) on dressed Atlantic cod was completed. For this experiment, 3-day-old iced Atlantic cod were immersed in chilled seawater (CSW) containing 0.5% KS for 2 days, and then placed in ice. This procedure simulated in-plant conditions where the fish are held over a weekend in CSW + 0.5% KS rather than in ice. The results of the experiment indicate that holding whole dressed fish in CWS + 0.5% KS for 2 days did extend the iced shelf life of the dressed fish, and the fillets cut from them, from 10 to 20% over conventionally iced controls.

Similar experiments using 5-day-old Atlantic cod are in progress. A bacteriological study on cod fillets dipped in 2.5 and 5.0% KS is in progress. This work may give some indication of how KS extends shelf life.

### Blue Crab

Organoleptic testing is continuing on blue crab meat pasteurized in O<sub>2</sub>-impermeable plastic pouches. After 8 mo of refrigerated storage, both samples are comparable to commercially pasteurized canned controls.

Experiments are under way to produce organoleptically acceptable sterilized canned blue crab meat using crab meat extracted by the Quick-Pick machine extractor.

### Nutritional Values

We are now up and running with a new Carbowax 20M column for the analysis of fatty acids. The first priority was the material on processing effects on nutritive value. The workup on the NMFS-University of Rhode Island collaborative research on nutritional changes over repeated freeze-thaw cycles was started, and the samples await gas-liquid chromatography analysis on the new column. A high-pressure liquid chromatograph has been ordered, and we anticipate being able to follow more closely the oxidative products of the eight various processing techniques.

### Engineering

Purchases for equipment to complete outfitting the *Gloria Michelle* are being ordered. The heat exchanger has been ordered, although the cost is considerably higher than the original estimate. A pneumatic proportional control valve is being studied and will be ordered. Vessel schedule changes have mandated the earliest availability to be August.

## MFPS/URI Cooperative Fisheries Engineering Unit

A 1/2-scale model of the Isaacs-Kidd midwater trawl is being built for additional tests in the University of Rhode Island's (URI) Ocean Engineering Department tow tank.

A proposal for a study of the international young gadoid pelagic trawl as a juvenile fish sampler for inshore waters is being put together with Jack Green of the Narragansett Laboratory.

A project to develop a shrimp sampling trawl for the Gulf of Maine has been started in cooperation with the Atlantic States Marine Fisheries Commission's Northern Shrimp Technical Committee.

The NEFC's Yankee No. 36 bottom survey trawl model was tested in the Sea Fish Industry Authority flume tank in Hull, England. The results will be included in the prototype-model correlation which is being undertaken in cooperation with Dr. Conrad Recksiek of the URI's Fisheries and Marine Technology Department.

The cooperative agreement between NEFC and URI concerning the Fisheries Engineering Unit has been finalized and is awaiting signing.

An automatic squid jigging machine is on loan to a Marshfield, Massachusetts, fisherman for demonstration purposes.

Research cruises of the *Gloria Michelle* during the reporting period are noted in the table below.

Cruise No.	Purpose	Area
GM 82-07	Current-meter deployment	Narragansett Bay
GM 82-08	Massachusetts Division of Marine Fisheries inshore bottom trawl survey	Massachusetts inshore waters
GM 82-09	Ocean Pulse Program diving survey	Jeffreys Ledge (Gulf of Maine) and Block Island (off Rhode Island)

### Product Safety Investigation

We undertook several steps to improve our methods for analyzing environmental contaminants, such as polynuclear aromatic hydrocarbons (PAH's). These steps included:

1. Bond Elut Experiments--Five experiments were run to optimize yields. It was determined that good yields (75-100%) could be obtained by charging a mixture of PAH's onto the column as a 95% water/methanol solution.
2. Dunn Experiments--Seven experiments and partial experiments were conducted to optimize yields. It was determined that good yields (70-100%) could be obtained by 20% deactivation of the florisil step. However, this resulted in a reduction of cleanup efficiency.
3. Tonogai Experiments--Three experiments were run to verify the usefulness of this procedure as a quick screening method. High but variable yields were obtained. This is acceptable for quick screening.
4. Vydac Column--A new high-performance liquid chromatography column, the Vydac 201 TP 54.6, was installed and evaluated for the separation of the 16 priority pollutant PAH's. Excellent separation was found.

#### Gas Chromatography-Mass Spectrometry Analysis for PAH's

Work is proceeding on the confirmation of suspected PAH's in fish or shellfish extracts which have been analyzed by gas chromatography-mass spectrometry. A 25-m x 0.31-mm SE-54 crosslinked wall-coated open tubular fused silica column is being used to separate a mixture of 17 PAH's. Separation has been achieved for: benzo(a) anthracene from chrysene; perylene from benzo(e) pyrene; benzo(e) pyrene from benzo(a) pyrene; and 1, 2, 3, 4-dibenzopyrene from 3, 4, 8, 9-dibenzopyrene. Mass spectra have been obtained for each of the priority PAH's; selected ion monitoring has also been an effective tool for determining PAH's by gas chromatography-mass spectrometry.

#### Chromatogram Reinterpretation for PAH's

Eighteen chromatograms of New York Bight samples were reinterpreted for PAH consistency from analysis to analysis.

#### Data Bank for PAH's

Mr. Peter Spinney has been hired during the summer months to enter all of our pollution data into a data bank. A PAH file has been configured and nearly all of the data have been entered.

#### EPA's Intercalibration Exercise of Sediments for PCB's

The samples received from EPA were analyzed for polychlorinated biphenyls (PCB's) and the data calculated by the Webb-McCall method. The results included both the Soxhlet and

ultrasonic homogenization methods of extraction. A report was submitted to EPA's Cincinnati Office.

### Workup of Targeted Finfish and Shellfish for PCB's

Workup of samples collected from the New York Bight region has begun. Samples of American lobster, Atlantic rock crab, and red hake have been worked up and analyzed.

### Training of Summer Personnel

Training of our physical science aids, Lisa Stout and Andrew Close, in the workup of PCB's has begun and will continue under close supervision for a period of time.

### Product Quality Investigation

We welcome Suzi Gerow who will be working under the direction of Elinor Ravesi, and Rebecca Marsden and Mark Lawrence who will be working under Ron Lundstrom's direction during their summer appointment.

An iced storage study was completed with Atlantic cod fillets packaged or treated in various manners and irradiated with 100 Krad. On the basis of sensory analysis, chemical tests, and bacterial tests, the samples treated with potassium sorbate had the longest shelf life compared to samples which had either been air-packed, vacuum-packed, or packed in an atmosphere of 60% carbon dioxide. It is planned to initiate a follow-up study to compare the shelf life of sorbate treatment alone versus sorbate treatment plus irradiation.

A new project concerned with the development of data regarding the edibility characteristics of different marine species is being initiated. The objective of this study is to determine specific edibility characteristics of regional species in terms of their flavor, texture, and appearance using a standardized methodology. For the sensory and objective tests, these data will provide both processors and consumers with edibility factors for different species. This will demonstrate both similarities and dissimilarities in the eating characteristics between species and among groups of species. Potential panelists for the edibility study are being trained or screened for their ability to discern the four basic tastes--salt, sweet, sour, and bitter. This will be followed by ranking tests or triangle taste tests to determine acuity or threshold levels among the panelists.

In a preliminary screening study on the effect of proteolytic enzymes on frozen red hake, bacterial, fungal, and papain proteases were mixed into minced red hake at a concentration of 0.1% wet weight. Plate-frozen blocks of these three treatments were stored at 0° F. A control sample having 160 ml of water mixed

into the minced fish was also stored at 0° F. As reference material, untreated minced fish blocks were stored at -80° F.

Initial sensory evaluation indicated that all the protease-treated samples were very soft, while the reference and the water control had a very good texture. However, after just 7 wk, the texture of the water control was judged as borderline as it had become moderately rubbery within that time. The bacterial protease-treated samples remained very mushy, but the fungal and papain protease-treated samples were considered to have become firmer during storage.

Instron measurements using a modified six-blade Kramer shear press corresponded to the sensory results. On the seventh week of storage, all samples except the water-treated control lost 25% of their weight during cooking. The water control lost 35% of its frozen weight.

The moisture content of all samples is 84% and has not been affected by treatment or storage time. The extractable protein nitrogen content has been reduced to about 15% of its critical value. The trimethylamine oxide content of all samples held at 0 F has dropped to about 25% of its original value, while dimethylamine (DMA) and formaldehyde have risen to levels indicative of tough, rubbery red hake. Trimethylamine remains at a very low level.

Perry Lane, Thomas Connors, Judith Krzynowek, and Joseph Mendelsohn attended the "Flavor and Texture Profile" training session at the U.S. Army's Natick (Massachusetts) Laboratories during 24 May-4 June.

Previous studies have shown that red hake exposed to oxygen (air) has a lower production rate of DMA and formaldehyde and less textural alteration. In order to study the effect of packaging material on the storage stability of red hake fillet blocks, flat-frozen fillet blocks were vacuum packaged in either polyethylene, nylon-surlyn, or retort-pouch film. A fourth set of samples was air-packed in polyethylene. These samples were stored at 0° F, and a reference control was stored at -80° F. After 6 wk of storage, a Gloucester Laboratory taste panel scored the treated samples slightly lower than the control in texture. Shear force measurement (Instron), extractable protein nitrogen content, dimethylamine, and formaldehyde contents all show signs that a change has occurred, but not an objectionable change. This study is continuing.

Sarcoplasmic protein patterns were compared for Greenland halibut (Pacific and Atlantic varieties), Dover sole, Atlantic halibut, and an unknown sample using agarose gel isoelectric focusing. The unknown sample had a protein pattern substantially different from the patterns of the known samples and an identification was not possible. This analysis was conducted for the NMFS Western Inspection Office at Bell, California.

We have begun to purchase equipment and supplies needed to establish a tissue culture facility at the Gloucester Laboratory. We will be evaluating several potential uses of monoclonal antibodies in fishery biology and technology.

### Product Standards and Specifications Investigation

"U.S. Standards for Grades of Fresh or Frozen Shrimp" has been published in the *Federal Register* of 20 May 1982. "U.S. General Standards for Grades of Fresh or Frozen Fish Steaks" is in the NMFS Central Office awaiting publication.

A proposed "Draft Inspectors' Instructions for Grading Fresh or Frozen Shrimp" has been prepared. A revised "Draft Inspectors' Instructions for Grading Fresh or Frozen Fish Steaks" has been prepared.

A revised draft of a proposed "U.S. General Standards for Grades of Frozen Fish Portions and Fish Sticks" has been sent to about 40 organizations for review and comments.

An initial draft of a proposed "U.S. Standards for Grades of Frozen Lobsters" is now being reviewed.

An initial draft of a proposed "U.S. Standards for Grades of Fresh or Frozen Clams" has been prepared.

A "Commercial Item Description for Whole and Dressed Fish" has been completed and sent to the NMFS Central Office.

A "Commercial Item Description for Canned Tuna" was reviewed and comments made by our Investigation.

In response to a request from the USDA for a purchase document to cover freshwater catfish, a proposed commercial item description covering whole and dressed fish was prepared and sent to the NMFS Central Office.

### Technical Assistance

Information and technical assistance were provided by the Resource Utilization Division in the following areas: artificial seawater; shrimp processing; consumer attitudes toward seafoods; ocean pout; brine strengths; melanosis of shrimp; yields of cured fish; quality tests; rapid thawing method for fish; microbiology of fish; use of Torrymeter; red hake; time-temperature effect on shelf life; lipids in fish; fish standards; international publications; mixed-species labeling; spiny lobsters; imitation crab legs; catfish steaks; composition of red hake; heading and gutting machines; fish silage; codworms; and squid processing.

## Publications

- KAYLOR, J. D.; LEARSON, R. J. Krill and its utilization: a review. NOAA Tech. Rep. NMFS SSRF. (A)
- KRZYNOWEK, J.; WIGGIN, K. Sterol and fatty acid content in 3 groups of surf clams (*Spisula solidissima*): wild clams (60 and 120 mm size) and cultured clams (60 mm size). Comp. Biochem. Physiol. (A)
- KRZYNOWEK, J.; WIGGIN, K.; DONAHUE, P. Cholesterol and fatty acid content of 3 species of crab found in Northwest Atlantic. J. Food Sci.:May-June 1982. (P)
- LICCIARDELLO, J. J.; RAVESI, E. M.; ALLSUP, M. G. Stabilization of the flavor of frozen minced whiting. 1. Effect of various antioxidants. Mar. Fish. Rev. (A)
- WILHELM, K. A. Extended fresh storage of fishery products with modified atmospheres: a survey. Mar. Fish. Rev. 44(2):17-20;1982. (P)

## ENVIRONMENTAL ASSESSMENT DIVISION

### Behavior of Marine Fishes and Invertebrates Investigation

As part of the Investigation's ongoing effort to define critical life habits of key marine species, a study has been initiated to examine food habits of juvenile bluefish throughout their first growing season. Bluefish, a recreationally important species and a dominant predator in Mid-Atlantic and Southern New England waters, appears to have significant impact on prey populations. In preliminary lab studies, juvenile bluefish have exhibited daily consumption rates as high as 12% of their body weight.

In this present study, bluefish and prey species are being sampled concurrently at regular intervals with subsequent qualitative and quantitative analysis of both stomach contents and prey collections. Results from these analyses will be examined for changes in diet with size, season, and prey species availability and abundance.

### Environmental Chemistry Investigation

Vincent Zdanowicz participated in Part I of the annual sea scallop survey on *Albatross IV* Cruise No. AL 82-06, collecting about 200 tissue (viscera and kidney) samples from 17 stations. This activity represents a cooperative effort by the Biochemistry and Physiology Groups within the Physiological Effects of Pollutant Stress Investigation at the Milford Laboratory, our Investigation, and the Resource Assessment Division at the Woods Hole Laboratory. We initiated metal analyses of tissues collected

during the 1981 New York Bight benthic contaminants monitoring survey on *Albatross IV* Cruise No. AL 81-09, and completed entry of data on metals in sediments from four 1980 surveys (*Kelez* Cruise No. KE 80-04, *Albatross IV* Cruises No. AL 80-07 and AL 80-09, and *Delaware II* Cruise No. DE 80-09), into the Sandy Hook Laboratory Automatic Data Processing Unit. V. Zdanowicz and J. O'Reilly and several other members of the Environmental Assessment Division met with B. J. Johnson of EPA's Edison, New Jersey, facility to discuss coordinating New York Bight monitoring activities.

Seawater samples for nutrient analyses were collected during the MARMAP survey on *Delaware II* Cruise No. DE 82-03 and during the warm-core ring survey on *Albatross IV* Cruise No. AL 82-04. The analyses of ammonium have been completed for both surveys, and analyses of nitrate, nitrite, silicate, and phosphate have been run for the warm-core ring samples. About 150 nutrient analyses were performed for J. Mahoney of the Biological Oceanography Investigation to provide background information on seawater filtrates used in his study of plankton growth potentials.

Sixty cross-shelf profiles of nutrient data, along the Hudson and Chesapeake transects, were generated using the Harvard Symap Contour Program, as well as data from 11 surveys in 1979 and one in 1980. Contour maps of nutrients in surface and bottom water between Cape Hatteras and Nova Scotia were also prepared for each of these surveys. These depictions form the basis for reports in preparation which characterize the 106-mile and Philadelphia Dumpsites.

