

Gibson



NORTHEAST FISHERIES CENTER

NEWSLETTER

JULY-AUGUST 1983

SPOTLIGHT:

"AUTOMATED SATELLITE TRANSMISSION OF TEMPERATURE PROFILES
AND METEOROLOGICAL CONDITIONS FROM SHIPS OF OPPORTUNITY".....1

PROGRAMS:

RESOURCE ASSESSMENT DIVISION.....7

MARINE ECOSYSTEMS DIVISION.....17

RESOURCE UTILIZATION DIVISION.....26

ENVIRONMENTAL ASSESSMENT DIVISION.....34

AQUACULTURE DIVISION.....47

PATHOBIOLOGY DIVISION.....52

NATIONAL SYSTEMATICS LABORATORY.....71

ATLANTIC ENVIRONMENTAL GROUP.....74



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



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST FISHERIES CENTER

ADMINISTRATION

CENTER DIRECTOR (ACTING)/
ASSISTANT CENTER DIRECTOR FOR FISHERIES MANAGEMENT. .RICHARD C. HENNEMUTH
DEPUTY CENTER DIRECTOR (ACTING) DR. BRADFORD E. BROWN
ASSISTANT CENTER DIRECTOR FOR ENVIRONMENTAL MANAGEMENT/
SANDY HOOK LABORATORY DIRECTOR. DR. CARL J. SINDERMAN
CENTER PLANNING OFFICER DR. GEORGE J. RIDGWAY
CENTER OPERATIONS OFFICER HERBERT STERN, JR.
RESOURCE ASSESSMENT DIVISION CHIEF/
WOODS HOLE LABORATORY DIRECTOR (ACTING) DR. BRADFORD E. BROWN
MANNED UNDERSEA RESEARCH & TECHNOLOGY PROGRAM CHIEF . DR. RICHARD A. COOPER
MARINE ECOSYSTEMS DIVISION CHIEF/
NARRAGANSETT LABORATORY DIRECTOR. DR. KENNETH SHERMAN
RESOURCE UTILIZATION DIVISION CHIEF(ACTING)/
GLOUCESTER LABORATORY DIRECTOR (ACTING) ROBERT J. LEARSON
ENVIRONMENTAL ASSESSMENT DIVISION CHIEF DR. JOHN B. PEARCE
AQUACULTURE DIVISION CHIEF/
MILFORD LABORATORY DIRECTOR DR. JAMES E. HANKS
PATHOBIOLOGY DIVISION CHIEF/
OXFORD LABORATORY DIRECTOR. DR. AARON ROSENFELD
NATIONAL SYSTEMATICS LABORATORY DIRECTOR. DR. BRUCE B. COLLETTE
ATLANTIC ENVIRONMENTAL GROUP DIRECTOR DR. MERTON C. INGHAM

"NORTHEAST FISHERIES CENTER NEWSLETTER"

The "Northeast Fisheries Center Newsletter" is an informal bimonthly report on Northeast Fisheries Center (NEFC) activities, primarily for NEFC employees. 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. To cancel delivery or change mailing address, please write: Information & Publications Office, Northeast Fisheries Center, National Marine Fisheries Service, NOAA, Water St., Woods Hole, MA 02543.

**AUTOMATED SATELLITE TRANSMISSION
OF TEMPERATURE PROFILES AND METEOROLOGICAL CONDITIONS
FROM SHIPS OF OPPORTUNITY**

by

Steven K. Cook
Atlantic Environmental Group

INTRODUCTION

In 1970, the National Marine Fisheries Service (NMFS) and the Maritime Administration began a cooperative program to identify, describe, and monitor seasonal and annual variations of temperature and circulation in major currents of the Gulf of Maine, Gulf of Mexico, and western North Atlantic, using ships of opportunity as relatively inexpensive platforms for collecting data. The program, which supported NMFS's Marine Resources Monitoring, Assessment, and Prediction Program, used U.S. Merchant Marine Academy midshipmen, U.S. Coast Guard personnel, and contractors to collect expendable bathythermograph (XBT) data on board various merchant, Coast Guard, and research vessels along our Atlantic and Gulf coasts.

Presently, NMFS's Atlantic Environmental Group (AEG) operates four XBT transects along the Atlantic and Gulf Coasts (Figure 1). Concurrent with two of the XBT transects, we operate continuous plankton recorder transects. We have operated most transects for at least five years on a monthly or bimonthly basis, and some for almost 10 years, providing a significant time series of subsurface data.

For our XBT data, we portray, analyze, and synthesize them with long-term meteorological and other oceanographic data which may influence distribution or abundance of living marine resources. We provide such information to fishery researchers and managers, and to commercial and recreational fishermen for locating pelagic fish concentrations or avoiding Gulf Stream eddies.

To provide XBT transect data more quickly to NOAA personnel, including ourselves for our interpretation of satellite infrared imagery, we are upgrading our shipboard XBT systems for satellite data transmission.

SYSTEM DESCRIPTION

In December 1982, we deployed an expendable bathythermograph and meteorological data collection and satellite transmission system on board the M/V *Oleander*, a ship of opportunity operating weekly between Port Newark, New Jersey, and Hamilton, Bermuda. This system, commonly called SEAS (Shipboard Environmental Data Acquisition System), provides for: (1) prompt collection of meteorological and XBT data; (2) the digitization, compaction, and calculation of inflection points for the XBT data; and (3) the timely transmission of these data through a GOES satellite system in the World Meteorological Organization's standard meteorological and XBT formats. These data are then available in near real-time for the National Weather Service's National Meteorological Center, AEG's Ocean Ecology Analysis Program, etc.

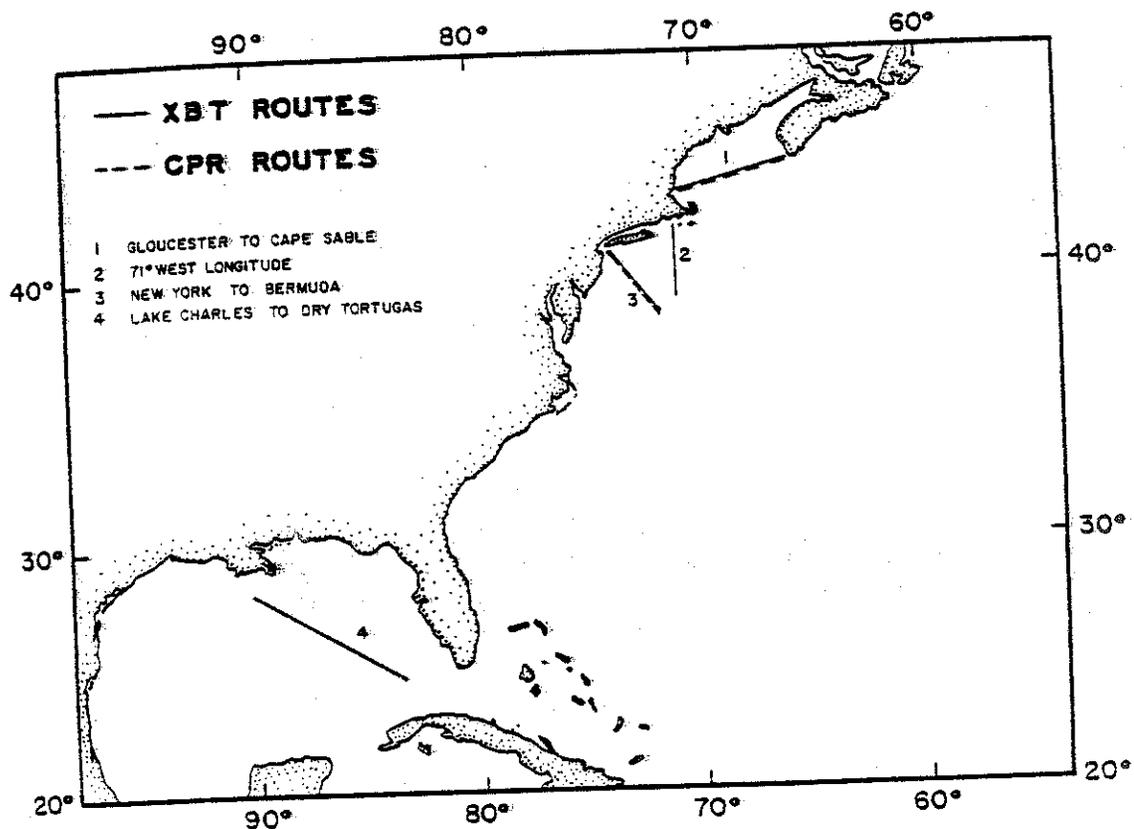


Figure 1. Expendable bathythermograph (XBT) and continuous plankton recorder (CPR) routes in the Atlantic and Gulf, part of the Atlantic Environmental Group's Ship-of-Opportunity and Ocean Monitoring Programs.

Hardware

The system has four components: (1) A Bathy Systems XBT Controller-- provides a direct interface with Sippican XBT probes, a crystal-controlled time base (9-cm depth error in 1800 m), and an RS-232 interface to a computer; (2) a Hewlett-Packard Model HP/85 desktop computer--provides digital recording on magnetic cartridges, a CRT and printer, and a complete operating system for program development; (3) a Synergetics Data Collection Platform, including a Master Control Module, a GOES transmitter, and an uninterruptible power supply; and (4) a Synergetics Omnidirectional Antenna with cable and connectors.

The HP/85 mounts on top of the XBT Controller, making a package measuring 19"x14"x10". The Data Collection Platform measures 10"x10"x10". The total system weighs approximately 40 pounds. Installing the system consists of only plugging in three 120-V wall plugs, positioning the omniantenna, and screwing in the antenna lead and XBT launcher cable.

Software

Software for XBT data includes: (1) a recording cycle which begins automatically when an XBT probe enters the water; (2) data storage on separate files to eliminate the need for a data base or the chance of accidental write-overs; (3) real-time plotting and playback of temperature profiles, and data listings (including depths of occurrence for whole-degree isotherms and inflection points); (4) generation of plots with enlarged depth and/or temperature scales; and (5) generation of BATHY messages in the standard World Meteorological Organization "JJXX" format.

Software for meteorological data includes: (1) a data entry program that prompts the operator for the appropriate input; (2) internal quality control checks; and (3) automatic data formatting into the standard World Meteorological Organization Ship Synoptic Code No. FM-13-VII.

SYSTEM OPERATION

Temperature Profiles

To begin the program for entering temperature profile data, one inserts the programming tape into the HP/85 and turns it on. The HP/85's autostart function loads and runs the program automatically. After this point, the program is prompting and will ask that appropriate data be entered, e.g., type of XBT probe, launch number, geographic location, etc. Following these entries, one receives a message "ready to launch" and an audible "BEEP" signal. The pin is pulled from the launcher, the probe is launched, and data from the probe are digitized, formatted into a standard Bathy message, and displayed on the CRT for real-time viewing to determine a good or bad drop.

The XBT Controller samples the incoming thermistor resistance values from the probe 10 times per second. A 12-bit analog-to-digital converter then converts the resistance values to voltages. The RS-232 serial interface then transmits voltage-versus-time information to the HP/85. When the probe reaches its maximum depth or hits bottom, the data acquisition cycle ends and the temperature profile data are automatically stored on a magnetic tape cartridge within the HP/85.

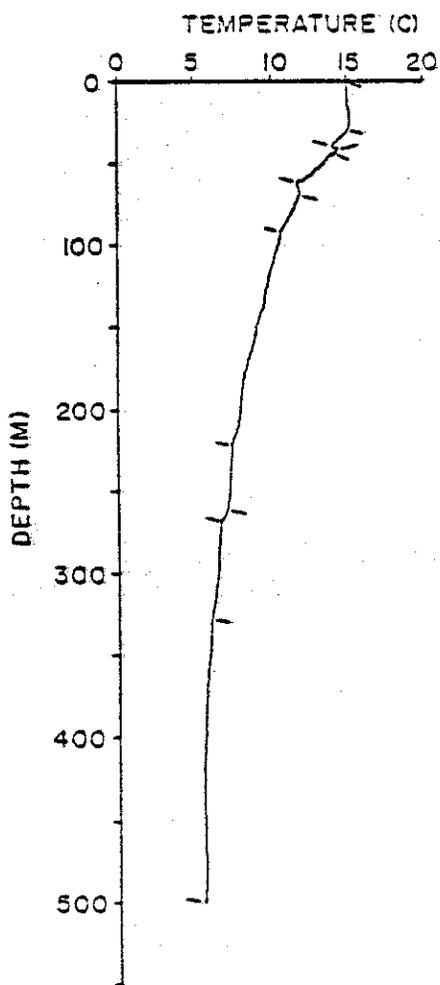


Figure 2. Vertical profile of ocean temperature. Derived inflection points indicated by tick marks.

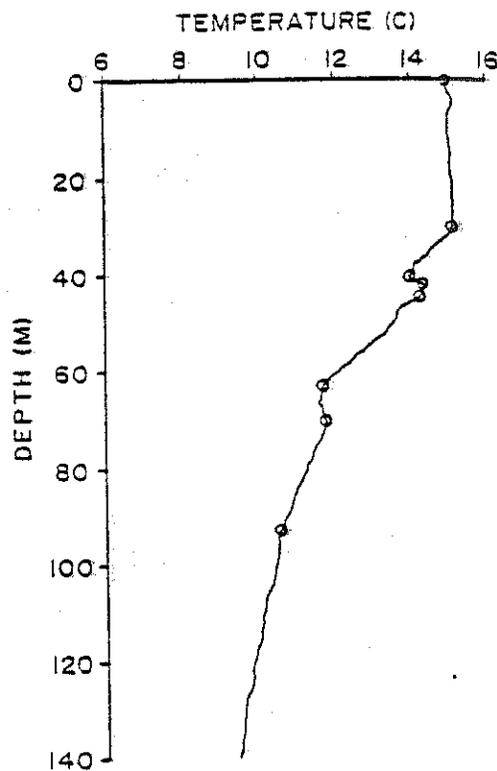


Figure 3. Expanded depth and temperature scale of portion of Figure 2. Derived inflection points indicated by circles. Notice temperature inversion at 40 meters resolved by three inflection points over vertical range of five meters.

Immediately after an XBT temperature profile has been stored on the HP/85 magnetic tape, a BASIC program processes the profile to select the minimum number of depth-temperature pairs necessary to generate an accurate representation of the entire vertical profile (not to exceed 29 depth-temperature pairs). Figures 2 and 3 and Table 1 show an XBT observation and the derived inflection points used to construct a Bathy (JJXX) message identical in form to that routinely prepared and transmitted via radio from ships at sea.