Al Matte met with Joel Solomon and Gary Ward of the NOAA Office of Ocean Technology and Engineering Services to initiate plans for a joint effort with Brookhaven National Laboratory's Ocean Science Group and the Environmental Chemistry Investigation at the Sandy Hook Laboratory, to compare and evaluate various nutrient sample processing and analysis procedures. This cooperative effort will generate a high degree of compatibility and standardization between the major groups measuring nutrients within the Northeast monitoring area.

Monitoring of chlorophyll and phytoplankton production continued with the May-June MARMAP survey on *Delaware II* Cruise No. DE 82-03. This survey sampled the Gulf of Maine, Georges Bank, the Scotian Shelf, and water north of the Hudson Shelf Valley off Long Island.

Dave Burdick and Jackie Frisella (Narragansett Laboratory) measured chlorophyll pigment concentrations during the warm-core ring survey on *Albatross IV* Cruise No. AL 82-07. Chlorophyll (netplankton and nanoplankton) was measured throughout the water column to about 100 m using samples obtained with the Niskin rosette at 84 stations. Additionally, underway in-vivo phytoplankton fluorescence was measured continuously during the ring survey using the ship's saltwater system. These readings will provide greater resolution of chlorophyll in the shelf-water

entrainment feature and allow comparisons to be made between the in-situ fluorometer tied to the multiple opening-closing net and environmental sensing system and shipboard fluorometer. Chlorophyll data collected by Burdick and Frisella were provided daily to Bob Evans and Otis Brown of the University of Miami to provide "sea truth" need to calibrate the coastal zone color scanner.

Kathy Workman completed extractions and analyses of over 4000 chlorophyll samples collected during two warm-core ring surveys made in 1981 (*Albatross IV* Cruises No. AL 81-11 and AL 81-12).

V. Zdanowicz and J. O'Reilly, working with B. Reid, revised a manuscript which summarizes data from the 1980 New York Bight benthic contaminants survey.

A paper entitled "Nutrients, Hydrography and Their Relationship to Phytoflagellates in the Hudson Estuary," by Draxler, Waldhauer, Matte, and Mahoney, was submitted for publication to *Marine Environmental Research*.

Three reports, summarizing extensive data on nutrients and chlorophyll on Georges Bank and surrounding water, were prepared and provided to key NEFC personnel responsible for synthesizing all ecological information relating to the U.S.-Canadian Georges Bank maritime boundary issue: (1.) "Gradients in Surface Phytoplankton Biomass On and Around Georges Bank," by Evans-Zetlin, O'Reilly, and Matte; (2.) "An Examination of Inorganic Nutrient Data On and Off Georges Bank in 1979," by Draxler, Matte, and Waldhauer; and (3.) "A Comparison of the Abundance (Chlorophyll *a*) and Size Composition of the Phytoplankton Communities in 20 Subareas of Georges Bank and Surrounding Waters," by O'Reilly and Evans-Zetlin.

#### Biological Oceanography Investigation

Algal assay of 37 seawater samples was completed. In these assays, the nutrient spikes were reduced from previous levels to make them more comparable to seawater ambient levels. For example, the nitrogen addition was reduced from 20.0  $\mu\text{g-at}/\ell$  to 5  $\mu\text{g-at}/\ell$ , and metals were reduced to 1/50 of their former levels. Nitrogen was the critical nutrient in most of the samples, as was the situation in previous assays. Phosphorus level was more critical than nitrogen in five of the samples, this assay result being in agreement with relatively low ambient phosphorus concentrations. Vitamin B<sub>12</sub> supply did not limit growth in any of the samples and neither did silicate, even when its ambient level was lowest (1.4  $\mu\text{g-at}/\ell$ ). A disadvantage of the lowered levels of nutrient additions is that this has resulted in occasional weak growth of the assay diatom, *Thalassiosira pseudonana*. The likely possibility that this growth stress was due to metal deficiency is being examined in the next assay by restoring the metal concentrations to former levels. Analyses of

ambient nutrient levels in assay samples were provided by the Environmental Chemistry Investigation.

In collaboration with Denise Hollomon, planning and equipping were begun for an assay of the growth potential of the dinoflagellate *Gonyaulax excavata* in New York and New Jersey waters, including major shellfish areas.

Dr. Harold G. Marshall of Old Dominion University in Norfolk, Virginia, and Myra S. Cohn have prepared a paper, "Phytoplankton Populations and Distribution Patterns Over the Northeastern Continental Shelf of the United States," for the Proceedings of the Marine Technology Society's Oceans '82 Conference to be held in Washington, D.C., in September. A NOAA Technical Memorandum, "Seasonal Phytoplankton Assemblages in Northeastern Coastal Waters of the United States," by Marshall and Cohn, has been submitted to the journal *Estuarine, Coastal and Shelf Science* for publication. Water samples for phytoplankton composition were obtained on three Ocean Pulse/Northeast Monitoring Program cruises and are being processed.

The statistical analyses of data from our experiment concerning the effects of varying concentrations of cadmium on seabed oxygen consumption rates are continuing.

A significant amount of time during this reporting period has been devoted to the maintenance and repair of lab diving equipment, as well as providing diver support to researchers from academia and other government agencies.

A first draft of a paper, accepted for the Oceans '82 Conference, has been completed and is being reviewed.

Bill Phoel was again requested to estimate the origin of a body found washed up on a New Jersey beach. The request was from the Monmouth County (New Jersey) Prosecutor's Office.

Work on the Superflux technical report continues with proofing of the figures and tables in preparation for photography and typing in July and August.

As part of the Coastal Habitat Assessment, Research, and Monitoring Program and other remote sensing activities, Craig Robertson attended a 1-wk course in June on terrain analysis by satellite and aircraft imagery at the U.S. Geological Survey's Earth Resources Observational System's (EROS) Data Center in Sioux Falls, South Dakota. Techniques of data acquisition, processing, and interpretation were taught, and an explanation of the EROS facilities and functions was given.

In an attempt to implement further the agreement of cooperation between NOAA/NMFS and Hampton Institute, a trip to Hampton, Virginia, was made by Jack Pearce and Craig Robertson in June to view their marine science facilities and discuss future interactions between the two organizations. Subsequent to this trip, two students from Hampton Institute were placed at the Sandy Hook Laboratory as cooperative education employees for the summer.

Jim Thomas, Bill Phoel, and Craig Robertson attended the Northeast Monitoring Program (NEMP) meeting on the preparation of the NEMP annual report in June at the Milford Laboratory.

Craig Robertson and Jim Thomas visited NASA's Goddard Space Flight Center in May and searched 11 000 orbits of Coastal Zone Color Scanner, or CZCS, (laserfax file) data for scenes usable to the NEFC. A new file, the Greenbelt Engineering File, was discovered and examined. The file is available in near real-time and consists of one scene per day of the East Coast of the U.S. to determine the functioning of the CZCS. A portion of this file (April 1979-June 1981) was given to the NEFC and is now located at the Sandy Hook Laboratory.

Jim Thomas visited the Charles S. Draper Laboratory in May and June to produce a series of sea-surface temperature and chlorophyll images for the Gulf of Maine-Georges Bank region. The data were derived from the CZCS on the Nimbus-7 satellite and were used to examine the temporal patterns of sea-surface temperature and chlorophyll in the Gulf of Maine-Georges Bank region between March and August 1979. Generally, from March to May, concentrations of chlorophyll increase. From June to August, chlorophyll concentrations decrease except for specific areas. Except for the nearshore waters and estuaries of Nova Scotia, the Scotian Shelf has lower concentrations of chlorophyll than the central Gulf of Maine, except in March and April when concentrations are about the same, and in July when concentrations over the Scotian Shelf are greatest. Georges Bank has higher concentrations than the Gulf of Maine, Scotian Shelf, and slope water except in May when the Gulf of Maine, Georges Bank, and slope water are approximately the same, and in July when the Scotian Shelf and Georges Bank are about the same. An area of persistent high chlorophyll concentration occurs along the southwestern coast of Nova Scotia from March to August. The waters of the Bay of Fundy, northern coastal Maine, and Nantucket Shoals have elevated concentration of chlorophyll from March through at least July. From March to May, increased concentrations spread southward along the coast from the Bay of Fundy to Cape Cod Bay, following the general circulation in the Gulf of Maine. With the exception of the Scotian Shelf and central Gulf of Maine, generally the colder waters (usually areas of upwelling or other increased vertical mixing) have higher concentrations of chlorophyll. The Georges Bank-Gulf of Maine region was subdivided into areas and histograms (number of pixels versus radiance counts) of chlorophyll concentrations for each area were constructed to determine associations between areas.

## Environmental Statistics Investigation

The methodology for interpretation of synergistic and antagonistic effects using environmental data and physiological responses has been developed. The exploratory data analysis for the enzyme concentration measurements (GDH, PK, MDH) with heavy-metal body burdens (Ag, Cd, Cu, Zn) from sea scallop tissues, and for osmosis measurements with inorganic elements (Na, K, Ca) in scallop plasma, has been performed.

The New London (Connecticut) Dumping Ground benthic data sets have been analyzed on the seasonal pattern differentiation between the dumpsite and unaffected stations. The differentiation is based on the multivariate measurements of total organisms and species counts, as well as information, Simpson, and equitability indexes.

Ongoing statistical consulting for various investigations in NEMP continued, particularly on the heavy-metal exposure study, heavy-metal patterns analysis, hard-clam sampling design problems, New London benthic community study, and pathobiology data handlings.

We reviewed the monograph "Ecological Diversity in Theory and Practice" for *Mathematical Reviews*, and a proposal, "Effects of Sewage Disposal on Demersal Fish Assemblages: Development of a Predictive Assessment Tool," for the NOAA Office of Marine Pollution Assessment, completed the draft "Species Sensitivity Assessment for Heavy Metal Monitoring," and presented a seminar on the subject to the Sandy Hook Laboratory research personnel.

## Coastal Ecosystems Investigation

### Community Structure

We continued to receive comments and make revisions on our annual report concerning contaminants in the benthos of the New York Bight. Data from the benthic macrofauna portion of the report were used in a paper written for the Oceans '82 Conference. We also worked on revising the NEMP annual report, and began writing a section of a paper, to be coauthored with several other benthic ecologists, on long-term degradation of the macrobenthos of northeastern estuaries.

Several meetings were held to plan an intensive sampling of the New York Bight apex aboard the *Delaware II* in September. Objectives are to characterize contaminant distributions and effects thoroughly, to separate effects of the various pollutant sources, and to determine changes since the early 1970's. The planning is coordinated with EPA which has also been sampling Bight sediments for several years; we hope to be able to merge the two efforts. We are also planning to increase our sampling in Buzzards Bay, to examine fates and effects of the PCB's which have

been found in high concentrations in the New Bedford area. This work is coordinated through the NEFC's Manned Undersea Research and Technology Program.

Ann Frame has now completed identifications/confirmations of macrofauna specimens through our winter 1980-81 sampling, and is well along on the summer 1981 collections. Steve Fromm has been coding and computerizing the faunal data as they are confirmed. Steve presented a poster paper at the American Society of Ichthyologists and Herpetologists meeting in DeKalb, Illinois, concerning his work on stress effects on sodium and potassium levels in *Fundulus*.

Clyde MacKenzie and Dave Radosh resumed their field experimental studies on surf clam ecology. Clams which had been transplanted from Long Island coastal waters to lower New York Bay were harvested for determination of contaminant uptake, gill tissue respiration, and egg/larval viability. This is a cooperative project with the Milford Laboratory. Clyde and Dave are now preparing to deploy trays of sand with various amounts of silt or sewage sludge added, to examine variables affecting setting success for clams and other macrobenthos. Clyde also worked on a paper on ways of increasing American oyster production in the Northeast, while Dave neared completion of a manuscript on effects of hypoxia on benthos.

We also: (1.) provided information on New York Bight benthic species richness, as related to sediment PCB's, to Willard Bascom of the Southern California Coastal Water Research Projects; (2.) gave talks on environmental problems and research to 7th and 8th grade students from the Marine Resources Consortium of Monmouth County; (3.) provided material for a seminar at Ramapo College on impacts of ocean dumping; and (4.) sent information on environmental trends in Raritan Bay to the Battelle Laboratory in Duxbury, Massachusetts, which is working on a report on that system for the Hudson-Raritan Estuarine Program.

### Benthic Energetics

Knee McNulty contributed to the preliminary Center staff study of the New York Bight apex 12-mile Dumpsite characterization by preparing a report (see "Reports" section) that succinctly inventories much of what we know about alterations caused by dumping. Dr. McNulty is currently bringing together material to prepare a more comprehensive report of the 106-mile Dumpsite. Jan Ward and Dot Jeffress are also working on site characterizations by preparing a benthic data summary for the 65-mile Alternative Dumpsite. This work includes editing the historical data set and beginning to work up remaining samples from 1974-75 surveys in the area.

A draft of our computerized file on the life histories of dominant, common, or ecologically important benthic invertebrate species was completed and initial output is available as a report (see "Reports" section). This file enables us to update, retrieve, and manipulate life history information rapidly for the species in the file. The file can be integrated with other benthic files (e.g., community structure) to assess the predominance or change in any life history attribute (e.g., dominant feeding type) in a sample or community, as well as examine relationships in the wide range of benthic environmental or biological characteristics. Relating to the file, we have been working with the Automatic Data Processing Unit at the Sandy Hook Laboratory to place all historical benthic data files in a central framework using standard input formats. We are also acquiring other benthic files from NOAA's National Oceanographic Data Center pertaining to the Northeast, to develop the ability to retrieve data rapidly from any area or for any species. This will improve our response time in preparing site characterizations and assessing real or potential impacts of a toxic-waste spill, oil-drilling activity, or related events. Bridge logs from five 1977 cruises were reformatted and added to the file, supporting associated benthic survey data that will be incorporated as well. Assistance was provided to other researchers in terms of samples, life history information, and zoogeographic references (for Georges Bank).

Eighteen species of continental slope and rise fish were combusted for calorimetric analysis by Russ Terranova; these data are unique for the western Atlantic and will be useful to improve our knowledge of biological energy pools and fluxes in this area. This may have application for the 106-mile Dumpsite characterization or future impact assessments there, as well as new slope oil-drilling lease sites. We are in the final stages of preparing a preliminary inventory of the energy equivalences (caloric) of marine organisms. This inventory will list by phyla and species all calorimetric data we have located in the literature (84 sources at present). The data will be available by various flesh weights (i.e., cal/wet wt, cal/dry wt, cal/ash-free dry wt) as available from sources or calculated if sufficient data were available. We expect that this inventory will greatly assist energy budget modeling, food habits, and other areas of research. This inventory has also been computerized for rapid updating, retrieval, and manipulation. Work continues on the preparation of a manuscript on the secondary productivity of benthos in Georges Bank for a joint NEFC/WHOI book; a first draft is available and is being improved.

#### Ocean Pulse/Northeast Monitoring Program Coordination

Work progressed in preparing and editing the next draft of the 1981 NEMP annual report. The current draft contains almost all the information available, summarized by monitoring discipline and by Regional Action Plan Water Management Units. With the exception of the executive summary, all sections of the report

have been drafted and organized, although some rewriting is still necessary and figures have to be finalized. Work also continues in developing new or extending existing contracts required to support the program for the remainder of the year. Some time was spent coordinating Ocean Pulse participation in this summer's sea scallop survey and developing a reasonable approach to Ocean Pulse participation in future bottom trawl surveys.

## Physiological Effects of Pollutant Stress Investigation

### Physioecology

Adult blue mussels held in ambient seawater in a diluter system continue to be sampled biweekly for copper analysis.

Adult blue mussels were spawned and three embryo experiments were set up. The embryos were tested against heavy metals for determination of LC<sub>50</sub> values.

A cooperative study with Dr. Weiss of the New Jersey Medical School has been completed. Dr. Weiss has removed his fish from our heavy-metal exposure diluters and brought them back to his lab for examination.

We participated in the collection of adult American oysters and surf clams that had been placed off Staten Island and off Swinburne Island, respectively, by C. MacKenzie of the Sandy Hook Laboratory. The animals were brought to the Milford Laboratory and spawned. Gamete viability is being tested.

We participated in the annual sea scallop survey on *Albatross IV* Cruise No. AL 82-06 during 1-11 June.

### Physiology

We spent 3 days at the Sandy Hook Laboratory testing blue mussels held in cages at three New York Bight stations. This joint study with the EPA's Narragansett, Rhode Island, facility will continue on a monthly basis into fall. Mussels are held at two very polluted stations (Ambrose and Sewage Sludge) and a control site. New collections of mussels from Rhode Island are set on station each month giving a series of 30-day exposures to New York Bight waters.

We also made gill-tissue respiration measurements on surf clams collected from polluted estuarine waters in New Jersey. The samples were provided as part of a study being conducted by C. MacKenzie of the Sandy Hook Laboratory.

A 60-day exposure of winter flounder to 10 and 20 ppb of copper was completed in early June. There was no significant difference in gill-tissue respiration between controls and either copper-exposed group. There was a significant rise in plasma sodium concentration in the 20-ppb group compared to the

controls. There were no significant differences between controls and the metal-exposed groups in any of the other hematological measurements completed to date, namely, Hct, Hb, MCHC, RBC, plasma osmolality, Na, and Ca. In mid-May, a 60-day exposure of windowpane to 10 and 20 ppb of copper was completed. Red cell counts and hemoglobin concentrations were significantly lower in the 10-ppb-exposed group, but not in the 20-ppb-exposed group, when compared to the controls. There was also a concomitant decrease in gill-tissue respiration in the 10-ppb, but not the 20-ppb, exposed fish. Measurements of plasma ions and osmolality in blood samples from this exposure test are still in progress.

A series of 6, 9, and 12-wk exposures of sea scallops to copper or cadmium was also completed this period. This set of metal-exposed animals was also sampled by Biochemistry and Chemistry personnel. The results of this study will be analyzed during the next reporting period.

We participated in the first leg of the annual summer sea scallop survey, collecting samples from a number of stations within Ocean Pulse strata. We are now preparing for participation in the remainder of the sea scallop survey as well as the upcoming summer NEMP cruise.

### Biochemistry

During this reporting period, we participated in the first leg of the annual sea scallop survey and in the first month's sampling of the study that the EPA's Narragansett facility is conducting with blue mussels deployed at three stations in the New York Bight apex. The Physiology and Biochemistry personnel, in collaboration with EPA colleagues, will compare the relative practicality, sensitivity, and overall feasibility of a variety of biological monitoring techniques.

Sea scallops exposed in our diluter facility to either cadmium (10 ppb) or copper (20 ppb) for 6, 9, and 12 wk were taken down and their tissues excised for analysis by Physiology, Biochemistry, and Chemistry. The copper exposure has been completed, while the cadmium study will continue until mid-July.

Analyses were completed for both adductor muscle and kidney samples from sea scallops taken during Ocean Pulse surveys on *Albatross IV* Cruises No. AL 82-01 and AL 82-03, as well as from the February sampling of the Asbury Park (New Jersey) population. The latter is an ongoing study with the Environmental Chemistry Investigation at the Sandy Hook Laboratory. Work is well under way on sea scallop adductor muscle samples from the Ocean Pulse survey on *Delaware II* Cruise No. DE 81-07 during November; kidney analysis is finished, and the muscle samples will be completed in early July.

As a result of correspondence with Dr. R. J. Thompson of the Marine Sciences Research Laboratory at Memorial University in St. John's, Newfoundland, we have undertaken to supply him with gonad tissue and whole animals from the Asbury Park scallop population, in order that he may establish both a fecundity index and a growth curve for these particular animals; Sandy Hook's Environmental Chemistry Investigation and Milford's Biochemistry Group have been sampling this population at monthly intervals for the past year. We plan, with Dr. Thompson, to conduct an intensive, concentrated study of these scallops just prior to, during, and immediately after their annual spawning period in September and October.

### Anaerobic Bacteriology

Our major activity this reporting period was the speciation of bacterial isolates obtained from samples collected on an Ocean Pulse survey on *Albatross IV* Cruises No. AL 82-01 and AL 82-03. In addition to the isolates for confirmation of *C. perfringens* type, some 120 isolates were speciated for *Vibrio* types. Except for the demonstration of one *V. cholerae* type in sediments from the AL 82-03 cruise, no pathogenic vibrios were demonstrated in water, sediment, or animal samples. This is probably reflective of the low counts obtained on vibrio media when the ambient temperature is low. However, on the second cruise, AL 82-03, the total number of bacteria did begin to increase.

Our data base on the presence of *C. perfringens* in marine animals is not extensive. When available, animals from different locations are examined for the presence of *C. perfringens* and vibrio species. Clams and oysters from the Sandy Hook, New Jersey, and New Haven, Connecticut, areas were recently examined. Bacterial counts in animals from the Sandy Hook area were high, whereas they were low in animals from New Haven. Speciation of isolates has not yet been completed. Information on the presence of various bacterial types in animals will give us a data base with which we can predict degrees of contamination. This information is lacking for *C. perfringens* and, to some degree, for the vibrios.

### Chemistry

In the past, we have had difficulty in obtaining windowpane with sufficient stomach contents to perform PCB analyses on this material. Recently, we sampled windowpane by otter trawl about every hour beginning at 1:00 a.m. We found a peak of heavy feeding by these flounder at about an hour after daylight. However, just recently we collected windowpane at Hempstead Harbor, New York, at about an hour after daylight, and found only a small incidence of food in their stomachs. Storm activity in the area just prior to collection may have kept these fish from actively feeding. We will be attempting to make these collections again later in the year.

Routine analyses of metals in diluter systems were performed weekly. Metal uptake analyses in a variety of tissues and organisms were also performed.

### Publications

- BEJDA, A. J.; OLLA, B. L. The behavioral response of juvenile red hake, *Urophycis chuss*, to decreasing levels of dissolved oxygen. Paper to be presented at 112th Annual Meeting of the American Fisheries Society. (Abstract.) (A)
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## AQUACULTURE DIVISION

### Aquacultural Genetics Investigation

#### Fish Mutation and the Environment

Statistical analyses have confirmed the impression that mutation incidences in the blood and hematopoietic tissue of windowpane caught near the mouth of Hempstead Bay differ significantly from those caught at "Mini-Pulse" (inshore Long Island Sound version of Ocean Pulse) Station 90, and from those few analyzed from Mid-Atlantic coastal stations. There is a seasonal variation in incidences, which appears to go along with the station difference. Mean incidences tended to vary twofold and threefold. The mutation incidences calculated for the larval blood of red hake also showed statistical significance in respect to station and water mass. These increased rates of mutation in adult flounder and larval hake appear to be related to environmental contamination because of the locations of stations with high and low incidences. These larval fish are not migratory. The hematopoietic tissue of adults could show measurable responses after a 2- to 3-day period spent in polluted waters.

Incidences were calculated with the micronucleus test as modified for use on fish. The statistical test was an analysis of variance using square-root transformation. Further statistical treatment of the data would require especially prepared computer software because of the nature of the distribution of incidences. The Long Island Sound study is being extended through additional sampling, this time with young-of-the-year fish. Prior sampling was with 2- to 3-year-old fish. The study of larval fish is being extended to a collection of early- and later-stage larvae of Atlantic mackerel, and to a second collection of larval and juvenile red hake.

Currently being analyzed are mutation data on 196 Atlantic cod from Georges Bank, coastal Cape Cod, and Massachusetts Bay. Incidences of mutation are being examined in respect to time of collection, water mass, station, sex, age-length category, and infection with piscine erythrocytic necrosis virus. There appears to be a tendency for larger, older fish to have higher mutation incidences, and smaller, younger fish to have the lowest incidences. The flounder study would not have detected this because all fish sampled were in a restricted age-size category.

On this spring's Polish-American joint survey for Atlantic mackerel, extensive collections of mackerel blood and kidney tissues were made for analyses of mutation incidences in these fish using the same test. This collection of samples should enable an estimate of any increase in mutation over time as the schools of mackerel migrate offshore overwintering grounds to polluted inshore waters on their annual spawning migration.

Samples examined to date indicate that mackerel may have a higher background incidence of mutation than measured in the adult cod or windowpane. Plans are being made to sample young-of-the-year mackerel in the early fall.

Plans are also being made to sample adult silver hake (all age/size categories) on Georges Bank and in the Mid-Atlantic on the NEFC's fall bottom trawl survey. Analysis of hake kidney tissue will demonstrate any association in this species between mutation incidence and age, sex, station, water mass, and season of capture, and analytically determined levels of heavy metals and toxic hydrocarbons. Mutation incidences will be calculated using the micronucleus test on the immature erythrocytes of the erythropoietic tissue of the forekidney. Among fish collected for biochemical analyses (see "Environmental Assessment Division" section), silver hake appear to have the heavier contaminant burden. The levels of contaminants in these fish seem to be related to the proximity of their capture to the contaminated New York Bight apex.

Prior experimental work demonstrating the applicability of the mouse micronucleus test to fish was conducted on salmon parr. An experiment, now nearing completion, utilized the fore-kidney tissue of adult *Fundulus* with similar results.

Another experiment with *Fundulus* is demonstrating the feasibility of using an adaptation of the mammalian sperm mutation test on field-caught marine fish in survey studies, as well as in lab tests.

A rapid procedure is being worked out for demonstration of the germ-line primordial cells in larval fish collected during plankton surveys. While the germ line is presumed to be not as sensitive to perturbations as the developing hematopoietic tissue of fish embryos and larvae, ability to use it in some analyses conducted on field and lab specimens should sometimes be advantageous and, of course, germ tissue is of prime concern. An experiment is under way to test the sensitivity of the methodology as being developed.

Eggs of wild-caught Atlantic mackerel are being fertilized and incubated. This is in continuing efforts to perfect efficient cytogenetic techniques for demonstrating the meiotic-fertilization apparatus in fish; also, for karyotyping and performing sister-chromatid exchange assays on the chromosomes of the yolk-sac membrane.

### Shellfish Aquacultural Genetics

Hybrid American oyster (*Crassostrea virginica*) spat have been obtained from crosses between oysters from the New Haven area of Long Island Sound and oysters from: Norwalk, Connecticut; Rhode Island; Massachusetts; and subtidal and intertidal populations in

South Carolina. Performance of these hybrids under local conditions is being evaluated.

Additional first- and second-generation inbred oysters have been obtained from full-sib matings. Performance of these will also be evaluated.

The third generation of oyster progeny selected for fast and slow growth is currently undergoing spawning trials at 1 yr of age. Almost all oysters spawning, however, are males, so it appears that the next generation of selected progeny cannot be produced until potential parents are 2 yr of age. About 10% of the fastest growers and 50% of the slowest growers have been chosen this last generation for continuation of the bidirectional selection experiment.

### Aspects of Nutritional Requirements of Mollusks Investigation

#### Algal Growth

Investigation of minimal algal growth media requirements was continued using the  $X_1$  formulation. Upon introducing *Isochrysis galbana*, *Dunaliella euechlora*, and *Tetraselmis maculata* in minimal growth medium  $X_1$  into carboy culture, it became evident that the latter species was not able to sustain an adequate population in semicontinuous culture with the standard weekly harvest. An initial experiment was conducted to determine which nutrient or nutrients were limiting growth in this medium. Experimental media were prepared with concentrations of nitrate, phosphate, or vitamin mix ( $B_{12}$  and thiamin) intermediate between those used in the minimal  $X_1$  and the standard E carboy growth media. *T. maculata* cultures that had been maintained in  $X_1$  were inoculated into the above media, and culture density was determined daily for 12 days.

All experimental media produced more abundant growth than that obtained in  $X_1$ ; however, vitamin fortification did not stimulate growth to as great an extent as phosphate or nitrate additions. *T. maculata* grown in  $X_1$  media with 10 or 15 mg/l of  $KH_2PO_4$ , or with 150 or 225 mg/l of  $NaNO_3$ , achieved growth greater than or equal to that in E medium which contains 20 mg/l of  $KH_2PO_4$  and 300 mg/l of  $NaNO_3$ . Further investigation will be required to arrive at a minimal medium formulation suitable for culturing this organism.

A new line of investigation has been initiated that is designed to elucidate the importance of vitamins in algal growth media and consequential effects upon grazers. Strains of phytoplankters that have demonstrated an ability to grow in artificial seawater medium  $ASP_2$  with vitamins absent ( $ASP_2NV$ ) were transferred into the standard enriched natural seawater medium used in mass-culture carboys E modified by elimination of vitamins (ENV). Responses of the phytoplankters in ENV were compared with those of the same species in the standard E medium. Of three

species tested, growth of two (*Dunaliella euchlora* and strain D-828, an unidentified diatom) was virtually identical in the two media. In contrast, the flagellate *Pyramimonas grossi* grew more slowly in the vitamin-deficient medium. These three algae are being prepared for introduction into the mass-culture system in both the standard and vitamin-deficient media so that sufficient populations will be available for a feeding study.

### Semicontinuous Algal Cultures

The carboy culture system has been producing particularly dense cultures in recent months. Increased reliability has resulted from two improvements. Semicontinuous cultures have been less susceptible to bacterial contamination, as evidenced by one noteworthy example, an *Isochrysis galbana* carboy that has been in the system since 7 August 1978. In addition, the rate of removal of contaminated cultures has been increased from 1 or 2 per week to 3 or 4 per week. Thus, the number of axenic cultures is increased. In replacing eliminated carboys, the following new species have been introduced into the mass-culture system: *Cyclotella cryptica*, *Pavlova gyrans*, *Carteria chunii*, and strain NOR-5-4-66G, an unidentified green flagellate. The nutritional value of these species to juvenile oysters will be tested in the experimental rearing-chamber system.

### Spawning and Rearing of Mollusks Investigation

We have begun developing an analytical capability for studying the energetics of the surf clam (*Spisula solidissima*). Respiration, clearance rate, assimilation of nutrition, and excretion rate will be measured to determine the "scope for growth" of clams in different culture environments. This instantaneous measure of physiological condition can be used to evaluate culture regimes quickly and distinguish those which promote growth from those that inhibit it by inducing stress.

Hatchery-reared juvenile surf clams have been deployed in sand-filled cages in Long Island Sound at a depth of 20 ft. Cages have been planted in Milford, Groton, and Sconington, Connecticut. Comparison will be made of the growth at different sites, as well as evaluation of stocking densities in the cages. Comparable groups of clams are being reared in the pumped raceway system.

We have begun a study of bay scallop (*Argopecten irradians*) growth in various New England locations. Our work has shown that single-season growth of this species to market size is feasible in Long Island Sound, but a slight growth improvement will result in substantially larger adductor muscles at harvest and make bay scallop mariculture commercially more attractive.

## Publications

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## PATHOBIOLOGY DIVISION

### Fish Pathology Investigation

Fish maturity and pathology data collected on bottom trawl survey cruises are being entered into the System 1022 through keypunching by a private contractor in Red Bank, New Jersey. Data log sheets are picked up at the Sandy Hook Laboratory and completed punch cards are returned within 1 wk. Listings are then proofed for accuracy and entered into the data base. To date, the 1981 fall survey, 1982 winter survey, and three of four parts of the spring 1982 survey have been entered.