Table 1. Depth-temperature pairs for inflection points.

Depth (m)	Temperature (C)	JJXX Code
		88888
0	15.07	00151
30	15.10	30151
41	13.94	41139
43	14.31	43143
45	14.22	45142
61	11.79	61118
70	11.73	70117
93	10.46	93105
		99902
224	7.11	24071
262	6.70	62067
267	6.38	67064
		99903
332	5.62	32056
		99904
498	4.96	98050

These digitized data are then sent to the transmitter where they reside in a buffer awaiting an appropriate transmission time. GOES passwords, I.D. codes, channel assignments, and time slots have already been automatically entered into the Data Collection Platform by the program. At the assigned time slot, the message is automatically transmitted and routed through the GOES satellite to the National Environmental Satellite, Data, and Information Service at Wallops Station, Virginia, and into the National Meteorological Center's XBT file.

Meteorological Conditions

The command "Load Met" begins the standard shipboard meteorological observation program. After this entry, the program prompts the observer for data necessary to complete the message. Prompts are either in a long form for those not familiar with shipboard meteorological observations, or a short form for those with experience. Data are internally checked for quality control through comparison with reference ranges for acceptable values.

Upon completion of the entry, the observation is sent to the Data Collection Platform where it resides in a buffer until an appropriate transmission time. Routing and transmission are done in the same manner as the BATHY message described previously.

STATUS

Since installing the system on board the M/V *Oleander* in December 1982, we have had to make only one software modification to allow hand entry of bottom depth values. This modification prevents the automatic digitization of spurious data after the XBT probe has hit bottom. Since January 1983, the equipment (both hardware and software) has worked efficiently and reliably. The effort to streamline data reporting with improved programming and operator interaction has succeeded. Indeed, since deployment, over 250 XBT messages and 130 meteorological observations have been collected and transmitted. The project has evolved from experimental to operational; plans are underway to outfit all ships involved in AEG's Ship-of-Opportunity and Ocean Monitoring Programs with these systems.

RESOURCE ASSESSMENT DIVISION

submitted by

Dr. Michael P. Sissenwine, Acting Chief

No July-August report was received. The May-June report, which was received late, has been included for documentary purposes.

During, May-June Brad Brown and Mike Sissenwine were heavily involved with Center and Division-level administrative work. Brad's activities included meetings with Department of Commerce budget examiners to describe Center programs and work on problems associated with our current ADP agreement with the Woods Hole Oceanographic Institution. He also spent considerable time on planning next year's agreement. In May, Brad completed the first draft of a joint paper (with G.P. Patil) on risk analysis which is scheduled for presentation to the American Statistical Association. Mike Sissenwine assisted with the NOAA FY 1985 budget initiative for the Fisheries Oceanography Cooperative Investigation (FOCI) and assumed responsibility for NEFC marine mammal research programs.

Vaughn Anthony attended meetings of the International Council for the Exploration of the Sea (ICES) Advisory Committee on Fisheries Management and the ICES workshop on fish stock assessment methods in Copenhagen, Denmark, which together took much of the month of May. In June he completed a paper with Mike Fogarty on environmental influences upon recruitment of Gulf of Maine herring which he presented at the International Herring Symposium in Nanaimo, B.C. He coauthored a second paper on Gulf of Maine herring management which was presented at the same meeting.

FISHERY BIOLOGY INVESTIGATION

Summer additions to the Investigation include Jane Palmer (student at SMU, Dartmouth, MA), Detra Green (under a student cooperative appointment from South Carolina State) and Scott Mosely (under summer appointment from the University of Massachusetts). Annette Noble (graduate student at the University of Maryland) and Melinda Davis (faculty member at Fort Valley State College in Georgia) also came on board for the summer and are currently engaged in a variety of aging research projects.

In spite of heavy administrative workloads and occasional extended absences, Investigation staff members generated a considerable volume of age determinations and other results. Under the supervision of Vi Gifford and Kris Andrade, the "technician pool" (including Melinda Grace, Alicia Kelly, Blanche Jackson, Leslie DeFilippis, Tracy Williams, Nancy Munroe and Jane Palmer) not only kept up with routine workloads generated by commercial and recreational catch sampling and research vessel surveys but also completed a substantial volume of special requests, e.g., special surveys and Foreign Observer Program collections, and backlogged freezer samples. This output has been all the more impressive when one considers that five of the above technicians have been employed on a part-time basis. Sample processing includes thawing, otolith and scale collection,

length measurements and sex determinations, aging work and transmission of relevant data to the ADP unit for keypunching and storage in computer mode.

Congratulations are extended to John Ropes for his 30 years of federal service and for his achievement of the status of Fellow in the American Institute of Fishery Research Biologists. John continues to produce papers on bivalve biology and to serve as the Investigation microscopist and photographer, not to mention the valuable insight into ageing problems which he contributes.

The sample preparation and aging work of our staff in the past two months is deserving of specific mention. Alicia Kelly and Nancy Munroe mounted 820 otoliths from several species, impressed 1,771 winter flounder and 818 yellowtail flounder scales, processed 2,237 freezer samples, and (with assistance from Melinda Grace) summarized and recorded data for 6,819 yellowtail age determinations from the second, third, and fourth quarters of 1982. Tracy Williams impressed 1,387 winter flounder, yellowtail, summer flounder and haddock scales, and processed 123 freezer samples. Jane Palmer processed 1,029 freezer samples and impressed 395 haddock and bluefish scales. Jane Palmer, Leslie DeFilippis, and Melinda Grace together mounted 336 alewife otoliths.

Leslie DeFilippis processed 674 freezer samples, impressed 640 yellowtail scales and 214 haddock scales and (with Melinda Grace) also impressed 455 summer flounder and 954 winter flounder scales. Melinda also processed 1,085 freezer samples, sectioned 94 redfish otoliths, and summarized and recorded data for 1,186 redfish age determinations and 613 haddock age determinations. Blanche Jackson sectioned 666 otoliths, processed 1,194 freezer samples, impressed 1,571 scales, mounted 299 otoliths, and summarized and recorded data for 1,212 haddock age determinations and 1,256 yellowtail age determinations. Total fish processed by pool equals 6,342.

A summary of aging work by species is as follows:

Species	Number aged	Reader
Cod	718	Grace, Gifford
Haddock	1,011	Andrade, Jackson
Redfish	259	Andrade, Gifford
Red hake	1,483	Dery
Pollock	422	Andrade, Smith
Yellowtail	3,974	Shepherd, Gifford
American plaice	100	Dery
Winter flounder	2,320	Fields
Summer flounder	100	Fields
Sea herring	848	Dery*
Mackerel	411	Dery
Surf clam	630	Shepherd, Palmer

* With Jean Chenoweth of the Maine Department of Marine Resources.

RESOURCE SURVEYS INVESTIGATION

Investigation personnel devoted considerable time to evaluating and refining survey data auditing procedures developed for the VAX system and to auditing the 1982 winter (herring), spring (groundfish) and summer (scallop) cruises. Investigation staff members also completed computer generated distribution plots for 56 Georges Bank species taken during 1980-1981 surveys. Rose Concha finished documenting the LORNAV program which converts LORAN bearings into latitude-longitude coordinates.

Technical Standardization Unit activities centered on preparations for Summer 1983 shellfish cruises. Chuck Byrne and Andy Thoms participated in summer flounder mesh selectivity studies with other NEFC and State of New York staff. Dennis Hansford participated in EPA sampling cruises (aboard the R/V *Antelope*) in Massachusetts Bay and in diving work for the Northeast Monitoring Program south of Block Island.

SHELLFISH INVESTIGATION

Fred Serchuk continued a variety of assessment-related tasks on cod and scallops with Adam Green and Eileen Klopfer. He also developed sampling designs and protocol for the 1983 USA sea scallop research survey cruise and reviewed a State-Federal Project report on gillnet fishery research in the Great Lakes, an S-K proposal on sea scallops and preliminary results of the 1980 National Recreational Survey for cod landings. Judy Penttila continued work on revisions to the American plaice assessment. Steve Murawski completed an analysis of stock distributions on Georges Bank and prepared a document entitled, "Calculation of U.S. and Canadian access to fish and shellfish stocks on Georges Bank" in support of the U.S. position in the current World Court case with Canada. He also began work on an ICES document for the 1983 Statutory Meeting entitled, "Optimal effort allocation among competing mixed-species fisheries, subject to fishery mortality constraints," with Mike Sissenwine and Jim Kirkley (Center Economist).

LARGE PELAGICS - FISHERIES ECOLOGY INVESTIGATION

Wendy Gabriel joined the Division in June as Chief of this Investigation and began preparation for participation on a panel formed to direct NMFS assessment work for the International Commission for the Conservation of Atlantic Tunas. Judy Gordon initiated work on groundfish survey data summaries that will be used for comparison of multispecies fishery production units or continental shelves.

COASTAL FISHERY RESOURCES INVESTIGATION

The Investigation received \$100 K to conduct research related to identification of US stocks of Atlantic Salmon in non-US fisheries. These funds will be used to: (1) investigate stock identification methods other than external tagging; (2) assist the Maine Sea-Run Salmon Commission in automating their data base; (3) enhance the tagging effort in Maine and elsewhere; (4) establish a data base management structure at NEFC to handle US stock information; and (5) sponsor technical workshops.

John Boreman served as editor-in-charge of a monograph submitted for publication by the American Fisheries Society. Rhett Lewis has been named to a RAD committee to look at survey data automation procedures.

OFFSHORE FISHERY RESOURCES INVESTIGATION

Emory Anderson devoted considerable time to coordinating a mesh selection study for summer flounder conducted by New York State and NEFC personnel off Long Island. Anne Lange continued to develop parameter estimates required for improved yield per recruit assessments for *Loligo* squid. Frank Almeida completed the final compilation and editing of the Division's 1982 Status of the Stocks report with Vaughn Anthony; he also continued morphometric analyses for silver hake and work on an update of the red hake assessment. Gordon Waring continued studies on spiny dogfish.

Susan Shepherd and Bridget O'Brien continued analysis of catch data from the Polish research fishery for mackerel, survey data for mackerel, butterfish and hakes, and other activities in support of ongoing assessment tasks. Susan has also been working with Richard Hennemuth on a paper dealing with survey catch variability for different types of marine animals ranging from plankton to fish to whales.

GULF OF MAINE/GEORGES BANK RESOURCES INVESTIGATION

Jay Burnett, University of Massachusetts graduate student, joined the Investigation for the summer under a temporary appointment. He will be primarily involved with research on witch flounder. Donna White returned for the summer under a student cooperative appointment with the University of Maryland.

Steve Clark contributed to a draft manuscript by the Atlantic States Marine Fisheries Commission's (ASMFC) Northern Shrimp Technical Committee describing the design and performance of a new shrimp research trawl and worked on a variety of assessment related tasks with Karen Foster, who returned in June following an extended maternity leave. Mike Fogarty returned to the Investigation in June following a semester of work towards his doctorate at the University of Rhode Island and initiated work on the 1983 herring assessment. He also coauthored revisions to a chapter in a forthcoming volume on Georges Bank with Mike Sissenwine and Marvin Grosslein and a paper with Vaughn Anthony dealing with environmental impacts on herring recruitment which was presented at the International Herring Symposium, Nanaimo, B.C.

Ralph Mayo and Uvetta Dozier completed a series of assessment-related projects on Gulf of Maine redfish. Ralph also assisted ADP staff members with upgrading Division software packages and data bases. Margaret McBride continued work on the 1983 yellowtail assessment and responded to industry requests for information on growth, distribution and spawning patterns of yellowtail in different stock areas. She also coauthored a paper with Steve Clark on yellowtail flounder stock assessment which was presented at the Northeast Division Meeting of AFS at Mount Snow, Vermont. Bill Overholtz and Donna White continued work on the 1983 haddock assessment; Bill also completed and submitted two manuscripts developed from his dissertation research for peer review.

PUBLICATIONS

- Barnthouse, L.W., J. Boreman, S.W. Christensen, C.P. Goodyear, W. Van Winkle and D.S. Vaughan. 1983. Population biology in the courtroom: the lesson of the Hudson River controversy. Bioscience. (A).
- Boreman, J. 1983. A simulation of striped bass egg and larva development based on temperature. Trans. Am. Fish. Soc. 112(2B): 286-292. (P).
- Grosslein, M.D. and T.R. Azarovitz, eds. 1982 fish distribution. MESA New York Bight Atlas, Monograph 15. New York Sea Grant Institute, Albany, 182 p. (Species synopses in this atlas were authored or coauthored by Anderson, Anthony, Azarovitz, Burns, Byrne, Clark, Dery, Despres-Patanjo, Lange, Mayo, Murawski, Ropes, Serchuk, Silverman, Waring and Wilk.) (P)
- Overholtz, W.J. and A.V. Tyler. Long-term community responses of the demersal fish assemblages of Georges Bank. Ecological Monographs. (S).
- Overholtz, W.J. and A.V. Tyler. The effects of competition and predation on the population dynamics of a demersal fish assemblage on Georges Bank. Trans. Am. Fish Soc. (S).
- Resource Assessment Divison. 1983. Status of the fishery resources of the Northeastern United States for 1982. NOAA Tech. Mem. NMFS-F/NEC-22.
- Ropes, J.A., D.S. Jones, S.A. Murawski, F.M. Serchuk and A. Jearld, Jr. Documentation of annual growth lines in ocean quahogs, *Arctica islandica* Linne. Fishery Bulletin. (S).
- Ropes, J.A., S.A. Murawski and F.M. Serchuk. Size, age, sexual maturity, and sex ratio in ocean quahogs, *Arctica islandica* Linne, from off Long Island, New York. Fishery Bulletin. (S).
- Waring, G.T. Age, growth and mortality of the little skate off the Northeast coast of the United States. Trans. Am. Fish Soc. (S).
- Divison staff also continued preparation of a series of articles highlighting NEFC assessment activities for publication in *Commercial Fisheries News* (Stonington, Maine). Articles appearing in the May-June issue included an account of the joint Rhode Island - NEFC - industry yellowtail survey off southern New England in January, a review of the biology and status of the Mid-Atlantic surf clam resource, and a discussion of ocean quahog growth; June articles featured migrations of spiny dogfish and trends in halibut landings.