For data analysis, the Northwest Atlantic is being divided into 30-min "squares" of latitude and longitude. Prevalence data on selected disease conditions and fish species will be summarized for each square.

The maturity/pathology log sheet is being redesigned to provide space for additional field notes on individual fish processed by survey personnel. More importantly, blocks will be provided on the log sheet for observations on internal pathology of major organs in the peritoneal cavity.

Our X-ray analysis of *Ammodytes* sp. collected on the winter bottom trawl surveys has been completed and entered in the Northeast Monitoring Program's System 1022 data base. The data base has also been updated to exclude all stations which had a sample size of less than 20 individuals. Specimens collected during the 1982 spring bottom trawl survey have yet to be processed.

Current experimental studies of the infectious pancreatic necrosis virus of southern flounder have been completed. Mortalities were experienced in both virus-injected and sham-injected fish, with a higher percentage of virus-injected fish dying. We are currently quantifying virus titers in all of the experimental animals to see if there are significant differences between virus-injected fish and some of the dead controls which may have been naturally infected before they were brought into the lab.

A "Big Mack Attack" (a special study of Atlantic mackerel) is proceeding on schedule. We are attempting to obtain blood and

tissue samples from mackerel from the Gulf of Maine and the Gulf of St. Lawrence this month. The mackerel seem to be spawning somewhat later than usual, perhaps being influenced by the cooler-than-normal early summer temperatures in the Northeast. Initial shipments of blood smears have been forwarded to the Polish-American Plankton Sorting and Identification Center in Szczecin, Poland, for examination.

Light-microscope studies have been conducted on the cytological condition of the retina of starved striped bass larvae. The larvae were starved from the time of hatching and collected for light- and electron-microscope study approximately every third day. Cell degeneration and a decrease in cell numbers were observed for the optic fiber layer, ganglion cell layer, and inner nuclear layer as early as the 6th day of food deprivation (approximately 2 days after the yolk is resorbed) and became progressively worse over the next 6 days. The experiment was terminated after 12 days. Accompanying the loss of cellular elements, there was a pronounced displacement of the lens into the vitreous body or posterior chamber of the eye resulting in a sunken appearance. It is well acknowledged that vision is critical to the feeding behavior of larval fish and that their ability to feed by the time their endogenous food reserves are utilized (the "critical" period) is imperative to their survival. This study suggests that potentially irreversible changes in the structure of the eye accompanied by a possible loss of vision may result if striped bass larvae are deprived of food for only a brief period of time (e.g., 6-12 days) after hatching.

Progress on all electron-microscope projects has been adversely affected during this reporting period owing to persistent mechanical failures which have not yet been resolved.

#### Diseases of Larval Mollusks Investigation

An experiment was conducted jointly between this investigation and elements of the Aquaculture Division concerning mortality of larval American oysters (*Crassostrea virginica*) in relation to two stresses: starvation and the presence of pathogenic bacteria. One-week-old larvae were challenged with various concentrations ( $10^2$ ,  $10^3$ ,  $10^4$ ) of a known pathogen. Quadruple samples were taken after 48 hr and will be examined microscopically for dead and dying larvae.

On 26 May, the fourth Stratford-New Haven sampling cruise was completed. Bacteria associated with the oyster shell surface, mantle fluid, and gut were cultured. The highest numbers of bacteria were found on the shell followed by the gut and mantle fluid. This sequence was observed in both sampling areas. Bacterial numbers were consistently higher for all samples at the New Haven station. Bacterial isolations yet have not been made to determine generic percentages, although past cruises revealed high counts at the Stratford site. A plankton tow at each station did not contain any bivalve larvae.

On 13 April, our California hatchery isolates, CA10 (1), (2), and (4), were tested and all caused >98% mortality in oyster larval cultures. CA10 (1) and (2) are reisolates of our original CA10 received from Dr. Rita Colwell. Three Stratford isolates, which previously appeared pathogenic to oysters, still caused larval mortality. On 20 April, CA10 (1) was tested again and caused 96% mortality, while CA10 (2) caused only 50% mortality. The reason for this difference is unclear at present, but may result from attenuation of virulence in artificial media.

A chemical-spectrofluorometric method used to determine the relative numbers of molluscan phagocytes in monolayers has shown that a linear relationship exists between cell numbers and instrument readout over the range from  $2 \times 10^3$  to  $2 \times 10^5$  cells per milliliter. However, we have experienced difficulty in reconciling these readings with microscopic cell counts on gridded plastic Petri dishes. Since considerable variation in replicate counts occur with the latter, we believe these counts to be somewhat inaccurate. A comparison of results by a third method, using an electronic cell counter, is in progress.

On 21 June, samples of cultured oyster larvae were received from the Shinnecock Tribal Indians in New York. Hatchery staff noticed an oyster larval growth problem and asked for assistance. Samples were examined and no pathogens were found. The samples were given to Gary Wikfors of the Aquaculture Division's Aspects of Nutritional Requirements of Mollusks Investigation. He feels that the larvae are trying to feed on some large flagellated algae which plug the larval digestive tract. He is continuing his observations and will report his findings directly to the hatchery.

A study was conducted to determine whether the numbers and types of bacteria present in seawater change when charcoal filtration is included as part of the treatment process used for rearing shellfish larvae. An analysis of the data collected thus far has not been made.

Electrophoretic separation of the proteins found in the filtrate of a pigmented bacterium, which has been identified as a *Pseudomonas* sp., has been accomplished. The filtrate contains a metabolite which is toxic to developing oyster embryos. An attempt is being made to elute the metabolite from the gel section containing the toxic material.

A red pigment produced by a bacterium isolated from seawater has been extracted. The bacterium has been identified as a *Pseudomonas* sp., but differs from the red microbe which was studied and reported last year. This bacterium is also pathogenic to developing oyster larvae.

On 11 May, a commercial shellfisherman collected large numbers of gaping hard clams (*Mercenaria mercenaria*) near Bayview Beach in Milford. The Connecticut State Aquaculture Division

asked us if the condition was a result of disease. On 14 May 1981, the same situation occurred and was carefully documented by our sampling of that area. It is believed that this year's incident resulted from a winterkill, since clams located close to the sediment surface also were affected. On 10 June, the clam mortality in the Long Island Sound area was no longer apparent.

On 4 May and 9 June, John Hurst of the Maine Department of Marine Resources Boothbay Harbor Laboratory, sent sediment samples containing *Gonyaulax* cysts collected from Monhegan Island, Maine, on 30 April and 14 May. Microscopic isolation of these cysts is in progress and specific quantities are being selected to determine their toxicity in mouse bioassays. Other sediment samples containing *Gonyaulax* cysts collected in the Bay of Fundy are also being sorted and quantified for mouse bioassay. Eventually, sorted cysts will be ozonized to determine rates of inactivation, in-vitro and in-vivo, with softshell clams (*Mya arenaria*).

Progress was made in developing reagents and working protocols for enzyme-linked immunoassays (EIA). The reagent sequence in these assays consists of: (1.) bacterial antigen attached to plastic wells of microtitration plates; (2.) fish serum containing antibodies to the bacterium; and (3.) enzyme-linked rabbit immunoglobulin directed against the fish immunoglobulin. A chromogenic substrate for the enzyme is then added and the reaction stopped when the color intensity becomes strong enough to be easily seen. The EIA can be used either to identify bacteria (by introducing an unknown bacterial antigen in the presence of known fish antibody) or to detect and measure fish antibodies (by introducing an unknown fish serum into the test, along with a known bacterial antigen). Thus, the EIA will be used to identify bacterial pathogens of mollusks rapidly and to measure antibodies to a selected group of fish pathogens as part of the Ocean Pulse Program's surveys.

Antibodies to striped bass immunoglobulin were produced in a rabbit that had been injected with its own blood cells coated in-vitro with striped bass antibodies. Using the rabbit serum, a successful EIA was developed employing whole bacterial cells attached to microtiter wells with poly-L-lysine. Sensitivity of this technique will be compared with that attained when sonicated bacteria are adsorbed to plastic wells that have been commercially treated for high protein adsorbency. Since the rabbit antibodies used in this work were present at a relatively low level, a booster injection has been given to stimulate an increased antifish immunoglobulin titer in the rabbit.

Staphylococcal protein A attaches to the Fc portion of the mammalian IgG class of antibodies. A variety of useful immunological techniques have been developed using this protein. It is generally believed that fish lack a class of antibodies with sites that will adsorb protein A. However, we have found that a portion of striped bass anti-*Vibrio* antibodies is adsorbed with

protein A. This establishes the possibility that EIA tests can be developed for antibodies in a variety of fish species without the need to prepare a specific rabbit antfish globulin for each species.

### Comparative Invertebrate Pathology Investigation

Samples of blue mussels were collected from Wachapreague, Virginia, and Martha's Vineyard, Massachusetts.

Slide examination of October samples of blue mussels collected from Sandwich and Falmouth, Massachusetts, was completed. Data from both samples were entered into the Northeast Monitoring Program's data base. Results follow: Sandwich, Massachusetts (50 specimens with 266 lesions and parasites recorded)--pearls, 14%; acute inflammation, 90%; hemocyte aggregations, 62%; abscesses, 20%; hyaline cell infiltrates, 6%; metaplasia of the digestive gland, 98%; parasites/ciliates, 4%; *Chlamydia*, 2%; *Steinhausia mytilorum*, 20%; trematode redia, 2%; trematode metacercaria, 100%; and copepod encapsulation, 6%. Falmouth, Massachusetts (50 specimens)--pearls, 16%; *Pinnotheres*, 8%; pale digestive gland, 6%; acute inflammation, 94%; hemocyte aggregations, 54%; abscesses, 26%; hyaline cell infiltrates, 26%; pigmented aggregates, 12%; ceroidosis, 8%; metaplasia of the digestive gland, 94%; hemorrhage, 10%; parasites, *Steinhausia mytilorum*, 4%; turbellaria, 4%; trematode redia, 2%; trematode metacercaria, 4%; copepod encapsulation, 6%.

Austin Farley participated in the southern leg of the annual sea scallop survey on *Albatross IV* Cruise No. AL 82-06. Three samples were collected for gross examination and fixation of individual animals. In-depth gross examinations of survey-collected scallops were made by Austin of each animal sampled for histopathological studies. The data, which include observations on the size, color, and general condition of the tissues, shell abnormalities, and associated fouling organisms, will be compared with the information from the histological examinations. It is evident from previously published reports that certain fouling organisms (e.g., *Cliona* and *Polydora*) seriously affect the health of scallops. It is through these detailed observations that we can begin to separate "naturally" induced pathology from that which is human-induced.

Two European oysters (*Ostrea edulis*) sampled by Dr. Rosenfield on his recent trip to Spain, were examined to determine the cause of severe ongoing mortalities. One of the oysters was gaping when collected; the other appeared normal. The "sick" oyster showed extensive degenerative tissue changes which were accompanied by light-to-moderate bacterial necrosis. No cause of the ongoing mortalities could be determined. Larger samples of live oysters from the affected area have been shipped from Spain for more in-depth studies.

Sectioned tissues of amphipods collected on a Northeast Monitoring Program survey during *Albatross IV* Cruise No. AL 82-03 have been examined and data collated. There were 689 specimens taken from eight of the most important monitoring stations (of 14 stations, total). The amphipods were collected by Sandy Hook Laboratory personnel. The expected parasites were present as in material from previous cruises.

Tissue samples from 15 male and 15 female blue king crabs were submitted by personnel of the NMFS Kodiak facility as a part of the cooperative investigation of abnormal reproductive conditions in females of the Olga Bay, Kodiak Island, population. These samples were collected to complement previous material, which included only ovaries and pleopods of female crabs. A rhizocephalan parasite was found in tissue sections of five males and six females of the 30 crabs. Data analysis has not yet been accomplished.

In June, Dr. Daniel Gist (an endocrinologist from the University of Cincinnati who is acting as a consultant to a soft-crab operation at Crisfield, Maryland) consulted with Dr. Johnson concerning heavy mortalities being experienced in shedding tanks in the Crisfield area. The consensus among shedding-tank operators in Crisfield was that late cold-water conditions (during the cold, rainy part of June) may have been responsible. Most deaths occurred shortly before or during molt. Specimens were not available for gross or histological examination, so no diagnosis could be attempted.

Also in June, Mr. John Blann brought in 10 crabs from a shedding-float mortality occurring at Boone Creek, Oxford, Maryland. The Boone Creek crabs were also dying shortly before or during molt. Most of the 10 crabs submitted were moribund or recently dead at the time of dissection (the day they were brought in), but two molted successfully that day. The dead and dying crabs had extensive blood clots through most of the hemal sinuses and other signs that suggested they were infected with pathogenic bacteria. However, hemocyte aggregations (which are characteristic of bacterial infection) were absent. Sectioned tissues of these crabs are not yet available. The two Boone Creek crabs that survived molt both died within 2 days, and both had extensive blood clots. On the same date, crabs collected from the Tred Avon River by Oxford Laboratory personnel, and maintained in lab tanks, remained healthy before, during, and after molt. This suggests that the cause of death in Boone Creek crabs was peculiar to their environment previous to being placed in our tanks.

During the past 2 mo, the histology lab stained 3782 slides from a variety of marine invertebrates and vertebrates.

#### Microbial Ecology and Parasitology Investigation

One collection was made to obtain Atlantic rock crabs (*Cancer irroratus*) near the sewage-sludge disposal site in the New

York Bight apex. The area, known as the "Mudhole," located in the Hudson Shelf Valley, was selected because earlier findings showed that this site yielded specimens with a remarkably high incidence of the "black gill" condition. Furthermore, crabs from the Mudhole previously showed that copepods were present on up to 50% of gills examined, and probable microsporidian parasites were in the tissue of 50% of the gills. Over 1000 *C. irroratus* examined microscopically since 1975, and collected within the Bight apex, rarely showed copepod infestations in more than 20% of the specimens and probable microsporidians in more than 3% of the specimens. Three tows made in the trough or "swale" that characterizes the Mudhole each yielded catches of crabs and fish that necessitated the use of a winch to hoist the net from the water. A total of 200 *C. irroratus* were examined for visual evidence of gill blackening; 36 were selected for histological examination; and the same 36 were frozen for heavy-metal analyses by Richard Greig at the Milford Laboratory. Black gills were noted in 33 (16.5%) of the specimens examined. Data obtained from the collection confirmed previous findings that the Mudhole yielded crabs with the highest incidence of black gills observed at any of our historical collection sites. Histological sections have been prepared and are now being examined.

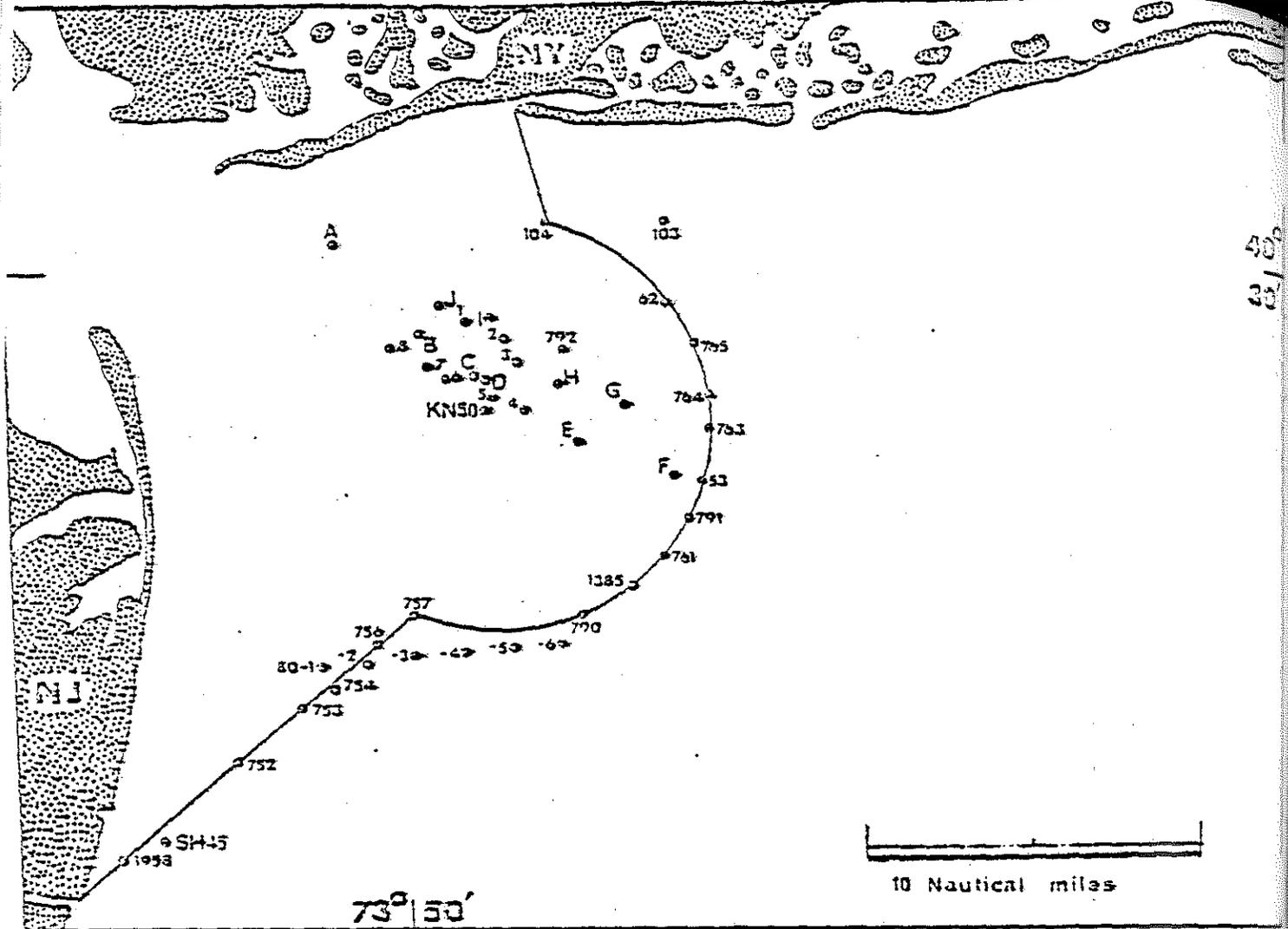
A new study to evaluate gill condition and intestinal parasites in young winter and summer flounder was initiated this year. Visual signs of gill discoloration, and the presence of nematodes and tapeworms in the intestine, were recorded during one cruise to the Mudhole and one Northeast Monitoring Program survey onboard the *Albatross IV*. Preliminary results are summarized below:

Species	Location	No. examined	Condition by frequency of occurrence		
			Discolored gills	Nema-todes	Tape-worms
Winter flounder	New York Bight	9	6	3	0
Yellowtail flounder	New York Bight	39	22	14	6
Winter flounder	"Mudhole"	13	9	3	0
Yellowtail flounder	"Mudhole"	30	27	0	3

The study was designed to direct most effort to yellowtail flounder with minimal observations to be made on winter flounder. It is of interest to note that 22/39 fish from the New York Bight (56%) had discolored gills, while the same condition was noted in 27/30 (90%) of the specimens from the Mudhole. Also, 14/39 (36%) of the yellowtail flounder caught away from the

Mudhole had nematodes, while only 3/30 (10%) had nematodes at the Mudhole collection site. Further studies are necessary to determine the validity of these preliminary findings. Gills from all fish listed in the table have been processed for histological study of tissue pathology and external fouling microorganisms. Kidney, liver, and intestine have also been sectioned and stained in order to catalogue tissue parasites that may be present. All fish examined for study purposes were selected to include only very young specimens: yellowtail flounder ranged up to 30 cm long, and winter flounder up to 26 cm.

Cooperative studies with EPA and FDA personnel on the distribution of potentially pathogenic amoebae, genus *Acanthamoeba*, have been remarkably successful. Areas studied now range from the Gulf of Maine, Georges Bank, and along the Northeast Coast to the mouth of Chesapeake Bay. Other areas impacted by enteric bacteria range southward to Florida and Puerto Rico. At all study sites, there has been an absolute association between bacterial MPN's (most probable numbers) of coliforms, fecal coliforms, and fecal streptococci, and the recovery of pathogenic and nonpathogenic species of *Acanthamoeba*. Observations made at the Philadelphia-Camden Dumpsite are now in press and will appear in the September 1982 issue of the *Journal of the Water Pollution Control Federation* with a companion article on the distribution of sewage-associated bacteria at the site. Concurrent studies made in the New York Bight apex and now in preparation for publication include observations made at the Mudhole. Two stations, No. 80-3 and 80-4 (shown on the accompanying map) were negative for sewage-associated bacteria, yet yielded two and six species of *Acanthamoeba*, respectively-- results which contradicted our previous analyses of the data. A review of all cruise data showed that the sediments from the two stations were black fluid muds and silts. Perusal of the literature showed further that the sample locations (Hudson Shelf Valley) were severely contaminated with PCB's, had high total organic:total carbon ratios, and had high fecal sterol (coprostanol) content. Findings at the Mudhole provide a new hypothesis for further consideration: i.e., seabottom depressions or "swales" may function as sinks for suspended or resuspended sludge particles and associated bacteria that are no longer viable. Since other workers have shown that *Acanthamoeba* feed successfully on bacteria killed by autoclaving as well as on living bacteria, there is the potential for them to be present in aged and redeposited sludge-derived mucks and muds. The present status of our cooperative studies illustrates the value of multidisciplinary studies on the ecological effects of ocean disposal practices.



New York Bight apex: All stations except (80)-3 through (80)-6 are within the area closed for the commercial harvesting of shellfish. Coliform bacteria are present at 73% of stations shown, fecal coliforms at 50%, and *Acanthamoeba* at 73%. For stations (80)-1 through (80)-6: (80)-5 had coliforms; none had fecal coliforms; and all but (80)-6 had *Acanthamoeba*. Acknowledgments: EPA (D. Lear, M. O'Malley); FDA (W. Adams, J. Gaines).

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rainbow trout from Italian hatcheries. (Abstract.) 13th Int.  
Assoc. Aquat. Anim. Med. Annu. Mtg. & 7th East. Fish Health  
Worksh.; 1982; 37. (P)

## NATIONAL SYSTEMATICS LABORATORY

### Systematics of Fishes

Completed was the first draft of the revision of the 18  
species of Spanish mackerels, genus *Scomberomorus*. The sections  
written during this period were species diagnoses, descriptions,  
color patterns, and relationships within the genus. A manuscript  
revising the needlefish genus *Potamorrhaphis* was completed,  
submitted, accepted pending revision, and revised.

### Systematics of Crustaceans

Continued was preparation of a revision of the shrimps of the  
genus *Sicyonia*, "rock shrimps," occurring in the American Pacific,  
from San Francisco Bay to Callao, Peru. Research is based on more  
than 3000 specimens and ecological data taken throughout the range  
of the 11 species found in the region.

Completed was a Laboratory review of a manuscript dealing  
with nomenclature, taxonomy, description, and distribution of  
*Callinectes sapidus* that will comprise a jointly authored species  
synopsis for the blue crab.

Completed were drafts of a trilogy of papers on the  
systematic status of the "forms" of the mud crab *Panopeus*  
*herbstii* prominent in the oyster community of eastern and southern  
United States. The study is, in part, a collaboration with Robert  
Reames, formerly with Dauphin Island Sea Laboratory in Alabama,  
and J. Bolling Sullivan and associates of Duke University Marine  
Laboratory in Beaufort, North Carolina.

Continued was preparation of a revision of Chace and Dumont's  
(1949) "Spiny Lobsters--Identification, World Distribution, and  
U.S. Trade," that appeared in *Commercial Fisheries Review*, Vol.  
11, No. 5, and has long been out of date and out of print. Color  
photos of seven species suitable for publication have been  
prepared and tabular data collated.

Continued was preparation of a revision of the mud shrimps of  
the eastern Pacific. A key to the species has been written, the

species occurring from California to Alaska described and illustrated, and preliminary diagnoses of five other species prepared.

Further data were collected by collaborators J. R. Factor and C. L. Van Dover for a paper on morphology of feeding structures in the deep-sea hydrothermal crab *Bythograea thermydron* from the Galapagos Rift.

### Scientific Services

Penaeoid shrimps from the waters of Kuwait were identified for Dr. Dennis C. Lees of Dames and Moore, Inc., in Seattle.

Information on systematics, ecology, and distribution of penaeoid shrimps, as well as extensive bibliographic references, were provided to: Mark Harding of Galveston, Texas; Margarita Beltran of the Universidad Autonoma de Mexico in Mexico Distrito Federal; and Pablo Sosa Hernandez of the Direccion de Investigaciones Oceanograficas for the Mexico Secretaria de Marina.

Correct scientific and common names for crustaceans, echinoderms, and mollusks from Ecuador, Peru, and Chile were given to D. Maher of the NMFS Pascagoula Laboratory; information on the name and range of the Jonah crab were supplied to S. Carlton of the NMFS Southwest Regional Office.

Information on the identify of the New Zealand roughy (a marine percoid) and on the country of origin of shrimp imported from Burma and Hong Kong were provided to Mr. Brady of U.S. Customs in New York.

Questions about swordfish anatomy were answered for the FDA.

A loan of percoid fishes was arranged for D. L. Page of the Illinois Natural History Survey.

Bathylagids collected on the Dana expeditions were transferred to Dr. H. G. Moser of NMFS La Jolla Laboratory at the request of Dr. D. M. Cohen of NMFS Seattle Laboratory.

A research proposal was reviewed for the Biological Research Resources Program of the National Science Foundation.

Manuscripts were reviewed for the *Proceedings of the Biological Society of Washington*, *Southwestern Naturalist*, and for a colleague at the NMFS Miami Laboratory. Comments on illustrations for an article on bluefin tuna were provided to the *National Geographic*.

## Publications

COLLETTE, B. B. Two new species of freshwater halfbeaks (Pisces:Hemiramphidae) of the genus *Zenarchopterus* from New Guinea. *Copeia* 1982(2):265-276;1982. (P)

COLLETTE, B. B. South American freshwater needlefishes of the genus *Potamorhaphis*. *Proc. Biol. Soc. Wash.* (S, A)

PEREZ, FARFANTE, I. Review: El mar de Puerto Rico. Una introduccion a las pesquerias de la Isla. By Jose A. Suarez Caabro. Editorial Universitaria, Universidad de Puerto Rico. *Ciencia Interamericana* 22(2):68;1982. (P)

## ATLANTIC ENVIRONMENTAL GROUP

### Ocean Monitoring and Climatology Task

The cooperative Ship of Opportunity Program obtained 16 expendable bathythermograph (XBT) transects and four continuous plankton recorder (CPR) transects in May and June: four XBT and two CPR transects in the Gulf of Maine, six XBT transects off Southern New England, four XBT and two CPR transects across the shelf and slope off New York, and two XBT transects across the Gulf of Mexico.

The announcements of eddy conditions in the Georges Bank-Middle Atlantic Bight area appearing on the next two pages were sent to the Commander of the Atlantic Area for the U.S. Coast Guard for publication in the June and July issues of the *Atlantic Notice to Fishermen*.

A review draft of a summary report of oceanographic features and processes pertinent to the dispersion and concentration of pollutants in northeastern U.S. coastal waters was completed in mid-May. Several scientists from AEG were involved in writing and editing the report, along with others from the NEFC, the National Ocean Survey, and the EPA. The report, known as the "NEMP Oceanographic Summary Report" (NEMP-IV-82-C-0004), has been distributed to participants in the Northeast Monitoring Program for review and use as a working document before preparing it for publication as a *NOAA Technical Report*.

## Publications

ARMSTRONG, R. S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. *Ann. Biol.* 38. (S)

CHAMBERLIN, J. L. Shoreward transfer of kinetic energy by Gulf Stream rings and by their interactions with the stream: What are the limits? *EOS, Trans. Am. Geophys. Union* 63(3):59;1982. (P)

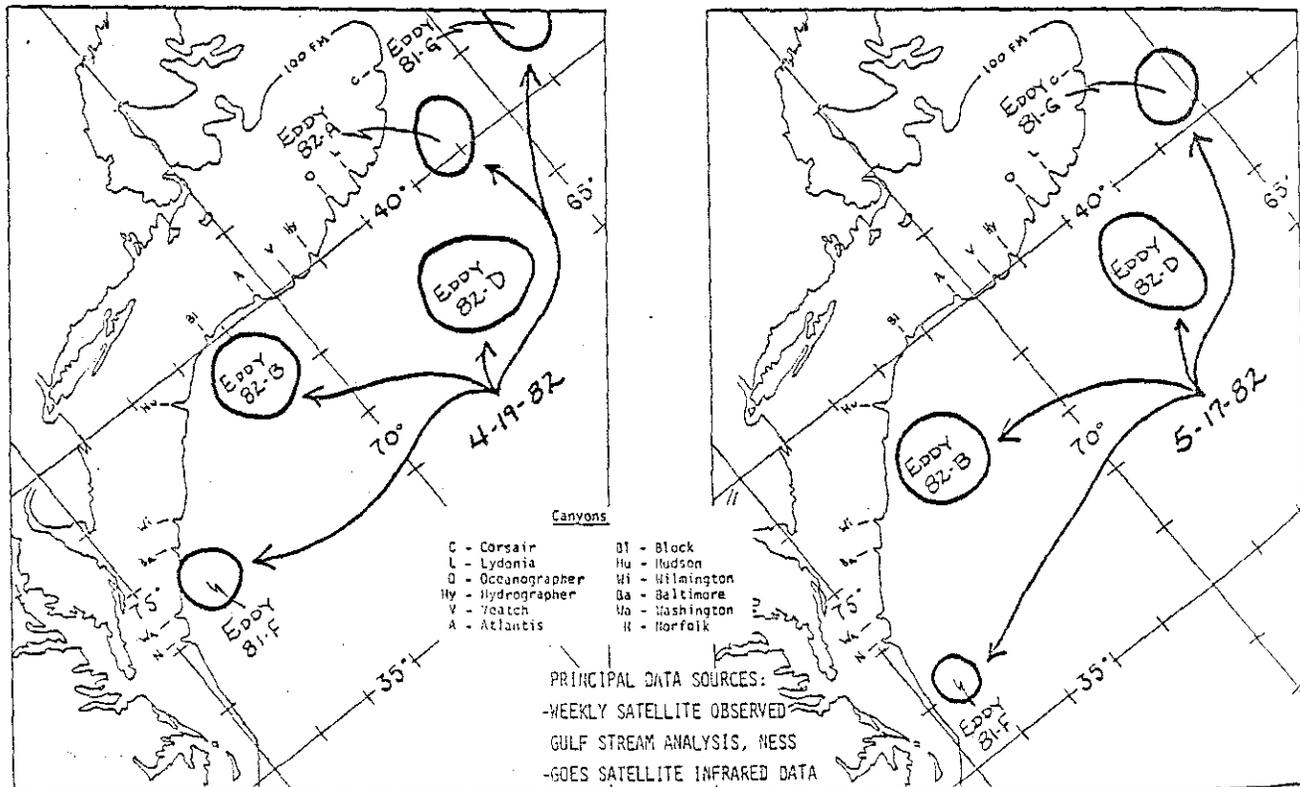
## GULF STREAM EDDY LOCATIONS

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

Eddy 81-F travelled southwest about 162 km (87 nm) to a center position near 36.1°N 74.3°W east of Cape Hatteras. Eddy 82-B moved southwest about 145 km (78 nm) and is now centered near 38.5°N 72.1°W, south of Hudson Canyon. Eddy 82-D moved about 43 km (23 nm) north to a center position near 38.8°N 67.4°W, south of Lydonia Canyon. Eddy 81-G travelled 136 km (73 nm) to a center position near 40.6°N 65.2°W, southeast of Corsair Canyon. Eddy 82-A was resorbed by Eddy 82-D during late April near 40.0°N 66.0°W, south of Corsair Canyon.