REPORTS

- Lange, A.M.T., and K.A. Paine 1983. USA and Canada catch, effort and USA value associated with the disputed portion of Georges Bank. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 83-17.
- Murawski, S.A., and F.M. Serchuk 1983. Assessment of surf clam resources in FCZ waters off southern New England. Nat. Mar. Fish. Serv., Woods Hole Lab. Ref. Doc. No. 83-20.
- Serchuk, F.M. and Robert S. Rak 1983. Status of the Georges Bank, Mid-Atlantic and Gulf of Maine Atlantic Sea Scallop Resources-1983, Summary. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 83-05.
- Serchuk, F.M. and Robert S. Rak 1983. Biological characteristics of offshore Gulf of Maine sea scallop population: size distribution, shell height -meat weight relationship and relative fecundity patterns. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 83-07.

MISCELLANEOUS

Travel, Meetings, and Presentations

May 3--Emory Anderson and Steve Murawski attended the Regional Directors Fishery Management Plan Priorities Committee Meeting in Gloucester, Massachusetts.

May 4--Emory Anderson attended the Middle Atlantic Fishery Management Council (MAFMC) Scientific and Statistical Committee Meeting in Philadelphia, Pennsylvania.

May 5--Steve Clark attended a meeting of the Northern Shrimp Technical Committee in Gloucester, Massachusetts.

May 9--Mike Sissenwine attended a meeting of the Groundfish Oversight Committee in Danvers, Massachusetts.

May 10--Emory Anderson, Dennis Hansford and Bill Michaels met with captains and scientists of Polish F/V's *Admiral Arciszewski* and *Kunatka* in Boston following completion of the mackerel research fishery to collect samples, supplies and equipment.

May 11--Several RAD staff members participated in a review of the 1983 American plaice assessment at Homeport.

May 11--Emory Anderson and Gordon Waring presented talks on assessments, sampling, and sample analysis at the annual meeting of the Foreign Fisheries Observer Program held in Hampton, New Hampshire.

May 12--Emory Anderson, Dick Hennemuth and H.C. Boyar met with captains and scientists of the above two Polish vessels as well as the Polish Fisheries Attache from New York in Woods Hole to discuss results of the 1983 mackerel research fishery.

May 11-12--Mike Sissenwine and Fred Serchuk attended the New England Fishery Management Council (NEFMC) meeting in Fairhaven, Massachusetts. Fred and Mike presented a review of the status of the sea scallop resource at the public hearing on in-season meat-count changes to the Sea Scallop Fishery Management Plan.

May 12--John Boreman and Stu Wilk met with NERO staff members in Narragansett to discuss options for outreach programs to the recreational fishing community. Recommendations from the meeting have been forwarded to the Center and Regional Directors.

May 12--Tom Azarovitz and Bob Pawlowski met with Ocean Assessments Division (NOS) staff in Rockville, Maryland.

May 13--Emory Anderson and Charles Byrne delivered equipment, supplies, and trawl codends to personnel from the State of New York at Orient Point, Long Island, and discussed procedures for conducting the summer flounder mesh selection study.

May 13-15--Steve Clark, Fred Serchuk, Margaret McBride and Gordon Waring participated in the International Commercial Fisheries Show in New Bedford, Massachusetts.

May 16-17--Brad attended meeting in Sandy Hook, New Jersey, to discuss risk analysis and its relationship to Center work.

May 16-18--Several Division staff members attended the Northeast Division meeting of the American Fisheries Society in Mt. Snow, Vermont. Margaret McBride presented a paper (coauthored with Steve Clark) entitled, "The Current Status of the Southern New England Georges Bank yellowtail flounder stocks." John Boreman presented a paper (coauthored with John O'Brien) entitled, "Stock Composition of striped bass landed in the Rhode Island trap net fishery."

May 16-20--Linda Despres-Patanjo attended the NOAA "Introduction to Supervision" course in Boston, Massachusetts.

May 17--Mike Sissenwine attended a review of risk analysis research at Sandy Hook, New Jersey.

May 17--Ira Palmer lectured on fishery science at the Barnstable Middle School.

May 9-19--Vaughn Anthony attended a meeting of the ICES Advisory Committee on Fishery Management in Copenhagen, Denmark.

May 20-27--Vaughn Anthony and Steve Murawski attended the ICES Workshop entitled, "Methods of Fish Stock Assessment," in Copenhagen, Denmark. Vaughn presented his earlier NAFO paper entitled, "The calculation of $F_{0.1}$: a plea for standardization," at that meeting.

May 19--Several Division staff members met in Woods Hole to review Division research priorities.

May 23--John Boreman met with Ed Baum of the Maine Sea Run Salmon Commission in Bangor, Maine, to discuss automation of salmon tagging data.

May 24--John Boreman and Ralph Mayo met with Clem Walton of the Maine Department of Marine Resources and Harry Mears of the Northeast Region's State-Federal Relations Branch to review a proposed PL 89-304 research project on alewives.

May 25--Emory Anderson and Frank Almeida participated in a port sampling trip to Chatham, Massachusetts.

May 25--Steve Clark, Gordon Waring and Mike Fogarty attended a meeting of the NEFMC Herring Oversight Committee in Saugus, Massachusetts.

May 26--Linda Despres-Patanjo and Joan Palmer attended a workshop entitled, "Women in the Workforce-- a Managers Role," at Lesley College in Cambridge, Massachusetts.

June 1-2--Brad Brown attended the Center Board of Directors meeting.

June 3--Tom Azarovitz, Dick Hennemuth and Bob Pawlowski met with New York OCS staff to discuss the February 1984 offshore lease offering.

June 6-7--John Boreman attended a Technical Panel meeting of the Hudson River Foundation.

June 7-16--Emory Anderson attended the ICES North Sea Roundfish Working Group in Copenhagen, Denmark.

June 8--Vaughn Anthony met with Robert Hanks and Richard Langton of the Maine DMR to review and revise DMR herring contract proposals for the collection of samples and catch-effort data.

June 8--Several Division staff members attended the Southern New England Chapter meeting of the American Fisheries Society at the University of Rhode Island, Kingston, Rhode Island. Steve Murawski presented an invited paper entitled, "Assessment and management of surf clam resources in FCZ waters off New England and the Middle Atlantic."

June 9--Rhett Lewis and Charles Ball attended a public hearing on the proposed Bluefish Management Plan in Hyannis, Massachusetts.

June 14--Brad Brown met with President William Palumbo of the Atlantic Offshore Fisherman's Association concerning Association involvement in statistical reporting.

June 9-18--Fred Serchuk and Anne Lange attended the NAFO Scientific Council meeting in Dartmouth, Nova Scotia, Canada.

June 20--Chuck Byrne met with trawl gear specialists at the University of Rhode Island concerning implications of changing survey trawl doors.

June 20-23--John Boreman attended a NOAA sponsored workshop on estuaries held in Newark, Delaware and presented a paper entitled, "Assessment of Estuarine-Dependent Fish Stocks in the Northeast."

June 20-23--Joan Palmer attended the NAFO Scientific Council meeting in Dartmouth, Nova Scotia, Canada.

June 20-23--Vaughn Anthony and Mike Sissenwine attended the International Herring Symposium at Nanaimo, British Columbia. Vaughn presented a paper which he and Mike coauthored, "Effects of the environment on recruitment and production of Gulf of Maine herring." A second paper coauthored by Vaughn and by Mike Sinclair and T.D. Iles of the Canadian Marine Fish Division entitled, "Atlantic herring management - the Gulf of Maine area example," was presented at the same meeting.

June 20-24--Gary Shepherd attended the annual meeting of the American Society of Ichthyologists and Herpetologists in Tallahassee, Florida.

June 21--Brad Brown, Fred Serchuk and other Division staff met with State of Massachusetts biologists, NEFMC staff, and representatives of gillnet, trawl and party boat interests to review gillnet research priorities.

June 21--Don Flescher presented a lecture entitled, "Fish photography and know your New England fishes," at the Cape Cod Museum of Natural History.

June 22--Emory Anderson gave a talk on fisheries to high school students in the Providence College summer program at Woods Hole.

June 22--Fred Serchuk, Emory Anderson, Anne Lange, Mike Sissenwine, Brad Brown and Steve Clark attended a dialogue meeting on squid research sponsored by the Atlantic Offshore Fisherman's Association, the NEFC, and the Massachusetts Division of Marine Fisheries in Buzzards Bay, Massachusetts.

June 21-24--Linda Despres-Patanjo attended the Fish Health Workshop in Leetown, West Virginia.

June 27--John Boreman chaired a meeting with other senior Resource Assessment Division staff in Woods Hole to review recreational research priorities.

June 29--Emory Anderson attended a meeting of the Data Needs Subcommittee of the MAFMC Scientific and Statistical Committee in Washington, D.C.

June 30--Several Division staff members participated in a special meeting of the Woods Hole Laboratory EEO Committee.

In June, Jim Crossen and Andy Thoms met with Walco Electric officials in Providence, Rhode Island, to evaluate submersible pump maintenance techniques.

During May and June, Bill Overholtz met on several occasions with Marine Ecosystems Division personnel to discuss multispecies modeling work.

In May-June, Steve Murawski attended regular meetings of the Mid-Atlantic Fishery Management Council as well as a special meeting to discuss surf clam issues in New England. He also attended the June meeting of the New England Council and a special joint meeting of Council staffs where he reviewed recommendations of the FMP priorities committee.

Visitors

May 3--Brad Brown met with Commerce budget examiners for NMFS to help describe the Center program and with Jack Suomala of the Draper Laboratory to review ongoing hydroacoustics research.

May 25--Brad Brown met with a fishery official from Panama to review work of the Northeast Fisheries Center.

June 3-7--Steve Clark met with Javier Perreiro of the Instituto Espanol de Oceanografia Laboratory, Vigo, Spain, to review assessment methods.

June 9--Steve Clark, Margaret McBride and Judy Penttila met with David Jermaine of Fishery Products, Inc., Danvers, Massachusetts, to review the status of New England flatfish stocks.

June 30--Steve Clark attended a meeting with Richard Langton and David Sampson of the Marine DMR and Harry Mears of the Northeast Regions State-Federal Relations Branch in Gloucester, Massachusetts, proposed shrimp and juvenile fish research projects under PL 88-309.

In June, Bill Overholtz met with Brock Bernstein of the Marine Fish Division, Fisheries and Oceans, Canada (Dartmouth, N.S.) to review multispecies assessment research.

June 27-30--Emory Anderson, Frank Almeida and Bill Overholtz met with Don Waldron of the Marine Fish Division, Fisheries and Oceans, Canada (Dartmouth, N.S.) to review silver hake assessment work and multispecies assessment research.

University Affairs

May 9--Brad Brown met with Conover Bailey of the Woods Hole Oceanographic Institution to discuss areas of cooperative research.

June 20--Brad Brown met with Dr. R. Summerfelt, Head of the Department of Analytical Ecology at Iowa State University concerning research work at the Northeast Fisheries Center.

In May, Gordon Waring had discussions with Marta Nammock, former graduate student at VIMS and Tim Slauson, former graduate student at State University of New York at Stony Brook, regarding their thesis research on spiny dogfish.

In May, Frank Almeida assisted Kim Trostel, student at Brown University, in making a series of VPA runs for use in a sensitivity analysis of a fishery model she is developing.

June 10--Rhett Lewis, Charles Ball, and John Boreman met with Lincoln University Coop Student Representatives to discuss the Coop Program.

June 29--John Boreman, Wendy Gabriel and Mike Sissenwine met with Brenda Norcross (VIMS) to discuss oceanographic features influencing croaker recruitment.

Public Affairs

May 13--John Boreman, Darryl Christensen and Stu Wilk met with representatives of the Mid-Atlantic Party and Charter Boat Association in Philadelphia to discuss use of voluntary log books under the Bluefish Management Plan.

May 18--Bill Overholtz and Ambrose Jearld gave presentations on the status of New England fish stocks, assessments, and aging methods to industry representatives at the Foley Fish Co., New Bedford, Massachusetts. Frank Almeida gave a similar presentation June 15.

During May and June, Emory Anderson had numerous telephone conversations with commercial fishermen regarding the mackerel fishery and Polish research program on mackerel, and with fishermen participating in the summer flounder mesh selection study in New York.

During May and June, Fred Serchuk responded to requests for recreational information on cod and silver hake resources (Al Ristori); for

information on differences between calico and sea scallops (US Coast Guard); for information on scallop resources on the Grand Banks (US State Dept.); for information on cod resources (OECD); and data on sea scallop resource conditions to a commercial fisherman from New Bedford.

June 3--John Boreman met with representatives of environmental interest groups from the Hudson River valley to discuss potential impacts of the proposed Bay of Fundy Tidal Power Project on the American shad stock in the Hudson River.

June 23--Anne Lange, Mike Sissenwine, and Brad Brown met with Philippe Vergne of LMR, Inc. to discuss squid biology, fishery, and assessment.

During May and June, Anne Lange visited various commercial fishing vessels engaged in the recent intensive squid fishery in Nantucket Sound at Falmouth Harbor and discussed their operations.

EEO Activities

May 4--Several Division staff members participated in a program given by Ann Walter of the Cape Cod Women's Credit Union on the advantages of banking at a credit union (sponsored by the Federal Women's Program).

May 10--Steve Clark and Ralph Mayo attended a meeting of the Woods Hole Laboratory EEO Committee.

May 11--Brad Brown attended afternoon meetings of the annual New England Conference of the Association of Affirmative Action Professionals at Brandeis University in Waltham, Massachusetts.

June 7--Several Resource Assessment Division staff attended the workshop instituted by the Woods Hole Federal Womens Program Committee on relationships in the workplace.

June 7--Steve Clark and Ralph Mayo attended a meeting of the Woods Hole Laboratory EEO Committee. Margaret McBride was appointed to the Black Heritage Month Planning Committee for 1984.

June 22--Steve Clark chaired a meeting of the Affirmative Action Review Subcommittee in Woods Hole.

June 22--Several Division staff members participated in a program given by Christine Bania of Mosely, Hallgarten, Estabrook and Weiden, Inc. on the designing of financial plans (sponsored by the Federal Women's Program).

Sea Duty

April 27-May 6--Malcolm Silverman, Don Flescher, John Nicolas, Susan Shepherd, Ralph Mayo and Jay Burnett participated in the Gulf of Maine leg of the *Albatross IV* spring bottom travel survey.

May 6--Steve Clark participated in a sea sampling trip aboard F/V *Rosanne Maria*, Gloucester, Massachusetts.

June 7--Fred Serchuk and Thurston Burns participated in a one-day party boat fishing trip aboard the *Yankee Patriot* out of Gloucester, Massachusetts, to become more fully acquainted with conflicts between party boats and gill netters.