During the next 30 days, Eddy 81-F will be resorbed by the Gulf Stream east of Cape Hatteras; Eddy 82-B may move southwest to a center position southeast of Baltimore Canyon; Eddy 82-D may move west to a center position south of Hydrographer Canyon; Eddy 81-G may move southwest to a center position south of Lydonia Canyon.

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



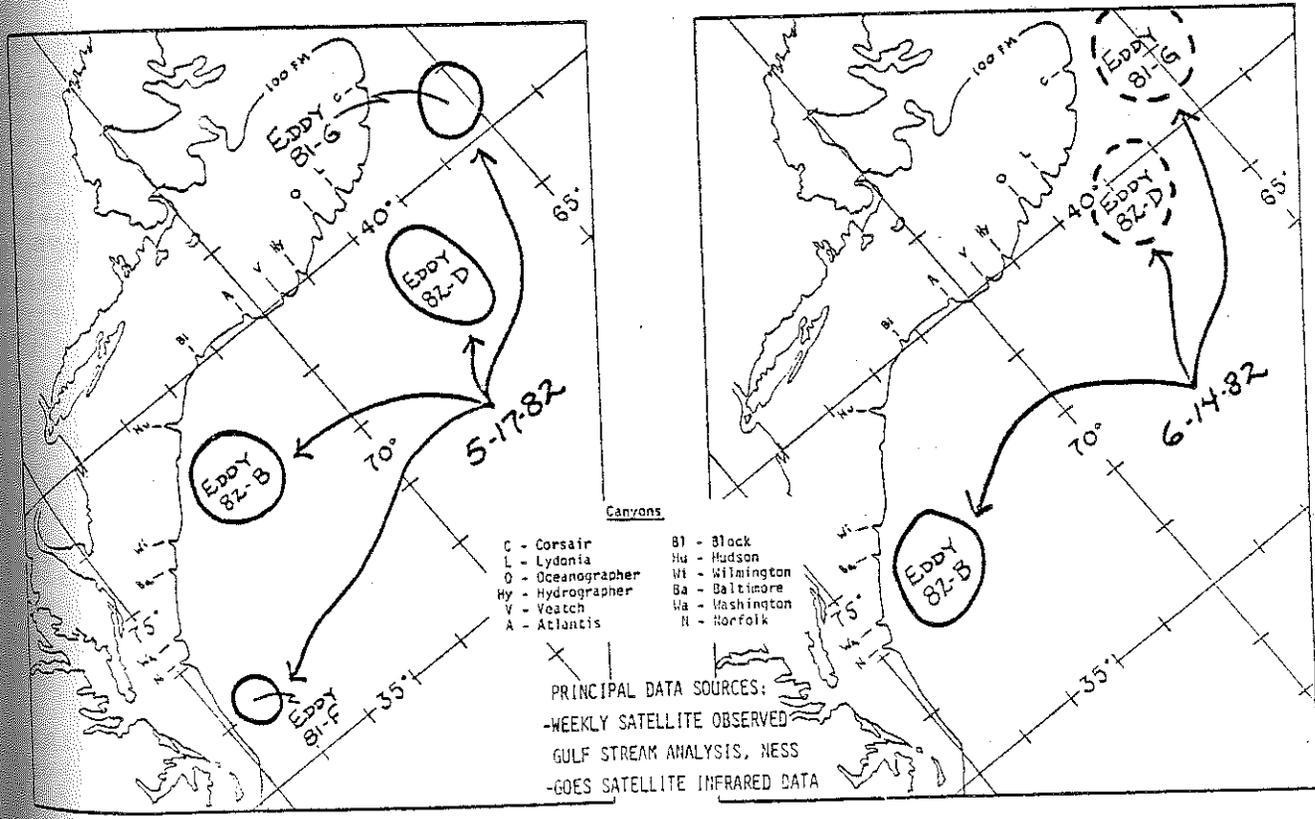
# GULF STREAM EDDY LOCATIONS

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

Eddy 82-B moved southwest about 158 km (85 nm) to a center position near 37.5°N 73.4°W, east of Washington Canyon. In late May eddies 82-D and 81-G were pushed north by a large Gulf Stream meander. Eddy 82-D moved about 94 km (51 nm) north-east and is now centered near 39.7°N 66.8°W, south of Lydonia Canyon. Eddy 81-G travelled north about 50 km (27 nm) to a center position near 41.1°N 65.1°W, east of Corsair Canyon. Eddy 81-F was resorbed by the Gulf Stream east of Cape Hatteras in early June.

During the next 30 days, Eddy 82-B may move southwest to a center position south-east of Norfolk Canyon; Eddy 82-D may move west to a center position south of Oceanographer Canyon and Eddy 81-G may move southwest a center position south of Corsair Canyon. Alternatively, the large Gulf Stream meander near 65°W may engulf both Eddy 82-D and 81-G, and then possibly produce a new, large eddy near 39°N, 65°W south of Corsair Canyon.

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



- CHAMBERLIN, J. L. Application of satellite infrared data to analysis of ocean frontal movements and water mass interactions off the Northeast Coast. Proc. Northw. Atl. Fish. Org. Ann. Mtg. 1981 September 13-16; Halifax, Nova Scotia. (In press.) (A)
- CRIST, R. W.; CHAMBERLIN, J. L. Bottom temperatures on the continental shelf and slope south of New England during 1981. Ann. Biol. 38. (S)
- CRIST, R. W.; CHAMBERLIN, J. L. Bottom temperatures on the continental shelf and slope south of New England during 1980. Ann. Biol. 37. (A)
- FITZGERALD, J. L.; CHAMBERLIN, J. L. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1981. Ann. Biol. 38. (S)
- FITZGERALD, J. L.; CHAMBERLIN, J. L. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1980. Ann. Biol. 37. (A)
- HILLAND, J. E. Variation in the shelf water front position in 1980 from Georges Bank to Cape Romain. Ann. Biol. 37. (A)
- HUGHES, M. M.; COOK, S. D. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1981. Ann. Biol. 37. (A)
- HUGHES, M. M.; COOK, S. K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1980. Ann. Biol. 37. (A)
- INGHAM, M. C. Weather conditions and trends in the Maine-Virginia coastal and offshore area during 1970-79. Proc. Northw. Atl. Fish. Org. Ann. Mtg. 1981 September 13-16; Halifax, Nova Scotia. (S)
- INGHAM, M. C.; McLAIN, D. R. Sea-surface temperatures in the northwestern Atlantic in 1980. Ann. Biol. 37. (A)
- JOSSI, J. W.; SMITH, D. E.; WHITE, G. A. Continuous plankton records: the sampling program of the U.S. National Marine Fisheries Service. Ann. Biol. 38. (S)
- McLAIN, D. R.; INGHAM, M. C. Sea-surface temperatures in the northwestern Atlantic in 1981. Ann. Biol. 38. (S)

#### TRAVEL, MEETINGS, AND PRESENTATIONS

##### Resource Assessment Division

During 1-3 March, John Boreman attended the Larval Fish Symposium in Solomons, Maryland.

On 3 March, Anne Lange attended the Mid-Atlantic Fishery Management Council meeting in Philadelphia, Pennsylvania, on squid joint ventures.

On 6 March, Steve Clark attended the 1982 Rhode Island Fishermen's Forum in Galilee.

On 12 March, Anne Lange attended a debriefing with the foreign fishery observers at Otis Air Force Base, Massachusetts.

On 17 March, Steve Clark met with fishing industry representatives in New Bedford, Massachusetts, to review the current status of groundfish stocks in the Georges Bank-Gulf of Maine area.

On 18 March, Fred Serchuk attended a meeting of the New England Fishery Management Council's (NEFMC) Groundfish Oversight Committee in Saugus, Massachusetts, to discuss development of a "braking mechanism" in the Interim Groundfish Plan.

On 23 March, Anne Lange met with the Regional Joint Ventures Review Team in Gloucester, Massachusetts. On the 24th, she met in Woods Hole with representatives from Dames and Moore, Inc., in regards to the U.S.-Canada maritime boundary issue.

On 29 March, Mike Fogarty attended the NEFMC's Lobster Oversight Committee meeting held in Danvers, Massachusetts.

On 6 and 7 April, John Boreman attended a Mid-Atlantic Fishery Management Council's Shad and River Herring Subcommittee meeting in Norfolk, Virginia.

During 12-15 April, Ralph Mayo, Mike Fogarty, Emma Henderson, Fred Serchuk, Mike Sissenwine, and Sherry Sass attended and presented papers at the American Fisheries Society's Northeast Division's Annual Meeting held in Cherry Hill, New Jersey. Papers presented were: "Estimating Rates of Escapement and Discard in Northwest Atlantic Trawl Fisheries," by Ralph Mayo; "Assessment of the US Offshore Lobster Fishery," by Mike Fogarty; "Two Methods of Fitting a Growth Curve to Fish Scale Measurement Without Back-calculating," by Emma Henderson; "Assessment and Management of USA Sea Scallops Resources: Booms, Boondoggles, and Boundary Disputes," by Fred Serchuk, Paul Wood, and Bob Rak; "An Overview of the Commercial Deep Sea Red Crab Fishery Off Southern New England," by Patricia Gerrior and Fred Serchuk; "The Uncertain Environment of Fish Harvesters, Fishery Scientists, and Fish Managers," by Mike Sissenwine; and "First Year Growth and Otolith Development of Winter Flounder," by Sherry Sass.

During 14-21 April, Emory Anderson participated in the International Council for the Exploration of the Sea's Mackerel Working Group meeting in Copenhagen, Denmark.

On 22 April, Anne Lange attended a debriefing at Otis Air Force Base, Massachusetts, of foreign fishery observers returning from joint-venture operations.

During 26-30 April, Brad Brown attended parts of the NMFS-State (Fisheries Agencies) Directors meeting in Washington, D.C., and also attended the Capitol Hill workshop.

On 28 April, Mike Fogarty and Gordon Waring attended a NEFMC Herring Oversight Committee meeting in Danvers, Massachusetts.

During 29 April-6 May, Steve Clark attended the ICES European Hake Working Group meeting in Copenhagen, Denmark.

On 5 May, Emory Anderson attended a Scientific and Statistical (S&S) Committee meeting of the Mid-Atlantic Fishery Management Council in Philadelphia, Pennsylvania.

During 10-13 May, Linda Despres-Patanjo attended a meeting of the International Association for Aquatic Animal Medicine held in Baltimore, Maryland.

On 17 May, Mike Fogarty attended a Lobster Fishery Management Plan Development Team meeting in Saugus, Massachusetts.

On 20 and 21 May, Fred Serchuk and Steve Murawski presented lectures on fisheries stock assessment and management to students in the Aquavet Program at the Marine Biological Laboratory in Woods Hole, Massachusetts.

During 25-28 May, Vaughn Anthony attended the meeting of Regional Fishery Management Council Chairpersons in Newport, Rhode Island.

During 29 May-26 June, Louise Dery visited the Instituto Espanol de Oceanografia laboratory in Vigo, Spain, and worked with Spanish scientists on aging and age validation of European hake, horse mackerel, and blue whiting.

On 2 June, Steve Murawski and Emory Anderson attended a meeting of the Fishery Management Priorities Committee in Boston, Massachusetts.

During 2-5 June, Anne Lange attended a meeting of the Northwest Atlantic Fisheries Organization Squid Working Group in Halifax, Canada.

On 3 June, Emory Anderson attended a meeting of the Regional Joint Ventures Review Team in Gloucester, Massachusetts.

On 4 June, Steve Murawski attended a public hearing on the Surf Clam-Ocean Quahog Management Plan in Pomona, New Jersey.

On 7 June, Anne Lange met in Gloucester, Massachusetts, with Ken Beal of the NMFS Northeast Regional Office concerning regulations on foreign fishing and joint ventures.

During 7-12 June, Fred Serchuk and Vaughn Anthony attended a Scientific Research Council meeting of NAFO in Dartmouth, Canada.

On 8 and 9 June, Linda Despres-Patanjo attended a joint U.S.-Canada Pathology Working Group meeting in Boothbay Harbor, Maine.

On 9 June, Senior Assessment Scientists and Fishery Assessment Investigation & Fishery Biology Investigation personnel attended the Southern New England Chapter meeting of the American Fisheries Society in New Bedford, Massachusetts.

On 9 June, Brad Brown met with Phil Coates of the Massachusetts Division of Marine Fisheries to continue development of joint statistical sampling projects.

On 9 June, Mike Sissenwine attended an S&S Committee meeting of the New England Fishery Management Council in Saugus, Massachusetts.

During 9-11 June, Brad Brown and Dick Hennemuth attended the National Academy of Sciences Ocean Policy Committee and Ocean Sciences Board joint workshop on the recent International Oceanographic Committee proposal for cooperative worldwide research relating oceanography to fishery needs.

On 10 June, John Boreman attended a public hearing on proposed striped bass regulations in Providence, Rhode Island.

During 13-19 June, Gary Shepherd attended the Annual Meeting of the American Society of Ichthyologists and Herpetologists in Dekalb, Illinois, and presented a paper entitled "Growth and Reproduction Variations in *Cynoscion regalis*."

During 13-16 June, Fred Serchuk, Steve Murawski, and John Lopes attended the 1982 Joint Annual Meeting of the Shellfish Institute of North America and the National Shellfisheries Association in Baltimore, Maryland. On 13 and 14 June, John presented a poster session on documentation of annular growth lines in ocean quahog. Fred and Steve met with members of the Sea Clam Packers Committee to discuss surf clam and ocean quahog management.

During 15-17 June, Steve Clark attended a joint meeting of the New England and Mid-Atlantic Fishery Management Councils in Mystic, Connecticut.

During 15-18 June, Joan Palmer attended the NAFO Scientific Research Council meeting in Dartmouth, Canada.

During 18-25 June, Brad Brown and Jack Suomala (C.S. Draper Laboratories, Inc.) attended the ICES Hydroacoustics Symposium in Bergen, Norway.

On 21 June, Steve Murawski and Emory Anderson met with NMFS Northeast Regional Office staff members in Gloucester, Massachusetts, to discuss analysis of data collected by the Fishery Management Priorities Committee.

On 24 June, Steve Clark chaired a meeting of the Northern Shrimp Technical Committee in Gloucester, Massachusetts, to discuss proposed research trawl development and evaluation studies. Chuck Byrne also attended.

On 25 June, John Boreman attended a meeting of the Striped Bass Study Planning and Coordination Committee.

On 27 June, Steve Clark lectured on fish stock assessment and management at the Shoals Marine Laboratory on Appledore Island, Maine.

During 28 June-10 July, Vaughn Anthony attended a meeting of the ICES Advisory Committee on Fishery Management in Copenhagen, Denmark.

#### Marine Ecosystems Division

On 1 and 2 May, Phil LeBlanc attended the Northeast Algal Symposium held at the Marine Biological Laboratory in Woods Hole.

On 13 May, Carolyn Griswold attended a Subcommittee meeting of the Regional Technical Working Group and helped develop a proposal for the Bureau of Land Management's Environmental Studies Program.

Ray Bowman met with Jeremy Collie of the Woods Hole Oceanographic Institution, and with Mike Sissenwine and Marv Grosslein of the NEFC concerning a Bureau of Land Management contract proposal to obtain fish stomach contents from selected species on Georges Bank.

During 24-26 May, John Pijanowski, who is with the NOAA Office of Ocean Technology and Engineering Services and who is coordinating the completion of the prototype Automated Plankton Sorting System, met with Perry Jeffries, Marc Berman, Alex Poularikis, Costas Katsinis--all of the University of Rhode Island, and with Ray Maurer to discuss details of system development through the summer.

From 27 May to 12 June, Ken Sherman attended meetings in Japan and Australia concerned with planning ecosystem research on the living marine resources of the Antarctic. On 27 and 28 May, he attended a BIOMASS Colloquium in Tokyo, Japan; during 31 May-3 June, he attended meetings of the Standing Committee on Antarctic

Research/Standing Committee on Ocean Research Group of Specialists for the Antarctic; and during 5-12 June, he attended the first meeting of the Scientific Committee of the Commission for the Conservation of Antarctic Marine Living Resources, held in Hobart, Australia.

During 31 May-4 June, the following talks were given at the spring meeting of the American Geophysical Union:

MOUNTAIN, D.; COHEN, E. Biological implications of the Georges Bank physical oceanography. (Invited.)

RAMP, S.; SCHLITZ, R.; WRIGHT, W. R. The influence of Northeast Channel flow on the general circulation of the Gulf of Maine-Georges Bank region. (Invited.)

ALLEN, A.; SCHLITZ, R. Wind-driven currents on the northern side of Georges Bank.

FAIRBANKS, R.; BAKER, T.; MOUNTAIN, D.; KALIBAS, G. Georges Bank circulation:  $H_2^{18}O$  - salinity tracer.

On 3 June, Ken Sherman attended a U.S. State Department meeting in Washington, D.C.

During 6-11 June, George Bolz attended the Second BIOMASS Workshop on Aging of Antarctic Fishes, held at the University of Maine in Orono.

On 9 June, Carolyn Griswold and Jerry Prezioso attended a meeting of the Southern New England Chapter of the American Fisheries Society in New Bedford, Massachusetts.

During 14-18 June, Mike Fahay attended the Annual Meeting of the American Society of Ichthyologists and Herpetologists, held at the University of Northern Illinois Campus in DeKalb.

On 22 June, Ken Sherman met with P. Jeffries of the University of Rhode Island in that School's Challenger Room.

Geoff Laurence and Larry Buckley traveled to the U.S. Fish and Wildlife Service's (USFWS) Columbia National Fisheries Research Laboratory to discuss results from the joint NMFS/USFWS striped bass study, and plan for presentations to be given at the Striped Bass Symposium scheduled for the American Fisheries Society's annual meeting in September.

Geoff Laurence completed an invited manuscript on larval fish nutrition and trophodynamics to serve as a discussion topic during Fish Ecology III, sponsored by the Cooperative Institute of Marine and Atmospheric Affairs at the University of Miami.

## Resource Utilization Division

Fred King participated in the 15th Session of the Codex Committee for Fish and Fishery Products, held in Bergen, Norway, during 2-8 May. In addition to being part of the U.S. Delegation, he was the Observer for the Association of Official Analytical Chemists. He was also the rapporteur for two working groups.

Fred King participated in a meeting of the New England Fisheries Institute, held in Quincy, Massachusetts, on 13 May.

Fred King participated in a meeting of about 50 industry and government representatives in Gloucester, Massachusetts, on 1 June. The meeting was hosted by the Canadian Consulate General in Boston.

A meeting was held at the Gloucester Laboratory during 15-18 June to discuss standardization activities. Apart from the Laboratory staff, the following were present: Jim Brooker of the NMFS Central Office; Don Mahar of the NMFS Pascagoula Laboratory; and Tom Moreau, Director of the Northeast Inspection Office. New starts were planned for a catfish and fish block standard, as well as a continuation of work on the shrimp steaks standards.

Fred King was an invited guest at the 12th Meeting of the West European Fisheries Technologists Association's Working Group for Analytical Methods, held in Nantes, France, during 28 June-2 July.

Professor Joseph Regenstein of Cornell University has asked Fred King to be one of the speakers at a symposium on sensory evaluation which is to be part of the Atlantic Fisheries Technologists Conference in Portland, Maine, during September.

John Ryan and Perry Lane attended a meeting of the Armed Forces Product Evaluation Committee at the U.S. Army's Natick (Massachusetts) Laboratories.

Judith Krzynowek presented a paper entitled "Effect of Processing on Sterol and Fatty Acid Composition of Crabmeat" at the 74th Annual Convention of Shellfish Institute of North America and the National Shellfisheries Association.

Burton Tinker presented a paper entitled "Quality Assurance of Seafoods: The Gloucester Laboratory Experience" at the Fisheries Institute in Kodiak, Alaska, sponsored by the Kodiak Community College.

## Environmental Assessment Division

Dr. J. Graikoski traveled to Washington, D.C., to review Saltonstall-Kennedy Act proposals for the NMFS Central Office on 11 and 12 May.

On 20 May, Frank Steimle, John Pearce, and Carl Sindermann participated in a meeting with EPA Region II at Edison, New Jersey. The purpose of the meeting was to coordinate again our anoxia monitoring efforts this summer and to explore other areas of cooperation.

Bob Reid attended a State of the (Long Island) Sound Conference in Stony Brook, New York, on 22 May.

Many members of the NEMP management team and principal investigations met at the Milford Laboratory on 1 and 2 June to discuss the annual report, funding, and future monitoring plans.

R. Greig attended a meeting on copper chemistry coordination held at the State University of New York at Albany during 2-4 June.

On 23 June, many Ocean Pulse Program principal investigators met with a representative from EPA Region II to plan the annual New York Bight benthic survey as a cooperative effort with EPA, which does similar surveys in the summer. A chemical intercalibration exercise between the two labs was suggested.

Bob Reid met with Manned Undersea Research and Technology Program personnel in Woods Hole on 24 June to plan sampling related to the New Bedford PCB problem.

On 24 June, several Ocean Pulse Program principal investigators met with Dr. Merton Ingham of AEG to discuss the feasibility of a periodic Ocean Pulse Program report on the status of the hydrographic environment. A draft outline of the purpose and areas of interest and sources of data was prepared and circulated for comments.

Bob Reid met with Don Boesch, Bob Whitlatch, Howard Sanders, and Fred and Judy Grassle at the Woods Hole Oceanographic Institution on 25 June to outline a joint paper on long-term degradation of estuarine macrobenthos.

Steve Fromm presented a poster paper, "Sodium and Potassium Values in *Fundulus heteroclitus*," at the Annual Meeting of the American Society of Ichthyologists and Herpetologists in DeKalb, Illinois.

#### Aquaculture Division

During 6-8 May, several of our staff participated in the New England Estuarine Research Society meeting in Old Saybrook, Connecticut.

During 13-17 June, J. Widman and S. Stiles attended the National Shellfisheries Association Annual Meeting in Baltimore, Maryland, and presented papers, the former on "The Intermediate Culture of Bay Scallops," and the latter on "Cytogenetic Method as a Tool for Assessing Condition of Shellfish Larvae."

During 24-26 June, E. Rhodes and J. Widman visited Dennis, Orleans, and Nantucket, Massachusetts, to discuss bay scallop culture with town shellfish biologists and commercial representatives.

### Pathobiology Division

Ms. Lisa Petti of the Milford Laboratory attended the 1982 Northeast Estuarine Research Society meeting on 7 May in Old Saybrook, Connecticut.

Dr. Murchelano and Mr. Newman attended the joint 7th Eastern Fish Health Workshop and the 13th International Association for Aquatic Animal Medicine Annual Meeting on 10 and 11 May in Baltimore, Maryland; Mr. Newman presented a paper on "Isolation of an Infectious Pancreatic Necrosis-like Virus From Southern Flounder, *Paralichthys lethostigma*."

Dr. Rosenfield conferred with Mr. Angelovic regarding NOAA /French National Center for the Exploitation of the Oceans pollution monitoring approaches on 24 May in Washington, D.C.

Dr. Rosenfield attended a conference on recreational fishing tournaments in Washington, D.C., on 24 May.

On 24 and 25 May, Dr. Blogoslawski of the Milford Laboratory attended a workshop on Seafood Science and Technology in Washington, D.C., and presented a talk on solutions to bacterial spoilage problems in fishery products.

On 26 and 27 May, Dr. Blogoslawski presented a paper on worldwide shellfish depuration at the Gulf Coast and South Atlantic States Shellfish Conference in Charleston, South Carolina; Mr. Kern also attended the Conference.

Dr. Murchelano presented a lecture and conducted a lab session at the "Aquavet" course at the Marine Biological Laboratory in Woods Hole, Massachusetts, on 28 May.

On 28 May, while on annual leave, Dr. Blogoslawski visited the Oak Ridge National Laboratory in Oak Ridge, Tennessee.

Drs. Murchelano and Robohm participated in a Northeast Monitoring Program planning workshop at the Milford Laboratory on 1 June.

Dr. Rosenfield discussed U.S./Canada pathobiology programs at the Maine Department of Marine Resource's Boothbay Harbor Laboratory on 9 June.

Dr. Rosenfield attended a Maryland Sea Grant Advisory Board meeting on 16 June in College Park, Maryland.

Ms. Wade attended the Scanning Electron Microscopy course at George Washington University in Washington, D.C., during the week of 21 June.

From 21 to 23 June, Dr. Blogoslowski visited the Canadian Fisheries and Marine Service laboratory in New Brunswick, Canada, to present a seminar on ozone detoxification of the softshell clam (*Mya arenaria*).

Dr. Rosenfield discussed--at the Oxford Laboratory--future cooperative research programs with representatives from the U.S. Fish and Wildlife Service's National Fisheries Center in Kearneysville, West Virginia, on 22 June. Mr. Newman attempted to isolate virus from flounder at the Kearneysville facility on 7 May.

Dr. Rosenfield attended a 2-wk Foreign Policy Seminar course beginning on 28 June in Washington, D.C.

#### National Systematics Laboratory

Dr. B. Collette attended a workshop on Fish and Wildlife Permitting Procedures presented by the U.S. Fish and Wildlife Service at the National Museum of Natural History on 19 May.

Dr. I. Canet worked at the NMFS Miami Laboratory from 7 to 19 June. Part of the more than 40 illustrations that will accompany the revision of the genus *Sicyonia* were finished and a few outlined, to be completed by the artist.

Dr. Collette and Mr. J. Russo attended the Annual Meeting of the American Society of Ichthyologists and Herpetologists (ASIH) at Northern Illinois University in DeKalb from 12 to 18 June.

Dr. Collette participated in meetings of the Executive Committee and Board of Governors as immediate past-president of ASIH. He presented a paper on needlefishes of the genus *Potamorhaphis*. Mr. Russo presented a poster display on Spanish mackerels of the *Scomberomorus regalis* species-group. Dr. Collette studied fishes at the Field Museum of Natural History in Chicago during the ASIH meetings.

#### Atlantic Environmental Group

Mert Ingham attended a Northeast Monitoring Program Management Team meeting which was held at the Milford Laboratory on 2 June.

On 5 June, Mert Ingham traveled to Dartmouth, Nova Scotia, Canada, to participate in the Northwest Atlantic Fisheries Organization Environmental Committee meeting. He presented six papers for the Atlantic Environmental Group.

Steve Cook attended a coordination meeting as part of the NOAA/RD Climate Activities Review, held in Washington, D.C., on 22 and 23 June.

On 23 and 24 June, Mert Ingham went to the Sandy Hook Laboratory to confer with NEFC and National Ocean Survey personnel concerning the quarterly oceanography report.

## SEMINARS

### Resource Assessment Division

On 5 April, Fred Serchuk presented a seminar on the current status and assessment of U.S. sea scallop populations to NEFC staff at the Homeport conference room in Falmouth, Massachusetts.

On 13 May, Fred Serchuk presented a seminar on the 1982 sea scallop assessment to NEFC staff at the Homeport office complex in Falmouth, Massachusetts.

### National Systematics Laboratory

Mr. J. Russo presented a seminar to the Smithsonian Small Computer Group evaluating a microcomputer system on 19 May.

## VISITORS

### Resource Assessment Division

On 21 May, Brad Brown met with representatives and consultants for the U.S. State Department to review requirements for the World Court case involving the U.S.-Canada maritime boundary issue.

During 24-26 May, Louise Dery, Ambrose Jearld, and Emma Henderson met with George Hirschhorn and Greg Small of the NMFS Northwest and Alaska Fisheries Center to discuss aging and growth research, including mathematical modeling.

During 21-24 June, Vaughn Anthony and Mike Sissenwine met with Bertrand Gobert, a visiting scientist from France, at the Homeport office complex to discuss stock assessment techniques.

On 22 June, Steve Clark, Fred Serchuk, and Vaughn Anthony met with Tim Smith of the NMFS Southwest Fisheries Center at the Homeport office complex to discuss stock assessment techniques.

On 22 June, Mike Sissenwine met with Mr. Koseki of the Japanese Fishery Agency at the Homeport office complex.

On 24 June, Fred Serchuk, Vaughn Anthony, and Emory Anderson met with Don Waldron of Fisheries and Oceans Canada at the Homeport office complex and reviewed his assessment of NAFO Divisions 4V, 4W, & 4X silver hake stock.

On 29 June, Steve Clark and Mike Sissenwine met with Don Bourne, a freelance technical writer, to review the preparation of a nontechnical paper on assessment of the Georges Bank haddock stock.

### Aquaculture Division

On 6 June, E. Kattau of Bayville, Long Island, New York, visited the Milford Laboratory.

On 30 June, E. Rhodes hosted a group from the Cooperative Educational Service Program in Stamford, Connecticut.

### Pathobiology Division

Thirty students from the University of Massachusetts visited the Diseases of Larval Mollusks Investigation at the Milford Laboratory on 5 May.

On 14 June, Thomas Kohlsaas of the South Carolina Department of Wildlife and Marine Resources visited Dr. Robohm and toured the Milford Laboratory.

Visitors to the Oxford Laboratory during the reporting period were Mr. Jeffrey Bier of the U.S. Department of Agriculture in Washington, D.C.; Mr. Robert Palmatier of Zeiss, Inc., in Falls Church, Virginia; Mr. Gus Koste, Sr., of Denton, Maryland; Mr. Gus Koste of Oxford, Maryland; Mr. George P. Stevens of Athens, Greece; Mr. Tim Cole of the University of Maryland's Center for Environmental & Estuarine Studies in Cambridge, Maryland; Mr. Alex Young of Easton, Maryland; Mr. D. H. Gist of the University of Cincinnati; Mr. Ryoji Koseki of the Japanese Fisheries Agency in Tokyo; Mr. and Mr. Galen Maxfield of Seattle, Washington; Mr. Fred Sieling, Ms. Lisa Garber, and Ms. Sara Otto of the Maryland Department of Natural Resources in Annapolis; Dr. G. L. Bullock and Mr. James E. Weaver of the U.S. Fish and Wildlife Service in Kearneysville, West Virginia; Mr. and Mrs. Ray Simmons and Ms. Martha Jones of Hoopers Island, Maryland; Ms. Karen Weber of Ellicott City, Maryland; and Mr. William Pegg and his ecology class from Frostburg (Maryland) State College.