MARINE ECOSYSTEMS DIVISION

submitted by

Dr. Kenneth Sherman, Chief

ICHTHYOPLANKTON INVESTIGATION

We completed ichthyoplankton surveys in three of the four MARMAP subareas in August by piggybacking on shellfish assessment surveys. Coverage was complete in the Middle Atlantic, Southern New England, and Georges Bank subareas but the Gulf of Maine was largely untouched. Heavy salp concentrations throughout much of the survey area caused significant clogging problems and hindered efforts to make preliminary observations of kinds and numbers of fish larvae. Our next survey begins on 12 September when we will again piggyback ichthyoplankton sampling on the autumn trawl survey aboard Albatross IV. Doris Finan and Bob Halpin will participate on the first leg of the trawl survey to conduct plankton sampling operations.

Wally Morse recently completed an update of the spawning stock biomass of sand lance, Ammodytes sp., off northeastern United States, adding 1981 and 1982 estimates to the 1974 through 1980 information. Assuming 10% egg survival, he calculated the biomass at 2.7 and 1.1 million metric tons in 1981 and 1982, respectively. Thus population estimates for this small forage species remain at or near the high levels observed during the late 1970's. Although larval sand lance occur throughout the MARMAP survey area, the center of their population is located off southern New England, followed by the Middle Atlantic, Georges Bank and Gulf of Maine subareas. John Sibunka and Myron Silverman continue to compile MARMAP survey information for their atlas which will include information on more than 60 surveys conducted from 1977 through 1983. Mike Fahay is completing final review of more than 70 manuscripts which will be part of the symposium publication commemorating E. H. Ahlstrom. Pete Berrien is working on spawning biomass estimates for yellowtail flounder and Atlantic mackerel. Tom McKenney is conducting a taxonomic study of searobin larvae, looking for diagnostic characters that will allow us to separate Prionotus evolans from P. carolinus. Technicians are busy supporting the above studies and participating in field work.

LARVAL FISH DYNAMICS INVESTIGATION

Experimental Studies

Cod, haddock, and yellowtail larvae collected on the spring process-oriented cruise, Albatross IV Cruise No. 83-03, have been analyzed for RNA, DNA, and protein content. RNA-DNA ratio values of cod and haddock were lower than observed in 1981, indicating slower growth. Fairly large differences in RNA-DNA ratio values of haddock larvae were observed between stations.

Survival of mackerel larvae reared in the laboratory was improved by switching to an area of higher salinity for collection of zooplankton food. Young of the year mackerel were captured in Narragansett Bay for study by personnel at the Oxford Laboratory.

Population Processes

Greg Lough devoted most of these two months to preparing a final paper for the cod symposium held last June in Arendal, Norway. George Boiz continued work on otolith analysis of larval haddock, cod, and yellowtail collected on the May 1983 cruise. Growth curves have been calculated for cod and haddock larvae from the 1983 season and compared statistically with the 1981 season. Philip LeBlanc completed processing of all MOCNESS 10-m ichthyoplankton (45 samples) from the May 1983 cruise and David Potter entered the data on computer. Dave also is examining all the available vertical distribution data on larval sand lance in our MOCNESS files. Processing of larval haddock and cod guts from the 1981 season was continued by Peter Auditore. All the gut data sheets have been checked by Peter and Roz Cohen, and delivered to ADP for keypunching and entry on the WHOI VAX files. Roz made several computer runs using a modified copepod production model on various zooplankton data sets and wrote a first-draft manuscript of the results.

Phil LeBlanc spent two days showing Dennis Hansford laboratory procedures for enumerating zooplankton samples and identifying the more common zooplankton found in the Gulf of Maine. Peter Auditore spent several days identifying the gut contents of siphonophores collected by Carolyn Griswold.

Hal Merry supervised the transfer of MOCNESS conducting cable off Albatross IV onto storage reels using his newly developed hydraulic powered Pengo Reel stand. The new system permits winding of MOCNESS cable under tension dockside, resulting in a savings of 8-10 hr of ship time during a cruise. Equipment inventory and status continued from the last May 1983 cruise. Hal also repaired the Zeiss Digitizer, several MARMAP meter blocks, and the forklift battery charger.

ECOSYSTEM DYNAMICS INVESTIGATION

Ecosystem Modelling

Ed Cohen and Marv Grosslein completed first drafts of the chapters "Total Ecosystem Production," "Fishery Research and Ecology," "Fishes," "Zooplankton," and "Large Pelagics" for the Georges Bank book. Work was begun on final drafts for the chapters on ecosystem production, fishery research, and zooplankton.

Wendell Hahm completed updating the documentation for the model GEORGE, and finished a series of runs to evaluate the basic control functions and initial parameters. At the end of July, Wendell left to take a position in the Rand Corporation.

Ed Cohen compiled data for a more complete and accurate set of parameters and initial conditions for the ecosystem model GEORGE. Based on the resulting model runs, Ed prepared the paper, "A Simulation Study: The Role of Predation on Pre-recruits in Regulating Year-Class Strength of Fish on Georges Bank" which Ed presented in August at the meeting of the International Society for Ecological Modelling in North Dakota. Ed also worked with David Mountain on an ICES paper dealing with the effects of water residence time on plankton population levels on Georges Bank.

Mike Pennington and Pete Berrien finished a draft of a paper on measuring the precision of the estimates of total egg production derived from the MARMAP plankton surveys. It was found that estimates of spawning

stock size based on the egg surveys were consistent with VPA estimates and that MARMAP plankton surveys provide a practical means for detecting large changes in population levels.

Ray Maurer transferred to the modelling task in August and began assisting Ed and Mary in compiling and analyzing input data for GEORGE, with particular focus on weight at age/length of post-larval fishes.

Roger Theroux continued work on the Georges Bank boundary issue and on the Benthic chapter for the Georges Bank book. Roger, along with Don Mack and Brian Hayden also have made significant progress revising the benthic data base management system. When completely implemented, considerable savings in time and effort will be realized for the routine analysis and management of the benthic data base.

Feeding Ecology

Ray Bowman and Bill Michaels completed and distributed WHL Ref. Docs. 83-16 and 17 entitled "Food of 17 Species of Northwest Atlantic Fish." The paper was submitted for publication in the NOAA Tech. Mem. Series. Ray and Bill also presented the paper at the AFS Northeastern Division meeting in May 1983.

A statistical program for analyzing the feeding ecology data base was completed by Don Mack, and a prototype audit program was written and tested by Brian Hayden. Brian is presently compiling a more complex audit program to detect typical errors found in the data. Approximately 2,000 Atlantic mackerel stomachs were collected this spring by various research vessels and the contents of these stomachs have been analyzed; a preliminary report is in progress by Tom Morris and Ray Bowman. Tom Morris prepared a final draft on comparative mouth morphology of eight flounders for subsequent publication. He also began a summary of all available bluefish stomach content data, entered references onto computer files in a standard format for later listings, and finally, continued to summarize spiny dogfish feeding data for 1981.

Summer employees Jim Myette, Andrea Siecicki, and Ron Mack assisted in summarizing MMS data; analyzed mackerel stomach contents; prepared various data conversions and summaries for a special study involved with the effects of depth on food data; compiled tables listing the foods of various cartilaginous fishes; examined the stomach contents of squid, spiny dogfish, silver hake, and Atlantic cod; and finally, began compiling qualitative or quantitative data for spiny dogfish, silver hake, and Atlantic cod for the years 1981-83. Andrea and Jim left work in August to return to college. Ron Mack will continue work until December.

Bill Michaels completed a slide-lecture to be presented at all pre-survey cruise meetings to familiarize technicians with the purpose and method for stomach sampling. Bill also has nearly completed a first draft of a paper on the food of weakfish. His usual duties such as ordering supplies, updating references for prey identification, auditing data and assisting summer employees took up much of Bill's time.

Ray Bowman became familiar with the ecosystem model GEORGE (inputs and outputs). He also worked on the preparation of final distribution plots of juvenile fishes for a subsequent manuscript. Statistical tests and various types of data analyses were completed by Ray on a paper describing factors which affect stomach content data.

PLANKTON ECOLOGY INVESTIGATION

During early July, Jack Green completed the final draft of the zooplankton chapter for the DWD 106 report. He also worked with Mark Berman and Ken Sherman on a revision of the manuscript on spawning strategies of fishes in the MARMAP survey area which was submitted for publication 15 August. Jack attended a meeting for participants in the 1983-84 Antarctic program 1-2 August, where logistics and cruise sampling schedules were discussed. A shipment of krill sampling gear was sent to San Diego for loading aboard the R/V Melville.

Jerry Prezioso, Joe Kane, and Pat Michalik participated in AL 83-07 to collect zooplankton samples. Jerry has been summarizing zooplankton sampling coverage of the northeast continental shelf since 1971 and continuing his analysis of krill data from the FIBEX program. Joe Kane completed revisions of a manuscript on larval fish feeding from samples taken on Evrika 80-02. He is currently collecting data on effects of preservation on biomass estimates of specific zooplankton species.

On 9 July, Carolyn Griswold met with Dr. Peter Larsen (Bigelow Lab.) to discuss a joint cruise on the Gloria Michelle scheduled for the end of September. From 10-17 July, Carolyn participated in a Johnson/Sea Link cruise along MARMAP transect E. She made a total of seven submersible dives as part of a water column ecology project. She collected 26 siphonophores for stomach analysis. A report on findings is being prepared.

Image Analysis

The automated stage assembly has been integrated with the computer network to complete the hardware of the prototype image analyzer. The pattern A-D dimensions of our modified Bogorov sampling chambers has been stored in the memory of the stage controller so that a sample of 200-250 planktons can be scanned by the system automatically. The Eclipse S-140 computer orders the stage to move a new section of the sample under the microscope/camera assembly. The frame grabber then digitizes and thresholds the image and sends it to a satellite microprocessor for image tailoring and feature extraction. These data are stored on disk files in the Eclipse for group identification by discriminant analysis.

Mark Berman demonstrated this system to Dr. Marsh Youngbluth of Harbor Branch Foundation on 21 July. On 22 July, Dr. Michael Reeve of NSF and Dr. Eric Hartwig of OMR visited to view progress and discuss plans for further development of image analysis techniques.

Biostatistics

All station data 1980-82 were moved from the MIS, quality-controlled, and merged into the MEDB (MARMAP Ecosystem Data Base). Zooplankton, larvae, and volume data sets were moved over to the PDP-11 computer. Tom Plichta did statistical analysis in the Gulf of Maine, Georges Bank, and Scotian Shelf regions for the US-Canada Issue.

System support group continued testing software for moving data from the MIS to the MEDB.

Karen Marti and Bob Kenney did statistical analysis and graphic work for the Zooplankton chapter of the Georges Bank book.

FISHERY OCEANOGRAPHY INVESTIGATION

During July and August the Fishery Oceanography Investigation completed most preparations for its Antarctic cruise (AMERIEZ) this fall. A contract was let to Niel Brown Instrument Systems (NBIS) to integrate the Variosens fluorometer to our NBIS CTD instrument. The integration was completed and bench tested. The system will allow fluorescence (chlorophyll) profiles to be obtained as part of regular CTD operations. David Mountain attended a planning conference in Minneapolis for the AMERIEZ cruise at which objectives, sampling program, and logistics were discussed. The Investigation will be responsible for the physical oceanographic sampling on the R/V Melville, supplying all of the necessary instrumentation. David Mountain and Ronald Schlitz will perform the sampling in cooperation with Bruce Huber of the Lamont Doherty Geological Observatory. In addition, Steve Ramp and Jack Thiel will perform the physical oceanographic sampling on the icebreaker USCGC Westwind, which will operate within the Antarctic ice pack where Melville cannot go. All of the instrumentation and material needed for the cruise was packed and shipped to Melville for her 7 September departure from San Diego.

Steve Ramp is revising the Northeast Channel current measurement manuscript and has obtained subsurface pressure data around the Gulf of Maine from Wendell Brown of University of New Hampshire. The data support an hypothesis given in the original draft of the manuscript that variations in the Northeast Channel flow act as a compensation to set up or set down of the Gulf of Maine by wind forcing. For example, when southwest winds drive an offshore (seaward) Ekman flow in the surface layer of the Gulf, the sea level at the coast is set downward, higher hydrostatic pressure then exists offshore, and this pressure gradient then drives a compensating flow through Northeast Channel into the Gulf. Analysis of the data set is in progress to be included in the revised manuscript.

Ron Schlitz and Jack Thiel have been testing the ATS communication systems for the laboratory and Albatross IV. Interference of unknown origin is hindering good quality data transmission and may be related to the location of the laboratory's antenna on the roof of the main building. The problem is still being investigated.

Catherine Jewell completed a draft manuscript describing the 1981 and 1982 SOOP XBT transects across the Gulf of Maine. Paul Jessen and David Mountain performed volumetric analysis of hydrographic data from various areas for the USA/Canada preparations. Dan Patanjo continued processing of recent MARMAP hydrographic data. Ben Marshall and Ron Schlitz continued processing CTD data from the Warm Core Ring cruises.

APEX PREDATORS INVESTIGATION

In July and August 49 tagged sharks were recaptured. There were 20 blue sharks, 8 shortfin makos, 7 lemon sharks, 6 sandbars, 2 Atlantic sharpnose, and one each of night, blacktip, silky and smooth hammerhead. One blue shark was at liberty for 3 yr, travelling 103 mi (Manasquan, NJ, to south of Montauk, NY). Another blue shark, recaptured at Montauk Charter Boats Tournament '83, had been triple-tagged by the R/V Geronimo one month earlier. A blue shark tagged on the Grand Banks by a commercial fisherman in August 1982 was recaptured in June 1983 SE of Nantucket, MA, (travelling 988 mi). A shortfin mako was at liberty 3 1/4 yr. It was tagged south of Pascagoula, MS, by a Foreign Fisheries Observer and

recaptured north of Havana, Cuba. A sandbar shark was recaptured after 10 3/4 yr at liberty, travelling 93 mi from south of Fire Island, NY, to Block Island, RI. The dusky shark travelled 371 mi from near the Dry Tortugas, FL, to south of Mobile Bay, AL, in 5 1/2 yr. Dr. Samuel Gruber of the University of Miami recaptured 7 lemon sharks he had tagged during an experiment. Five of these sharks had been tagged 1 yr earlier. They were all tagged and recaptured in the same location off Bimini, Bahamas. A smooth hammerhead was at liberty for 2 yr, travelling from Rudee Inlet, NC, to off the coast of Great Machipongo, VA.