### National Systematics Laboratory

Dr. Collette was visited by: Dr. John Randall of the Bishop Museum in Honolulu to discuss Red Sea fishes; Dr. James Tyler of the National Science Foundation who worked on the osteology of the Louvar while here; Dr. Frank Carey of the Woods Hole Oceanographic Institution to study scombroid skulls; Dr. Daniel M. Cohen of the NMFS Seattle Laboratory to study North Pacific gadoids; Dr.

Vladimir Walters of the NMFS Miami Laboratory to study bluefin tuna parasites; Mr. Douglas Herdson of the Instituto Nacional de Pesca in Ecuador to examine eastern Pacific fishes; Mr. Geoff Black of the University of Guelph to look for swimbladder nematodes in lake trout; and Dr. Frank H. Talbot of the California Academy of Sciences in San Francisco.

Dr. Williams was visited by Mr. Jay Blundon of the University of Maryland to discuss the crushing power of crab claws.

## UNIVERSITY AFFAIRS

### Resource Assessment Division

Fred Serchuk met with Roger Mann of the Woods Hole Oceanographic Institution on 3 March in Woods Hole, concerning possible development of an offshore shellfish workshop. He also spoke with Nancy Prominski, a graduate student at Duke University, on 19 March about sea scallop resource status and relationship of sea scallop management to the U.S.-Canada East Coast maritime boundary issue. He also spoke with Steve Otwell, a Professor at the University of Florida, on 24 March concerning the deepsea red crab fishery.

Gordon Waring communicated on several occasions with Marta Nammack, a master of science candidate at the Virginia Institute of Marine Sciences, and with Dr. Peter Woodhead, Professor of Marine Science at the State University of New York at Stony Brook, concerning spiny dogfish research. On 26 April, he met with Margaret Linskey of the Massachusetts Institute of Technology's Sea Grant Program to discuss spiny dogfish abundance, distribution, and age-structure data.

Anne Lange met with Dr. Wendy Gabriel of the University of Massachusetts' School of Fisheries, and with graduate student Gabriel Von Enler, regarding a project which Gabriel would be working on during spring semester involving a hypothesis of the life cycle of the shortfin squid (*Illex illecebrosus*).

Bob Rak gave a slide presentation to the faculty and graduate students of the Biology Department of Southeastern Massachusetts University on the activities of three research cruises in which he participated during autumn and winter 1981-82 aboard the Polish R/V's *Wiezno* and *Admiral Arciszewski*, and the NOAA R/V *Delaware II*.

Bob Rak is also preparing a draft of his master's thesis on the use of otoliths for aging the plainfin midshipman (*Porichthys notatus*) from Santa Barbara, California, and the length-weight relationship and fecundity of this species.

Mike Fogarty enrolled in a graduate-level course in population biology and fishery research at the University of Rhode Island.

On 7 May, Mike Sissenwine met with Maynard Silva of the Woods Hole Oceanographic Institution to discuss proposed research.

On 14 May, Fred Serchuk spoke with Warren Lieberman, a graduate student at Yale University, concerning uses of biological advice and fisheries assessments in New England fisheries management.

On 18 May, Mike Sissenwine and Mike Fogarty met with Dr. Robert Costantino of the University of Rhode Island to discuss application of population genetics studies to fisheries research.

On 25 May, Fred Serchuk met with Nancy Prominiski, a graduate student at Duke University, to review status of sea scallop stocks and management vis-a-vis the U.S.-Canada East Coast maritime boundary issue.

During June, Emory Anderson and Gordon Waring reviewed a report by Marta Nammack, a graduate student at the Virginia Institute of Marine Sciences, concerning age and growth and other biological data on spiny dogfish.

On 2 June, Brad Brown, Steve Clark, and Fred Serchuk participated in a review of Kevin Cain's bottom trawl survey analytical studies, at the Homeport office complex. Kevin is a graduate student at Harvard University.

On 7 June, Brad Brown met with Dr. Conrad Reistag of the University of Rhode Island and developed a cooperative project to investigate commercial sampling variability.

On 16 June, Mike Sissenwine and Bill Overholtz met with Peter Oster of the University of Connecticut to discuss use of Gulf of Maine survey data in community ecological studies.

On 16 June, Bill Overholtz met with Dr. Wendy Gabriel of the University of Massachusetts to discuss various community ecological studies planned for the summer.

On 25 June, Steve Murawski spoke with Dr. Michael Ross of the University of Massachusetts regarding cooperative research on witch flounder population biology.

#### Marine Ecosystems Division

On 28 May, fatty acid samples from the *Delaware II* MARMAP survey cruise were collected for Dr. Jeffries at the University of Rhode Island.

On 3 June, Roz Cohen met with Dr. Judith Capuzzo of the Woods Hole Oceanographic Institution (WHOI) to discuss biochemical analysis of copepods.

On 4 June, Greg Lough met with Dr. David Ritz of the Zoology Department at the University of Tasmania to discuss research of mutual interest.

On 9 June, Greg Lough and Phil LeBlanc attended a precruise warm-core ring meeting at WHOI.

During June, R. Cohen and G. Lough held several meetings with Susan Houghton of the Marine Biological Laboratory to discuss scanning electron microscopy studies of zooplankton mouthparts as related to feeding behavior.

During June, Dave Potter provided equipment and instructions to Dr. Peter Wiebe of WHOI in shipboard silhouette photography techniques for use in the identification of zooplankton on the WHOI R/V *Oceanus* warm-core ring cruise.

At the end of June, Greg Lough talked with Dr. Jennifer Purcell of WHOI aboard the WHOI R/V *Knorr* to provide them with the most recent observations of fish eggs and larvae along the Northeast's continental shelf so they could conduct experiments on gelatinous zooplankton predation.

#### Aquaculture Division

During 10-14 May, Earl Sanders of the College of Charleston (South Carolina) was trained in bivalve spawning and rearing procedures.

On 17 May, E. Rhodes met with Mary Gibbons of the State University of New York relative to a Ph.D. thesis problem.

On 18 June, E. Rhodes and R. Goldberg met with a University of Connecticut group to discuss a Sea Grant oyster management project.

#### Pathobiology Division

On 17 May, approximately 40 *Gonyaulax* cysts from Maine were given to Mr. William Walsh, a student at the University of Connecticut. He will be doing some respiration studies on the cysts.

Cooperative work is continuing between Fairfield University and the Disease of Larval Mollusks Investigation at the Milford Laboratory. William Rose has been assisting Dr. Julius Kuck with spectrofluorometer readings needed for his work. Dr. Ted Combs has been given fertilized eggs and seawater for studies on yeast damage to American oyster larvae.

Drs. Rosenfield and Sawyer discussed effects of parasitism in winter flounder vis-a-vis contract research with Drs. Cali and Takvorian of Rutgers University in Trenton, New Jersey.

Renee Mercaldo of Connecticut College in New London, a Junior Federal Fellow, reported for duty at the Milford Laboratory on 24 May. Joyce Bowling of Duke University in Durham, North Carolina, also a Junior Federal Fellow, completed a 2-wk assignment on 25 June.

On 2 June, Dr. Arthur Repack from Quinnipiac College in Hamden, Connecticut, was given 10 bacterial isolates collected in Long Island Sound from our previous 2-yr study (1979-81). He will be using them in a nutrition scheme for his protozoan work.

On 7 June, Patricia Charnas of Yale University in New Haven, Connecticut, was given surplus supplies to help in her studies.

The extracted pigment of a shellfish pathogenic pseudomonad was sent to Dr. Nancy Gerber of Rutgers University for analysis.

## PUBLIC AFFAIRS

### Resource Assessment Division

On 17 March, Fred Serchuk presented a talk on resource assessment activities to a biology class from Nantucket High School at the Woods Hole Aquarium.

On 16 April, Anne Lange presented a talk in Woods Hole on assessment techniques to the New England Marine Educators Association.

On 3 June, Brad Brown participated in a science program at the Barnstable (Massachusetts) Middle School.

### Marine Ecosystems Division

On 4 June, Wally Morse participated in a career day sponsored by the Berkley Township (New Jersey) School District.

Media interest in sharks was high in June, aside from the usual articles reporting our efforts. A television production, "PM Magazine," interviewed Jack Casey while shark tagging off Montauk on 30 June. In addition, ABC's American Sportsman will rerun the NMFS-Woods Hole Oceanographic Institution white shark tracking film on 4 July.

### Aquaculture Division

We have provided Hugh Rule of the Stamford (Connecticut) Public School System with seed-size surf clams and bay scallops. The animals will be reared in Long Island Sound as part of a summer educational program.

## Pathobiology Division

Dr. Rosenfield presented a talk on "China and Aquaculture" to the Monday Afternoon Seminar Club on 17 June in St. Michaels, Maryland.

### PERSONNEL

Elizabeth Bevacqua resigned and moved to Virginia in June. She will be greatly missed.

Ira Palmer returned to the Fishery Biology Investigation in May under a cooperative education appointment with the University of the District of Columbia.

Mark Costa returned to the Fishery Biology Investigation in May under a cooperative education appointment with Lincoln University.

Brenda Fields returned to the Fishery Biology Investigation in May after a period of graduate study at the University of Washington.

David Pyoas returned to the Fishery Biology Investigation in May under a cooperative education appointment with South Carolina College.

Wendy Gabriel, an Assistant Professor of Fishery Biology at the University of Massachusetts, joined the Fishery Assessment Investigation in June under a faculty appointment.

Christopher Gledhill, a graduate student at Iowa State University, joined the Fishery Assessment Investigation in June as a summer employee.

Eileen Klopfer returned to the Fishery Assessment Investigation from Smith College in June as a summer employee.

Cynthia Demo returned to the Fishery Assessment Investigation in June under a cooperative education appointment with the University of Delaware.

Susan Wigley, an undergraduate student at Bates College, returned to the Resource Surveys Investigation in June as a summer employee.

Margaret McBride returned to the Fishery Assessment Investigation in June after a period of graduate study at Oregon State University.

Fred Serchuk was appointed Membership Chairman of the Northeast Division of the American Fisheries Society for 1982-83.

## Marine Ecosystems Division

On 3 May, Tamara Sharp entered on board as a clerk-typist.

On 1 June, Ruth Briggs entered on board as a clerk-typist for Administration.

The Minority Apprenticeship Program hired five minority students for the summer: Job Williams, Paul Francis, Arnold Kee, Archimedes Merriweather, and Lysa Suggs.

Three students entered on duty as summer employees: Patricia Michalik, Stephen White, and Marie Carter.

Roz Cohen was appointed as a career counselor for the Woods Hole Laboratory Marine Ecosystems Division, in support of the NMFS's Affirmative Action Plan.

On 1 June, Ted Lillestollen of the NOAA Corps began a 2-mo assignment as a staff assistant to the Division Chief for preparation of computer graphics analyses dealing with the definition of natural boundaries on the continental shelf.

On 14 June, Glenn Gioseffi reported on duty as a computer aide for the summer.

On 17 June, Greg Skomal reported for duty as a computer aide.

During this period the Fishery Oceanography Investigation said goodbye to Art Allen and Gil Dering. Art's temporary appointment expired and Gil has taken a new position with Neil Brown Instrument Systems, Inc. We are sad to see them go and wish them the best in the future.

## Pathobiology Division

Dr. Brown of the Milford Laboratory received the 1982 Professional Award presented by the Greater Bridgeport (Connecticut) Negro Business and Professional Womens Club, Inc.

Ms. Robin Friend, a clerk-typist, and Mr. David Kent, a biological laboratory technician, entered on duty at the Oxford Laboratory in June for the summer. Ms. Marina Priesnitz began a summer appointment at the Milford Laboratory on 1 June.

Mr. C. Harrison transferred to the Milford Laboratory from the Woods Hole Laboratory.

## EEO ACTIVITIES

### Resource Assessment Division

Louise Dery attended meetings of the Woods Hole Laboratory EEO Committee on 2 March and 1 April.

Sherry Sass attended the 2 March meeting and also discussed Federal Women's Program activities with Karen Ferreira.

Louise Dery attended a human relations seminar given on 11 and 12 March at the U.S. Geological Survey in Woods Hole.

Louise Dery attended a class on "Personnel Management for EEO Staffs," given during 19-23 April in Boston by the U.S. Office of Personnel Management.

On 5 May, Brad Brown attended a workshop of the American Association of Affirmative Action Professionals held at the Massachusetts Institute of Technology.

On 13 May, Sherry Sass participated in the Federal Women's Program (FWP) Committee meeting in Woods Hole. Minutes were prepared and distributed to members.

On 20 May, Brad Brown attended part of the Boston Federal Executive Board's Annual EEO Meeting.

During the month of May, Brad Brown was involved in implementation of the career counseling component of the National Marine Fisheries Service Federal Equal Opportunity Recruitment Program.

On 1 June, Mike Sissenwine met with Dr. Bailey Jackson of New Perspectives, Inc., Amherst, Massachusetts, to plan an EEO workshop.

On 1 June, Ambrose Jearld, Sherry Sass, Steve Clark, Fred Serchuk, and John Boreman attended the Woods Hole Laboratory EEO Committee meeting.

On 17 June, Brad Brown and Mike Sissenwine attended the Center EEO Committee meeting in Narragansett, Rhode Island.

On 18 June, Brad Brown met with Maurice Ward of the NMFS EEO staff and Jan Praeger of the EPA to discuss involvement of the Rhode Island Minority Research Internship Program in activities with the NEFC's Narragansett Laboratory.

On 28 June, Sherry Sass participated in the FWP Committee meeting in Woods Hole. Minutes were prepared and distributed to members. Sherry also participated in arrangements for an individual development plan preparation workshop in late July.

On 28 and 29 June, Emma Henderson attended a management seminar in Washington, D.C., as a delegate for FWP.

### Marine Ecosystems Division

During May and June, monthly meetings of the Narragansett Laboratory EEO Committee were held. Robert Benway joined the Committee; he will represent the AEG.

Work continues on the Narragansett Laboratory's Minority Apprenticeship Program (in conjunction with the EPA's Narragansett facility) for the summer; we have five minority students on board for an 8-wk summer program.

Narragansett Laboratory EEO Committee members attended: (1.) a fact-finding meeting at Woods Hole with Dr. Bailey Jackson, and (2.) the Center EEO meeting which was held at the Narragansett facility on 17 June.

As a member of the American Fisheries Society's (AFS) Equal Opportunity in Fisheries Committee, Carolyn Griswold reviewed and commented upon a questionnaire being developed for women who are AFS members. She suggested that questions be added regarding supervisory responsibilities of women fishery biologists, and types of additional jobs women are given which their male peers may not be asked to do.

### Aquaculture Division

On 17 June, R. Goldberg attended a Center EEO Committee meeting at the Narragansett Laboratory.

### Pathobiology Division

Dr. Brown of the Milford Laboratory and Ms. MacLean-Park of the Oxford Laboratory attended the Center EEO Committee meeting at Narragansett during 16-18 June.