The R/V Geronimo, an educational research vessel skippered by Captain Steve Connet has tagged over 1,200 sharks for us this year. Capt. Connet and his crew of students from St. Georges School has the highest tag/recapture record of any cooperating tagger. We appreciate their efforts.

Project personnel attended six shark fishing tournaments during July and August. As in past years, tournaments contributed a significant fraction of data to our age, growth, reproductive, food habit, and catch statistic data bases. Tournaments ranged in location from New Jersey to Massachusetts. Over 200 sharks were examined. Primary species sampled were blue sharks, shortfin makos, scalloped hammerheads, duskys and sandbars.

During August, three great white sharks were harpooned as they fed on a dead whale off Southern New England. We examined and dissected these sharks, all in excess of 2,000 lb, at Mystic, CT, and Montauk, NY. These rare samples were of special value for reproductive studies since they were all mature males. Vertebral sections were taken by Wes Pratt, who hopes to determine the age of white sharks in the near future. This catch was timely, as Jack Casey and Wes Pratt have a paper on white shark distribution in preparation.

Wes Pratt and Gregg Skomal worked together on dissections of shark reproductive systems. Collected tissues were fixed and processed by Gregg to the paraffin block stage for work up this winter. Gregg reorganized the inventory of vertebral samples for impending age work and has started updating our photographic files.

During July and August, John Hoey continued working on the swordfish draft ("Distribution and trends in catch and effort for New England style swordfish effort") incorporating comments from in-house review, review by SEFC, and review by members of his academic committee. That draft was submitted to Ken Sherman and Brad Brown. Their comments were incorporated into the most recent draft, which was completed on 30 August. Work also continued on the shark distribution and abundance paper and on a draft chapter for the Woods Hole Oceanographic Institution's book on Georges Bank. A first draft was also completed tentatively titled "Recurrent groups of apex predators (swordfish, sharks, tuna) in the Western North Atlantic."

During July and August, 103 sharks were examined by Chuck Stillwell for food habits studies at five shark fishing tournaments. Sharks examined included blues (47), makos (26), sandbars (18), scalloped hammerheads (6), tigers (3), whites (2), and a dusky. Over half (53%) had everted their stomachs as they were being brought to the dock. A majority of these were blue sharks.

Shark stomachs with food contained remains of Gadidae (red hake, cod), fluke and flounder, skates, searobins, mackerel, and some squid (Illex sp.). Makos were feeding on bluefish, as were the two small white sharks.

The three large white sharks harpooned in August had everted their stomachs prior to being landed. The three sharks had been feeding on a dead whale when harpooned and were reported by the fishermen to be biting off chunks of blubber estimated to be 20-25 pounds each.

Bob Medved examined 400 sandbar pups at Chincoteague, VA, for length-weight and food habits studies. Food items consisted of blue claw crabs and small fish, primarily juvenile menhaden. Wet and dry weights of the stomach contents were determined for analysis of stomach evacuation rates and daily ration estimates.

Length-weight data from over 500 sharks from 11 tournaments and one field trip were entered onto the computer by Nancy Kohler. Length-Weight data for all years was edited for four species of shark. Fred Lerch prepared distribution maps from tagging and recapture data for 21 species of sharks.

Mike Couturier completed the transfer of the entire shark data base from the URI IBM computer to EPA's PDP 11/70.

PUBLICATIONS

- Grosslein, M. D., and T. R. Azarovitz. 1982. Fish distribution. MESA New York Bight Atlas Monograph 15. New York Sea Grant Institute, Albany, NY, 182 pp. (P)
- Ohman, M. D., B. W. Frost, and E. B. Cohen. 1983. Reverse diel vertical migration: An escape from invertebrate predators. *Science* 220:1404-1407. (P)
- Pratt, H. L., Jr., and J. G. Casey. 1983. Age and growth of the shortfin mako, Isurus oxyrinchus, using four methods. *Can. J. Fish. Aquat. Sci.* 40:000-000. (A)
- Sherman, K., J. R. Green, J. R. Goulet, and L. Ejsymont. 1983. Coherence in zooplankton of a large Northwest Atlantic ecosystem. MARMAP Contribution MED/NEFC 82-68. *Fish. Bull.* (A)
- Sherman, K., R. Lasker, W. Richards, and A. Kendall. 1983. Ichthyoplankton and fish recruitment studies in large marine ecosystems. MARMAP Contribution MED/NEFC 82-75. *Mar. Fish. Rev.* 45(10-12):1-25 (In press).
- Sherman, K., W. Smith, W. Morse, M. Berman, J. Green, and L. Ejsymont. Spawning strategies of fishes in relation to circulation, phytoplankton production, and pulses in zooplankton off the northeastern United States. *Mar. Ecol. Prog. Ser.* (S)
- Theroux, R. B., and R. L. Wigley. 1983. Distribution and abundance of east coast bivalve mollusks based on specimens in the National Marine Fisheries Service Woods Hole Collection. NOAA Tech. Rep. SSRF-768, 172. (P)

REPORTS

- Berrien, P. 1983. Silver hake, Merluccius bilinearis egg census and adult population estimate for 1979 in waters off eastern United States. ICES C.M.1983/G:46.
- Mountain, D. and E. Cohen. 1983. The effect of water residence time on the plankton population levels on Georges Bank. ICES C.M.1983/L:25.
- Sherman, K., R. Lasker, W. Richards, and A. Kendall. 1983. Ichthyoplankton and fish recruitment studies in large marine ecosystems. ICES C.M.1983/L:24.

- Sherman, K., W. Smith, W. Morse, and L. Ejsymont. 1983. Spawning strategies of fishes in relation to circulation, phytoplankton production, and pulses in zooplankton off the northeastern United States. ICES C.M.1983/L:25.
- Silverman, M. J. 1983. Distribution, abundance, and production estimates of yellowtail flounder, Limanda ferruginea, larvae off northeastern United States, 1977-1981. ICES C.M.1983/G:47.
- McKenney, T. W. 1983. Distribution and abundance of Merluccius bilinearis larvae in shelf waters off the northeastern United States, 1977-81. ICES C.M. 1983/G:48.

MISCELLANEOUS

Travel, Meetings, and Presentations

1 July, Ken Sherman travelled to Washington, D.C., for a planning session regarding the upcoming CCAMLR meeting at Australia.

8 July, Ken Sherman attended a meeting at Portland, Maine, to discuss ecosystems research by NMFS and arrange cooperative research with the State of Maine and the University of Maine.

31 July-1 August, Ken Sherman and Alan Ryan attended meetings at Washington, D.C., in preparation for the upcoming CCAMLR meetings in Australia.

5 August, Ken Sherman and Alan Ryan attended meetings at Washington, D.C., to prepare for the CCAMLR Australian trip.

8-11 August, Ed Cohen attended the International Society for Ecological Modelling (ISEM) meeting in Grand Forks, North Dakota, and presented the paper, "A Simulation Study: The Role of Predation on Pre-recruits in Regulating Year-Class Strength of Fish on Georges Bank" and then travelled to Seattle, Washington, to work with modelers at NWAFC.

15-18 August, Geoff Laurence, Mike Fahay, and Wally Smith attended the Ahlstrom Symposium at La Jolla, California. Fahay chaired the session on Gadiform larvae and presented a talk "Ontogeny and Systematics of Gadiformes," by M. P. Fahay and D. Markle.

25 August, Ken Sherman departed for the meetings of the CCAMLR in Hobart, Tasmania, Australia.

Seminars

6-7 July, Pete Berrien, Wally Morse, Ken Sherman and Wally Smith met with personnel from the Resource Assessment Division to discuss and implement closer interdivisional ties in assessing adult spawning biomass for selected coastal species.

21 July, Ken Sherman met with Perry Jeffries (URI), Mike Reeve (NSF), Eric Hartwig (OMR), and Mark Berman regarding the Image Analysis program.

28-29 July, Ken Sherman attended the Board of Directors meeting at Woods Hole.

15 August, Ray Bowman and Bill Michaels attended Steinar Olsen's (Bergen, Norway) lecture on "Long-line Analysis."

25 August, Tom Morris, Bill Michaels, and Ray Bowman attended James Gilbert's (Univ. of Maine) lecture entitled "Seals and Fisheries Interactions."

30 August, Roz Cohen, as chairperson, conducted a Woods Hole Laboratory Seminar Committee meeting.

31 August, Geoff Laurence attended the Board of Directors meeting at Woods Hole.

Visitors

Ray Bowman met with Dr. Matta N. Madyastha (India) and Jean Baptiste de Panafien (France) to describe the feeding studies conducted at the NMFS.

On 9 August, the following participated in a tour of the EPA and NMFS Narragansett laboratories: Mr. Erich Bretthauer (Acting Deputy Director, Office of Research and Development; also Director, Office of Environmental Processes and Effects Research), Dr. James Falco (representing Dr. Elizabeth Anderson, Director, Office of Health and Environmental Assessment), Dr. H. Matthew Bills (Acting Director, Office of Monitoring Systems and Quality Assurance), Dr. Roger Cortsei (Acting Director, Office of Health Research), Dr. William Rosenkranz (representing Mr. Don Ehreth, Acting Director, Office of Environmental Engineering and Technology), Dr. Carl Gerber (Director, Office of Exploratory Research), Mr. Ted Just (Special Assistant to the Acting Assistant Administrator, Office of Research and Development), and Mr. Allan Neuschatz (Deputy Director, Office of Research Program Management).

University Affairs

19 July, Philip LeBlanc and Peter Auditore attended the Warm Core Ring Workshop at the URI Alton Jones campus.

30 July, Brenda Cote, University of Quebec, visited the Woods Hole Laboratory to learn about our larval fish studies.

Personnel

At the end of July, Wendell Hahm left the Woods Hole Laboratory to take a position in the Rand Corporation.

In August, Ray Maurer transferred from the Narragansett Laboratory to the Woods Hole Laboratory (Modelling Task).

8-12 August, Ray Bowman attended a course entitled "Supervision and Group Performance" in Boston, Massachusetts.

EEO Activities

12 July, Roz Cohen participated in a follow-up FWP workshop on Communications in the Workplace.

2 August, Ray Bowman attended the monthly EEO meeting.

22 August, Donna Busch and Jack Green attended the EEO meeting at Milford, CT.

25 August, Jackie Anderson, Donna Busch, Carolyn Griswold and Jenny Meyer attended a Federal Woman's Program in East Providence.

RESOURCE UTILIZATION DIVISION

submitted by

Robert J. Learson, Acting Chief

FISHERIES TECHNOLOGY AND ENGINEERING INVESTIGATION

Product Standards and Specifications

Comments received on a proposed draft of the U.S. Standards for Grades of Fresh or Frozen Fish Steaks are being resolved before submission to the relevant Technical Working Group. Instructions for using the proposed standard have been prepared and are being reviewed by interested persons.

Following an August 9 meeting of the fish block Technical Working Group, three proposed draft U.S. Standards for Grades were revised. They are for Frozen Fish Fillet Blocks, Mixed Fillet-Minced Fish Blocks, and Minced Fish Blocks. A proposed protocol for conducting a grading survey of these products has been prepared and sent to interested persons for review and comment.

A proposed draft U.S. Standards for Grades of Frozen Fish Portions and Fish Sticks is being reviewed and commented on.

An initial proposed draft U.S. Standards for Grades of Fresh or Frozen Raw Clams is being prepared.

Instructions for using the proposed fish blocks standards have been prepared for review and comment.

At a meeting of the methods committee of the Technical Working Group on fish blocks, agreement was obtained on a procedure to determine the proportion of minced fish in mixed mince-fillet blocks. One hundred fish blocks were prepared with a known proportion of mince by the laboratory staff. These blocks will be used for a collaborative study as part of the procedure to have the method adopted as an official AOAC method. Perry Lane has been appointed as an Association of Official Analytical Chemists' Associate Referee to test and study analytical methods for percentage minced fish in fish fillet blocks.

Based upon the examination of over three hundred samples of shrimp, a revised Proposed General Standard for Grades of Fresh or Frozen Shrimp was prepared. It has been sent to the Washington Office for publication in the FEDERAL REGISTER as a Notice of Rulemaking. The instructions for using the standard are being revised.

We are reviewing our previously prepared Commercial Item Descriptions for Canned Salmon and Canned Tuna.

Processing and Preservation

Frozen Fish Quality

The frozen fish stability experiment where scrod cod fillets are being stored at -10° , 0° , and $+10^{\circ}$ F following iced storage for 1, 6, and 9 days is continuing. After 2 months, the organoleptic results show that all the samples that were stored at $+10^{\circ}$ F were judged as unacceptable (below borderline). The samples stored at 0° F and -10° F were all acceptable.

Those samples stored at the lower temperature (-10°F) were given a higher sensory rating of almost one point at each examination.

An edibility study of the texture and flavor of the samples used for the sensory evaluation was also made. This study involves rating the edibility characteristics of the fish on a score sheet developed by the U.S. Army Natick Laboratories to classify and compare the traits of a given species of fresh fish. This is the first time the edibility characteristics are being used to profile frozen-stored fish. As more data is generated, the sensory scores will be compared with the edibility scores to determine if there is a relationship.

Along with the sensory and edibility characteristic determinations, the texture and color of the samples are being measured. The texture is being measured on the Instron Texturometer of flakes taken from cooked fish fillets. The color is being measured on the Hunter L Colorimeter of a homogeneous sample of pieces cut from several fish fillets.

Blue Crab

Two packs of canned, sterilized blue crabmeat were prepared using different concentrations of citric acid, salt, and calcium EDTA in order to prevent bluing. Those solutions having the stronger concentrations of these agents diminished bluing to a great extent.

These experiments are being repeated using the revised formulations.

Sorbate Study

A manuscript on the effect of potassium sorbate on whole fish and fillets was completed and sent to the second author at Monsanto in St. Louis, MO, for the addition of further data and revision.

Engineering

A prebid conference on the solar project was held at the laboratory on June 29. Subsequently, the contract was awarded to Sunsav, Inc. of Lawrence, MA. Work should begin in a few weeks.

A meeting was held with Al Blott to arrange for the remaining modifications and improvements to the heating system of the GLORIA MICHELLE. Work will begin in October.

A special project was completed that required gathering all of the available information relating to the Real Property and Space Management Information System (RPSMIS) Data Base included as part of the Gloucester Laboratory facilities and making out Acquisition or Disposal Forms (ADF).

A heat pump installed in Room #10 has been completed and is on line, and several air-conditioners were rebuilt. The ice machine is also being rebuilt.

WFS/URI Cooperative Fisheries Engineering Unit

A new auxiliary generator for the GLORIA MICHELLE should be installed aboard the vessel by the end of August which will supply reliable electrical power for all systems aboard.

Al Blott assisted Woods Hole personnel in troubleshooting the hydraulic system on the survey clam dredge equipment to prepare for an upcoming trip aboard the DELAWARE II.

Monica Hallisey has gathered excellent results with the Lowrance X-15 sounder in the tow tank measurements after receiving a new transducer from the people at Lowrance.

R/V GLORIA MICHELLE cruises during the period were:

Cruise No.	Title	Area
GM 83-14	Lobster Tagging Study	Truxton Swell area of Gulf of Maine R.I. Sound
GM 83-15	Low-Drag Trawl Study and Color Sounder Documentation	
GM 83-16	Diurnal Plankton and Benthic Sampling	Narragansett Bay
GM 83-17	Lost Gill-Net Investigation	Stellwagen Bank and Jeffreys Ledge in Gulf of Maine
GM 83-18	Northern Shrimp Survey and Gear Development	Western Gulf of Maine

FISHERIES CHEMISTRY INVESTIGATION

Product Quality Chemistry

Research Progress

The iced shelf life, based on flavor score, of untreated cod fillets was 13-14 days, whereas 1 day post-mortem fillets irradiated with a gamma ray dose of 200,000 rads had an iced shelf life of about 21 days. Fillets either treated with potassium sorbate alone or treated with sorbate and then irradiated had a shelf life of 26-27 days. With fillets taken from 8 day post-mortem iced fish, the shelf life from time of capture was 15 days for irradiated samples and 19 days for either the sorbate-treated or sorbate-irradiated samples. Thus, the sorbate treatment provided a shelf life extension as good or better than the irradiation treatment, and irradiation of sorbated fillets did not seem to exert a synergistic effect on shelf life extension. The initial quality of the fish at the time of treatment had a strong bearing on shelf life. The overall shelf life of the 8 day post-mortem fish was about one week less than that of the 1 day post-mortem fish. The lowest concentrations of dimethylamine, trimethylamine, or hypoxanthine during storage were present in the sorbate-irradiated samples. The lowest bacterial numbers (aerobic plate count) during storage also were found in the sorbate-irradiated samples; yet, the taste panel rated these samples comparable in flavor to the sorbate-treated fillets which had a higher content of these compounds which are considered indices of spoilage. It is possible that the irradiation treatment imparted a slight off-flavor to the sorbate-irradiated samples which caused a downgrading of the flavor score.

We have finally been able to derive some hybridoma cell lines which seem interesting. Two cell lines have been designated "anti-fish" since they produce monoclonal antibodies which react with all fish species tested but not with lobster, beef, pork, lamb, or chicken. Two other cell lines

react with some but not all fish tested. The cross reaction pattern differs for these two cell lines indicating these monoclonal antibodies are different. Aliquots of each cell line are being stored in liquid nitrogen to preserve them. The cultures are being expanded to generate additional antibodies for further testing. The reactivity of the four cell lines is shown as follows:

Species	Cell Line *			
	4A-B2	4B-G2	4D-B1	4B-G11
Beef	-	-	-	-
Pork	-	-	-	-
Lamb	-	-	-	-
Chicken	-	-	-	-
Cod	+	+	+	+
Haddock	+	+	-	-
Atlantic halibut	+	+	+	-
Pacific halibut	+	+	-	-
Monkfish	+	+	-	+
Pollock	+	+	+	+
Cusk	+	+	-	+
Red snapper	+	+	-	+
Gray sole	+	+	-	-
Pacific cod	+	+	+	+
Chinook salmon	+	+	+	+
Coho salmon	+	+	-	-
Herring	+	+	-	-
Ocean perch (Pacific)	+	+	+	-
Red hake	+	+	-	+
White hake	+	+	-	+
Lobster	-	-	-	-
Chicken	-	-	-	-
Ocean perch (Atlantic)	+	+	+	-
Dab	+	+	+	-
Blackback	+	+	-	-
Molffish	+	+	+	+
Yellowtail	+	+	-	-
Striped bass	+	+	-	-
Black seabass	+	+	-	+
Tilefish	+	+	-	-
Weakfish	+	+	-	-
Greenland turbot	+	+	+	+
Gag grouper	+	+	-	-
Chum salmon	+	+	+	-

* (-) = no reaction; (+) = positive reaction.

As new cell lines are created, they will be tested in a similar fashion with the aim of isolating cell lines which produce species specific monoclonal antibodies.

Lipids

Samples of cod, whiting, and red hake mince were prepared from various portions (e.g. - headed and gutted fish, frames, etc.). These samples are in the process of being analyzed for proximate composition and calcium to determine if the minced product differs substantially from fillets and/or if it complies with USDC regulations. The effects of mincing on vitamin E content may also be investigated.

Canned blue crab samples have arrived. An experiment dealing with the effects of processing on nutritive value of crabmeat will start when reagents finally arrive.

The canned fish samples submitted to the Nutrition Lab for species identification still defy specification. We are adapting a method used at the Torry Research Station in Scotland but are encountering difficulties in the evaporation of the formic acid.

Product Safety Research

Polynuclear Aromatic Hydrocarbon (PAH) Analyses

A composite of the flesh from 11 American eels collected from the Merrimack River was analyzed in duplicate.

A mackerel liver sample was also analyzed. The mackerel had been collected from the Point Pleasant, NJ, area. Two in-house standard reference materials were analyzed for PAH's.

Hydrocarbon Analyses of Sediments Collected from Penobscot Bay

Forty-six sediment extracts were further cleaned up by liquid chromatography utilizing silica gel. The gas chromatographic hydrocarbon analysis of these samples has begun.

Evaluation of EPA's Tetrabutylammonium Sulfite Reagent for the Removal of Sulfur in Sediment Samples

Experimentation is proceeding to determine if further removal of interfering sulfur compounds is possible using this reagent.

Polychlorinated Biphenyl (PCB) Analyses of the Gonads of Mackerels Collected from Point Pleasant, NJ, Area

During the month of July, PCB analysis of the gonads of 47 mackerel samples was completed utilizing the new AOAC method. The mackerel heads were delivered to Woods Hole to determine the age of the fish via otolith examination.

PCB Analysis of Sediments Collected from Penobscot Bay and Casco Bay, ME

Fifty-three samples collected from Penobscot Bay and seven samples from Casco Bay were analyzed by the official EPA method for sediments. A report on the total PCB findings was submitted to Dr. Larsen of Bigelow Laboratories.

PCB Analysis of American Eel Collected from the Merrimack River

A composite of the edible portion was analyzed in triplicate. PCB results were slightly above the action level of 5 ppm.

N-nitrosamines in Fish Frankfurters

An on-site visit to the ABC Research Corporation, Gainesville, FL, was made by Donald F. Gadbois to collaborate with their representatives in a review of selected protocols and analytical procedures they are using in the conduct of some of their N-nitrosamine analysis identified in their proposal. He also collaborated with ABC research scientists in the analysis of some experimental hot dogs that were scheduled to be tested after six weeks of storage.

He has provided a final report to James Brooker, Washington, DC, regarding the site visit.

PUBLICATIONS

- A. Blott et al. ICES PAPER-"Development of a New Research Trawl for Northern Shrimp (Pandalus borealis) in the Western Gulf of Maine." Kaylor, J.D. and R.J. Learson. 1983. Krill and Its Utilization: A review.
NOAA Technical Report NMFS SSRF-769, p 1-10, July 1983.
Licciardello, J.J., R.C. Lundstrom, L.D. Racicot, E.M. Ravesi, and K.A. Wilhelm. Continued Investigations into the Stabilization of the Texture of Frozen Red Hake (Urophycis chuss). Final Report to the New England Fisheries Development Foundation on a Cooperative study with the University of Massachusetts. June 1983.
Lundstrom, R.C. 1983. Identification of Pacific Rockfish (Sebastes) Species by Isoelectric Focusing. J. Assn. Off. Anal. Chem., Vol. 66(4), p 974-980.

MISCELLANEOUS

Travel, Meetings, and Presentations

Dan Baker and Bob Van Twuyver traveled to Rockland, ME, to visit the Stinson Canning Company and discuss means of recovering waste energy for conversion to plant heating.

Bob Learson and Burt Tinker traveled to Brewer, Prospect Harbor, and Bath, ME, to visit sardine plants.

John Ryan visited five shrimp processing plants in the Tampa, FL, area to discuss the proposed U.S. Grade Standard for Fresh or Frozen Shrimp. He received many helpful comments which were used in the revision of the standard.

Don Gadbois traveled to Gainesville, FL, in regards to an official request from James Brooker's office in Washington, DC, for an on-site visit to the ABC Research Laboratories. He also traveled to Washington, DC, to report to some of the staff of the Office of Utilization Research the results of his visit to the ABC Labs.

Perry Lane participated in the final meeting of the New Bedford Quality Improvement Advisory Committee. A summary of accomplishments was made and future related areas of work outlined.

Perry Lane participated in a planning meeting for the Boston Seafood Festival at the New England Aquarium.

John Ryan and Perry Lane participated in meetings of the Gloucester Laboratory's Equal Employment Committee.

Bob Learson, Ron Lundstrom, and Linda Racicot attended the 28th Atlantic Fisheries Technological Conference held at the Chateau Frontenac in Quebec City, Canada. Ron attended the Executive Committee meeting and also presented a paper entitled "Production of Highly Specific Monoclonal Antibodies to Fish Proteins." Linda presented the following two papers:

1. "Effect of Oxidizing Agents on TMAO-ase Activity in Red Hake"
2. "Effect of Proteases on Textural Properties of Red Hake"

Ron Lundstrom was an invited speaker at the Annual Meeting of the AOAC Northeast Regional Section held at Bennington College. Ron presented a talk on "Seafood Identification Using Isoelectric Focusing and Monoclonal Antibodies."

Ron Lundstrom attended the Factor IV Committee Meeting held at the Milford Laboratory, July 22.

Visitors

Michael Jahncke, a graduate student at Cornell University, spent two weeks at the Gloucester Laboratory to prepare samples for storage studies as part of his doctoral study.

Dr. Torger Borresen of the Institute of Fisheries Technological Research, Tromslo, Norway, visited the laboratory and gave a seminar on minced fish technology.

Mr. A.M. Herzberg of the Fishery Technology Unit, Haifa, Israel, visited the laboratory and discussed current research with various staff members.

Mr. John Sweeney of the Fulton Lobster Company of Newark, NJ, information on the mechanical evisceration of whole squid tubes.

Public Affairs

Technical assistance was provided to the following:

Carter Newell from Eastern Research Laboratories visited the Nutrition Lab and left samples of blue mussels for species identification.

Good Housekeeping Magazine - information on fat content in selected species of fish.

Quality Control at Gorton's - information for nutritional labeling.

NMFS Enforcement, Seattle, needed assistance with species identification.

Sent library material to Mass. Division of Marine Fisheries.

Judith Krzynowek reviewed a manuscript from lipids.

Joe Licciardello reviewed a manuscript for the Journal of Food Science.

Ron Lundstrom reviewed two manuscripts - one for the Journal of Food Science, the other for the Journal of the AOAC.

Technical assistance was provided to Cornell Ladner (Mississippi Bureau of Marine Research) on antioxidants for seafoods and to John McGeough (Prelude Foods International, Newport, RI, on frozen storage of

red hake.

Technical information was given out on mincing fish, products that can be prepared from minced fish, and quality of frozen fish to the consumers.

Provided information on utilization of fish waste to Angela Russek, Maine Department of Agriculture, Food and Rural Resources.

Reviewed laboratory listings in the Marine Resources Guide for MIT-Sea Grant.

Provided information on parasites to Mr. Turner of Turner Fisheries, Boston, MA.

Furnished background information on bones to Dr. Bilenker of Great Atlantic and Pacific Tea Company.

Tony Trifilio, Ruggiero Seafoods, Newark, NJ, information on RSW and CSW.

Richard Parsons, Marine Fisheries, South Dartmouth, MA, information on storage of lobsters.

Michael C. White, San Diego, CA, information on sodium chloride and calcium chloride brines for freezing.

Personnel

Betty Tuhkunen has resigned from her position as microbiologist to pursue a master's degree in business administration.

Rebecca Marsden completed her summer appointment working in Ron Lundstrom's lab and has returned to college.

John Kenney has passed his exams for a Coast Guard pilots license to carry up to six passengers for hire.

EEO Activities

Two training seminars were attended by three female employees in accordance with career advancement goals. The seminars were "Women in the Workforce: A Manager's Role" and "Seminar for Executive Secretaries, Senior Secretaries, Administrative Assistants, and Officer Managers."

Certificates were sent out to 25 women, eight white males, and three minorities who completed the first half of a two part, twelve week course in computer programming entitled "Introduction to BASIC Programming" that was given at the Gloucester Laboratory.

Two college students, both female, will complete summer appointments at the Gloucester Laboratory.

On July 6, Barbara Jobe attended a meeting of the NMFS Regional Office EEO Committee.

During the months of July and August, the Gloucester Laboratory EEO Committee has concentrated its efforts on three major objectives. The first objective being the collection of data for a personnel profile of the workforce requested by the NEFC EEO Committee. Secondly, the committee drafted a list of proposed EEO elements and standards for Merit Pay and GWPAS performance plans. The EEO Committee also finalized the draft of a new Charter and By-Laws for the Gloucester Laboratory.

On August 22, Barbara Jobe attended the NEFC EEO Committee meeting held at the Milford Laboratory. The Center meeting was specifically held to finalize a list of EEO elements and standards for supervisors' performance plans to be submitted to the Center Directorate for comment and/or approval.

ENVIRONMENTAL ASSESSMENT DIVISION

submitted by

Dr. John B. Pearce, Chief

BEHAVIOR OF MARINE FISHES AND INVERTEBRATES INVESTIGATION

The Behavior Investigation has completed laboratory experiments on the effects of petroleum hydrocarbons on burrowing behavior of the sandworm, Nereis virens. Earlier tests had shown that when worms were exposed to sediment mixed with Prudhoe Bay crude oil at concentrations of about 5000 and 500 ppm, 60% of the treatment group animals emerged 2 to 4 h after initial burial. By 48 h, all worms at the lower concentration had reburrowed into the substrate while at the higher level emergence continued through 96 h. Even at 5000 ppm, mortality averaged less than 40%. To examine further how weathering of the oiled sediment affects burrowing behavior, tests were conducted with sediment weathered for 24, 48, 120, and 240 h. Analysis of these results indicates that effects on burrowing were reduced with weathering. Manuscript preparation of this study is currently in progress.

Field and laboratory studies of juvenile bluefish feeding ecology and behavior continue. Contents of 617 bluefish stomachs from individuals ranging 53 to 200 mm in length are being identified. The relationship between daily consumption and growth rates of juvenile bluefish under laboratory conditions is also being determined and will be related to field grown rates. On several occasions, fish held in tanks consumed food equivalent to 40% of their body weight and increased body weight by 16% during a 24-h period.

BIOLOGICAL OCEANOGRAPHY OF STRESSED ECOSYSTEMS INVESTIGATION

The help of student assistants made possible an acceleration in the algal assay studies during in this period. Assay was completed on a total of 50 NEMP/OP water quality survey samples. Work was resumed on assay studies of the growth potential of the red tide dinoflagellate Gonyaulax excavata in Lower New York Bay. Two stations were processed which included surface and bottom water samples collected on seven cruises last summer for a total of 28 samples.

A note, "Gonyaulax excavata monitoring in New Jersey" by Paul Olsen and Eric Feerst (New Jersey Department of Environmental Protection) and Myra Cohn and John Mahoney (SHL) was prepared for submission to Coastal Ocean Pollution Assessment News. In addition to working with the G. excavata assays this summer, Ms. Donna Johnson, who attends Hampton Institute in Virginia, reported on "Bryozoa appearance in the Delaware-Raritan Canal" to the Underwater Naturalist.

The Biological Oceanography Investigation is cooperating with the Environmental Chemistry Investigation in the examination of weekly phytoplankton samples collected from the Long Branch, New Jersey, pier. Additional phytoplankton samples are being examined from the New York Bight to assist in monitoring and forecasting summertime low dissolved oxygen episodes in the bottom waters of the Bight. A Prorocentrum micans bloom was identified off Belmar, New Jersey, during 14-16 July 83.

Collection and archiving of GOES cloud cover and NOAA sea surface temperature satellite imagery is continuing. Over 1000 images, received on the Telex machine since June 1983, have been archived. Plans are being made to expand further satellite data collection this fall by enhancing digital tapes at the NASA/Goddard Space Flight Center in Maryland, and at the University of Rhode Island. The latter work is in support of NOAA water column monitoring surveys of the Middle Atlantic Bight and NEFC estuarine plume studies.

Photography of the figures to be included in the Superflux Technical Report is approximately one-half finished. The completion of the photography is set for late this fall.

Jim Thomas attended an Ocean Color Instrument meeting on 8 July at the Brookhaven National Laboratory, Bigelow Laboratory for Ocean Sciences, University of Miami, Scripps Institute of Oceanography, National Science Foundation, Harvard University, and NOAA. The purpose of the meeting was to begin designing a series of pre-launch experiments to establish appropriate algorithms for the proposed OCI to be launched about 1987-88.

Jack Pearce and Jim Thomas participated in a NOAA Quality Assurance Program meeting at Rockville, Maryland, 25-27 July. Jim Thomas was selected to be a working group chairperson for biological rate measurements. The purpose of NOAA's Quality Assurance Program is to assure that NOAA data are of the highest quality -- that it can be intercompared with data sets from other localities, agencies and institutions and that it is credible. The five working groups (nutrients, human pathogens, biological rates, toxic organic chemicals, and toxic trace metals) are to review NOAA's current status and make recommendations for improvements.

COASTAL ECOSYSTEMS INVESTIGATION

Community Structure

Our semiannual NEMP regional monitoring and annual New York Bight survey was completed in July. We also held three meetings with EPA personnel who have been sampling in the Bight; an integrated sampling plan was devised and a joint survey of contaminants, benthic macrofauna and demersal fish of the Bight was begun in August. Processing of samples from the regional and Bight monitoring continued. We are now nearing completion of sample analysis from the summer 1982 Bight cruise and winter 1982 regional sampling.

We have begun a report synthesizing 1980-82 data from the Bight, for comparison with the 1973-74 MESA data. Our 1980-81 data were provided to Dr. Dan Dauer of Old Dominion University for an NOS-sponsored analysis of New York Bight data. We also began working with other NOAA elements and with Dr. Bob Diaz, VIMS, on testing an index of benthic degradation. We provided background material for a congressional hearing on the relative merits of sludge disposal at the 12- vs. 106-mile sites, and attended the hearings. We received and commented on Minerals Management Service's draft plan for offshore gas and oil development. Information on our New York Bight surveys and settling experiments was also sent to Congressman James Howard (D-NJ), Chairman of the House Public Works Committee.

We met with Dr. Angela Cantelmo, Ramapo College, to discuss her NEMP related studies on adenylate charges in soft clams to be carried out in

relatively clean and in contaminated estuarine areas. Work continued on the NEMP Annual Report.

Benthic Energetics

Frank Steimle was chief scientist of the summer NEMP/Ocean Pulse monitoring cruise aboard the R/V Albatross IV occurring 1-15 July 1983. During this cruise, Russ Terranova examined fish and lobster stomachs for most Ocean Pulse monitoring sites to support a feeding selectivity study, and conducted a 24-hr study at a site in the New York Bight apex to support energy and contaminant flow studies there. Benthic grab samples were also collected to support an ongoing study of the effect waste dumping has on the secondary production of benthic invertebrates in the New York Bight apex. Russ and Knee McNulty prepared for and participated in a joint EPA/NMFS cruise on the R/V Antelope in the New York Bight. We also prepared additional collections from the NEFC annual clam survey and the Rutgers University/NOAA cooperative tilefish studies. We also were involved in an alleged illegal dump of sewage sludge in Raritan Bay and assisted the states and others in making special collections and arranging for analysis; no evidence was found to support clearly the allegation.

Work continued on preparing or improving several manuscripts on the results of our various studies. These included papers for publication on: 1) "Biomass and estimated productivity of the benthic macrofauna in the New York Bight: a stressed area," 2) "Energy equivalences of marine organisms in the continental shelf of the Northeastern United States," and 3) "Organic and trace metal body burdens in the ocean quahog, Arctica islandica". A review report was also prepared by Jan Ward on effects of oil and chemically dispersed oil in the marine ecosystem to provide background information for a proposed simulated oil spill exercise on Georges Bank in September.

In addition to the above manuscripts, we reviewed: 1) a Sea Grant proposal for the NJMSC, 2) a draft final report on benthic secondary production studies off Delaware, and 3) an ocean dumping manuscript for the editors of the volume, Management of Wastes in the Ocean. Jan Ward continued compiling and computerizing life history information for ecologically dominant benthic invertebrate species for the Gulf of Maine area. Biomass determination continued for samples at the 60-mile alternate dumpsite.

Seabed Metabolism

Bill Phoel and Pete Kube obtained measurements of seabed oxygen consumption rates from the New York Bight apex cruise AL-83-06. There rates are being plotted and contoured and will be compared with similar data obtained in 1982, 1975, and 1974.

Pete Kube completed two years as a temporary biological technician with the Biological Oceanography Investigation and left to pursue a Masters Degree in Marine Science at the University of Rhode Island.

Jim Duggan, who has previously worked at Sandy Hook, has replaced Pete and is continuing to work on a Technical Memorandum on Seabed Oxygen Consumption off the Northeast US Coast, 1974-1983.

ENVIRONMENTAL CHEMISTRY INVESTIGATION

We continued to monitor bottom dissolved oxygen concentrations in the New York Bight during the EPA-NMFS cooperative benthic survey aboard the R/V Antelope. During this August's survey, we had the opportunity to use a newly constructed sampling device which simultaneously collects water 7 cm above the seabed and 1 m above the seabed. The sampler was designed by A. F. J. Draxler and built by E. Lauer and P. Rosenberg. At most sites, dissolved oxygen was significantly lower in the 7 cm sample than in the 1 m sample. Differences ranged from 0.0 to 1.2 mg/l. The lowest dissolved oxygen concentration (1.4 mg/l) was measured in the "7 cm" sample taken at a station in the Christiaesen Basin, 4 km southwest of the sewage sludge dumping site. The concentration above the seabed was 2.1 mg O₂/l.

Hydrogen sulfide was detected in water collected near the seabed in most areas of the Christiaensen Basin deeper than 27 m. The highest concentration of hydrogen sulfide (1.3 μ m) was measured at a station nearest to the sewage sludge dumping site. Available literature suggests that the low concentration of dissolved oxygen observed, especially in combination with hydrogen sulfide, can adversely affect some demersal species.

We continued the weekly monitoring of dissolved oxygen, the thermocline, chlorophyll and nutrients along a transect perpendicular to the Long Branch pier. This transect cuts across a band of low dissolved oxygen which appears each summer between Sandy Hook and Barnegat, New Jersey. By mid July, dissolved oxygen levels reached <2 mg/l in relatively shallow water (<30 m). Several strong wind events improved conditions in August. However, following a relatively calm period in late August, we saw the reestablishment of the thermocline at the inshore stations on the transect, and again found very low bottom dissolved oxygen concentrations (1.75 mg/l).

C. Murchant evaluated data on underway chlorophyll fluorescence which was recorded using the CAMAC computer aboard the Albatross IV (AL-83-03, AL-83-04). This technique is useful in providing maps of surface phytoplankton pigments. However, comparisons between underway fluorescence and extracted chlorophyll a pointed out the necessity of taking frequent calibration samples (extracted) along the cruise track. The relationship between the CAMAC record of fluorescence and the chlorophyll determined by extraction was good within a particular area of Georges Bank, but highly variable among areas of the Bank.

During the June Ocean Pulse survey (AL-83-05) chlorophyll and nutrients were measured along five cross-isobath transects between Cape Hatteras and Georges Bank. Extensive vertical sampling was done to define more clearly the relationship between nutrients, oxygen, light, the thermocline and the pronounced subsurface chlorophyll maxima which occur at this time of the year. Chlorophyll concentrations in the thermocline are usually 3 - 7 times higher than those in surface water. This subsurface chlorophyll maximum layer may represent a significant source of food for summer herbivores, particularly for the micro-zooplankton.

In the laboratory, Ruth Waldhauer, Al Matte, and Paul Lyons completed ammonium analyses for 490 nutrient samples collected during the AL-83-05 survey and several recent surveys of the Long Branch transect. Preparations were made for the upcoming third NMFS/Brookhaven National Laboratory nutrient intercalibration exercise aboard the Mt. Mitchell in September.

During the July Ocean Pulse survey (AL-83-05), Ralph Bruno collected 756 samples (sediment and fish tissue) for trace metal analyses. Roger Kothe and Vincent Zdanowicz collected 124 sediment samples for metal analyses during the annual New York Bight benthic contaminants survey (AL-83-06). During the NMFS/EPA cooperative survey of the New York Bight (Antelope 83-01), Roger Kothe collected an additional 342 sediment samples for metal analysis. On the Antelope survey, sampling of the Hudson Shelf Valley and the Christiaensen Basin was emphasized.

We continued the monthly collections of scallops from the Asbury Park site. Trace metal analyses (Sandy Hook) and biochemical assays (Milford) of these scallops are being performed and will form a good monitoring baseline for this species.

We completed hookup and programming of our new Perkin-Elmer automated data station. This station automates the calculation of metal concentrations determined on our atomic absorption spectrometer and greatly increases the efficiency of these analyses.

Ruth Waldhauer met with Dr. T. E. Loder at the University of New Hampshire to discuss and observe the progress of the analysis of dissolved organic nitrogen and dissolved organic phosphate in sea water samples. Dr. Loder has a NOAA contract to analyze 4,000 saltwater samples collected by us during 10 monitoring surveys from November 1980 to August 1982.

PHYSIOLOGICAL EFFECTS OF POLLUTANT STRESS INVESTIGATION

Physioecology

Studies of Crepidula fornicata, exposed to 0, 1, 5, and 10 ug/l of mercury ($HgCl_2$) in a diluter system continues. There have been numerous releases by adult C. fornicata, but no larvae survived to metamorphosis, including control larvae.

One experiment stressing oyster embryos with water collected at specific sites from the Central Long Island Sound Dumpsite was completed this reporting period. The results from this experiment are still being enumerated.

An experiment challenging oyster embryos with water collected at specific sites in the Hudson-Raritan Estuary was attempted this period. Water was collected and transported to the laboratory, but attempts to spawn oysters over a 3-day period were unsuccessful.

A major effort was spent in preparing a manuscript to be presented at the 1983 International Council for the Exploration of the Sea.

Other activities included calibrating and starting two diluters for the Physiology and Biochemistry subtasks. Both diluters are exposing lobsters to copper ($CuSO_4 \cdot 5H_2O$) at 0 and 20 ug/l.

The Ocean Assessments Division, Stony Brook Office, NOAA, recently awarded the Northeast Fisheries Center a contract to determine the influence of Hudson-Raritan Estuary water quality on the early development of finfish, molluscs, and crustaceans. This investigation, in cooperation with the Larval Fish Dynamics Investigation of the Narragansett Laboratory, will during the first 6-month phase of the study begin to acquire and establish the proper animal holding systems and water quality test systems at the Milford Laboratory prior to initiation of a feasibility study for doing such work. Fish and shellfish will be collected in the Hudson-Raritan Estuary and brought back to the Milford Laboratory. The fish and shellfish will then be spawned and the embryos and larvae reared in water

also collected from the Hudson-Raritan Estuary. The first phase of the study is designed to determine the feasibility of doing such a project, whereas during the subsequent two years, we will begin to do the actual testing.

Physiology

In the last narrative report we described a set of studies to evaluate sublethal physiological effects of contaminated dredge spoil dumping at the Central Long Island Sound Dumpsite. During this present reporting period, we have analyzed much of the data collected on blue mussels, lobsters and flounder used in this study. The results to date are reported here:

Lobsters (*Homarus americanus*)

There were no differences in heart or gill-bailer rates when lobsters held at a site 400 meters from the dump center were compared to those held in water at a control site 3 miles away. There was a significant difference in "cough" rate, however, with a significantly higher rate (0.7/min vs 0.4/min) at the 400 m E station. The cough is produced by a muscle and carapace-induced contraction with a powerful reversal of the water flow in the gill chamber. We have recently described the mechanics of this action in response to irritants, including pollutants, in an International Council for the Exploration of the Sea report and a manuscript in draft form.

Mussels (*Mytilus edulis*)

Table 1 gives the gill-tissue respiration rates of mussels held for one month at the various test sites. The only effect noted was a significant depression of oxygen consumption in mussels held at the ground-zero site and the 400 m E site when compared to those held at the control site in August.

Table 1. Gill-tissue oxygen consumption rates of blue mussels held at stations around the central Long Island Sound dumpsite. (Values are given as $\mu\text{l O}_2/\text{hr/g.}$)

Date	Ref	400 E	1000 E	Ground zero
March 3 (Predump)	1017	---	---	---
May 25	903	---	916	---
June 8	1224	1107	---	---
July 14	1013	1003	---	972
August 11	1027	869*	---	891*

* Significant depression ($P < .01$) when compared to reference station.

Windowpane Flounder (*Scophthalmus aquosus*) and Winter Flounder (*Pseudopleuronectes americanus*)

The greatest effects of the dump were on the plasma sodium and potassium levels of both flounder species. In June, sodium levels in both species had decreased from normal levels around 200 mEq/l to concentrations around 150. In July, the level in windowpane flounder had increased to a relatively normal 211 mEq/l, while that in winter flounder overshot the normal level to 263. In neither species were these changes accompanied by changes in total plasma osmolality.

Potassium levels tend to vary considerably month to month. However, the potassium level in winter flounder from the dumpsite in July was 12.7 mEq/l; the highest level encountered in the pre-dump samples from any station was 6.5. Levels in windowpane flounder increased at the same time but not as greatly.

The calcium concentrations of plasma from both species at the dumpsite were different from those taken at Station 90, our clean water station, following the dump. However, it appears that similar changes are taking place at both stations with a slightly different time-course. It cannot be assumed that the changes were the result of the dump.

Fish of both species had higher hemoglobin levels at the dumpsite than at Station 90 following the dump. However, in the winter flounder, it appears that those from Station 90 may be abnormally low rather than those from the dumpsite high.

One interesting sidelight of this study has been the comparison of winter flounder at Stations 90 and 9. Winter flounder from Station 9, our polluted station, had generally lower hematocrits, hemoglobins, and plasma calcium concentrations than those from Station 90. This agrees with the exposure work we've done on winter flounder, but it is generally the reverse of the trends in windowpane flounder.

Summary

1. A dumpsite related increase in lobster "cough rate" was detected. This cough response has been developed into a potentially useful monitoring tool.
2. A change in mussel oxygen consumption rate was noted three months after initiation of dumping but not before.
3. A comparison of mussel metabolic data will be made between our data and those of EPA and the University of Connecticut.
4. At least one more mussel test will be conducted in September.
5. Some interesting blood changes are apparent in flounder from the dumpsite. This study will also continue as a replacement for the original three-station Long Island Sound flounder hematology study.

Biochemistry

Research - Laboratory

Tissue analyses are underway for kidney, gonad, and adductor muscle taken from sea scallops, *Placopecten magellanicus*, in this spring's paired exposure study involving copper and cadmium (Cu or Cd, 20 ppb metal, 7 weeks and subsequent periods of clearing). The animals from this exposure series were from the Montauk population, post-study examination of

which produced some evidence of pre-existing stress. Although results from this study cannot be properly compared, therefore, to last winter's analogous exposure using the Block Island scallop population, results thus far tend to corroborate the earlier data.

A 1-month exposure of lobsters, Homarus americanus, to copper (20 ppb as the sulfate) was begun. This study, our first examination of the effects and uptake of copper in this animal, was prompted largely by the results of earlier metal-exposure work with scallops in which copper induced toxic effects in the kidney and reproductive system.

Research - Field

During this reporting period, Biochemistry participated in both the summer OPP/NEMP monitoring cruise, AL 83-05, and the northern leg of Resource Assessment's annual sea scallop survey, A1 83-07.

Analysis of flounder kidneys (177) collected during the OP cruise has already been completed. Scallop (86) tissues (kidney, gonad, adductor muscle) from this cruise await room in the testing schedule.

All biochemical data for last fall's OP monitoring cruise, AL-82-12, have been analyzed and evaluated. Most significant field observation was that scallops from four deepwater (DW) stations in the Gulf of Maine in early December - our first such collection for that month - had the highest glycogen yet seen in these DW animals. Over the past 2 years of gathering data on DW scallops via Resource Assessment and OPP/NEMP personnel, the seasonal pattern for muscle glycogen has remained very low, staying within range 120-360 and showing no late spring buildup as observed in other scallop populations. The only exception was an autumn DW collection in 1980 - our only one for that time of year - that averaged 396, range 328-502, for 4 DW stations. The present data, 1 month later in the year, confirm that observation. This curious rise in muscle glycogen in late autumn, in animals living in an environment of minimal nutrient availability, strongly suggests gamete resorption.

We continue to gather monthly information on the Asbury Park, New Jersey, scallop population for baseline records of seasonal metabolic and biological patterns. Most of the bench work this reporting period was with kidney, gonad, and adductor muscle tissues from these animals. Intensive sampling this year during May and early June (when the major transfer of glycogen reserves is made from muscle to gonad, as observed in the 1981 season) showed far lower glycogen than was observed in 1981 (no samples were obtained during that period in 1982). Jay O'Reilly (Environmental Chemistry, Sandy Hook) reports that the areal hydrography this year differs in some respects from the norm, e.g. the long wet spring increased riverine runoff, with the Hudson plume extending far down the New Jersey coast. O'Reilly's observation prompts the speculation that pollutants associated with the plume may have reached the Asbury Park scallops and affected their feeding activity. Chemical analysis of the tissues (metals in kidney and digestive gland) will help in interpreting our findings.

Chemistry

Several hundred tissue samples of lobsters exposed to cadmium and sea scallops exposed to copper in the laboratory were analyzed for tissue body burdens of these metals. In addition, gonadal samples from windowpane

flounder collected in Long Island Sound in the vicinity of Milford, Connecticut, were analyzed for polychlorinated biphenyls (PCBs).

Anaerobic Bacteriology

A major activity of this reporting period included participation in the July OP/NEMP cruise, AL-83-05 (Leg 1) and the annual New York Bight Benthic Monitoring cruise. Monitoring of the established stations at the Central Long Island Sound Dumpsite also continued, as well as analyses of mussels obtained by the EPA from the site. As a special study, eight sediment samples from two stations in Raritan Bay were analyzed for fecal coliforms and Clostridium perfringens to determine whether dumping of sewage sludge was occurring in that area.

On the OP/NMEP cruise, 24 stations were sampled for sediments in an area extending from Chesapeake Bay to northern Georges Bank, 10 stations for water samples, and 2 stations for scallops for enumeration of Clostridium perfringens and Vibrio spp.

On the New York Bight Benthic Monitoring cruise, sediment samples were obtained from 45 stations for monitoring of fecal coliforms. A comparison of fecal coliform counts with C. perfringens is also being done for comparative purposes. The sediment samples were collected on transects through the sewage dumpsite in the Bight and down the Hudson Shelf Valley to determine distribution patterns of these organisms in this area as well as their persistence in oceanic sediments. From the results of last year's extensive sampling and the confirmatory data from this cruise, the distribution patterns of C. perfringens and fecal coliforms in Bight sediments should be well-defined for this area.

Analysis of sediments from Raritan Bay for fecal coliforms and C. perfringens indicated a high degree of impact by waste materials not unlike that observed in the New York Bight sewage dumpsite.

Mussels are being held in cages at four stations (sites) in the Central Long Island Sound Dumpsite by the EPA as part of their monitoring program to study the effects of disposal of dredged material in offshore waters. The sites include the disposal site, control site, and two sites east of the disposal site (along the current pattern for the area). Our bacteriological analyses of the mussels show an increase in uptake of C. perfringens in those animals held at a site 400 m east of the dumpsite as compared to those held at the control site and 1000 m east of the dumpsite. Previous results on mussels held at the four sites showed no significant difference in the number of bacteria. The reason for the increase in bacteria in mussels at the 400 m E site could be due to the length of time the mussels were held at the site.

PUBLICATIONS

- Gould, E. and R. A. Greig. 1983. Short-term low-salinity response in lead-exposed lobsters, Homarus americanus (Milne Edwards). J. Exp. Mar. Biol. Ecol. 69:283-295. (P)
- Marshall, H. G. In press. Mesoscale distribution patterns for diatoms over the northeastern continental shelf of the United States. 7th Int. Diatom Symp. Vol.
- Marshall, H. G. In press. Phytoplankton of the northeastern continental shelf of the United States in relation to abundance, composition,

cell volume, seasonal and regional assemblages. Rapport et Proces-Verbaux.

Marshall, H. G. and M. S. Cohn. In press. Distribution and composition of phytoplankton in northeastern coastal waters of the United States. Estuar. Coast. Shelf Sci.

Olsen, P., M. Cohn, and J. Mahoney. Gonyaulax excavata monitoring in New Jersey. COPAS. (A)

Nelson, D. A., A. Calabrese, R. A. Greig, P. P. Yevich, and S. Chang. 1983. Long-term silver effects on the marine gastropod Crepidula fornicata. Mar. Ecol. Progr. Ser. 12:155-165. (P)

REPORTS

Bill, R. G. and F. P. Thurberg. 1983. Effects of pollutants on heart and gill bailer activities of the lobster, Homarus americanus. ICES C.M. 1983/E:58. 8 pp.

Gould, E. 1983. Seasonal biochemical patterns for a single population of sea scallops, Placopecten magellanicus, and their use in interpreting field data. ICES C.M.1983/E:57. 17 pp.

Marshall, H. G. 1983. Phytoplankton spatial distribution from Georges Bank across the continental shelf. ICES C.M./E:61.

Matta, J. F. and H. G. Marshall. 1983. A multivariate analysis of phytoplankton populations in the Gulf of Maine. ICES C.M. 1983/E:60.

Nelson, D., J. Miller, J. Pereira, and A. Calabrese. 1983. Monitoring water quality at a dredge spoil dump site using oyster larvae. ICES C.M.1983/E:59. 9 pp.

Thomas, J. P., J. E. O'Reilly, J. B. Pearce, J. B. Mahoney, M. S. Cohn, and H. G. Marshall. 1983. The use of phytoplankton measurements in monitoring environmental trends. ICES C.M./E:63.

MISCELLANEOUS

Travel, Meetings, and Presentations

On Friday, 1 July, Dr. John Pearce, Dr. Carl Sindermann, and Mr. Robert Reid met with Dr. Robert Abel, New Jersey Marine Sciences Consortium (NJMSC), and Mr. Derry Bennett, American Littoral Society (ALS), to develop preliminary plans for the Raritan Bay conference to be held 30 September. The conference will involve four panels and a plenary session. Panels will deal with recreational and commercial finfish, shellfish, industrial uses of Raritan Bay, and regulatory activities that bear on habitat conservation in Raritan Bay.

On Friday, 8 July, Dr. Pearce met with Dr. Don Miller, USEPA, Narragansett Laboratory, to finalize the 106-mile site characterization update (Water Management Unit (WMU)) description. Drafts were reviewed and final illustrative material inserted. The final typed manuscript has been forwarded for printing as a NEMP report.

On Tuesday, 26 July, Dr. Pearce and Dr. Thomas met with members of the NOAA/OAD staff to discuss the continuation of the NEMP and activities that would be finalized in FY 83 and continued in FY 84.

A. Calabrese participated in the NEFC Board of Directors meeting in Woods Hole on 28-29 July.

On 27-28 July, Drs. John Pearce and Jim Thomas participated in the NOAA Quality Workshop held in Rockville, Maryland. Various categories of

contaminants and other chemicals and processes that will be measured in the future by NOAA personnel and through contract were identified and steps developed to ensure that intercalibration between various investigators is accomplished. The first step was making a determination of the present intercalibration activities being used within the various NOAA facilities.

On Tuesday, 2 August, Dr. Pearce, Mr. Frank Steimle, and Mr. Jay O'Reilly met with USEPA personnel and the staff from various state and federal organizations in regard to continued monitoring of low dissolved oxygen (hypoxia) and its effects on living marine resources. It was noted that Center personnel have continued to monitor the development of low DO in the mid Atlantic Bight and to develop and organize data which will be of value in elucidating the mechanisms that might result in low dissolved oxygen. It was noted that hydrogen sulfide has been measured in bottom waters in areas where low DO has been noted. Jay O'Reilly was introduced as Frank's replacement.

On Wednesday, 3 August, Drs. Sukwoo Chang and John Pearce met with Center personnel, NOAA/OAD personnel from Stony Brook, and Dr. G. P. Patil. The meeting was concerned with furthering the risk assessment program being developed within the Center.

On Friday and Saturday, 5-6 August, Dr. Pearce participated in the annual meeting of the Advisory Council for the American Littoral Society. Dr. Pearce was appointed chairman of the ALS nominating committee for the Council and made recommendations as to how to further research activities within NOAA/NMFS in relation to certain ongoing programs within ALS.

On Wednesday, 10 August, Dr. Pearce participated in a meeting of the Board of the Regional Action Plan. The meeting was held in Milford, Connecticut, and was called to finalize the planning document for the Regional Action Plan. Frank attended several meetings with EPA to plan for the Antelope cruise and on 22 August, he accompanied John Mahoney to a seminar on the availability of biological and environmental data from the Nassau County (New York) Department of Health files.

D. Tucker attended a one-week training course on the operation of our new Baker automated blood analyzer at the company headquarters in Allentown, Pennsylvania.

Seminars

On Wednesday, 6 July, Dr. J. Kneeland McNulty gave a presentation at the monthly seminar series organized by the NJMSC at Sandy Hook Laboratory. The seminar was on the use of statistics in benthic ecology.

On 25 July, Frank Steimle and Russ Terranova presented an informal talk on the value and use of energy and controversial flow studies to fishery or habitat managers to a NJMSC CLASS.

On Tuesday, 2 August, Dr. Norman Rubenstein, USEPA, gave a seminar to the Sandy Hook Laboratory and the NJMSC. Dr. Rubenstein discussed results from recent bioassays and biological effects measurements that are being made within EPA in regard to disposal of solid wastes such as dredged material and sewer sludge.

On 10 August, at Sandy Hook Laboratory, Bob Reid described the Northeast Monitoring Program to a group of Resource Management Specialists from Gateway National Park.

Visitors

Frank Steimle and Russ Terranova discussed the use of the bomb calorimeter and provided instructions and references to Dr. Kent Johnson of the University of Iowa, who is developing a study on the energetic responses of freshwater bivalves to a pollution gradient.

Jack Pearce and Bob Reid met with Angela Cantelmo 13 July at Sandy Hook to discuss her Ocean Pulse-funded studies of odenylate charges in soft clams to be carried out in relatively clean and in contaminated estuarine locations.

Bob Reid and Tony Pacheco discussed with the COE plans for a major inventory of fish and benthos in areas of New York Bay which may be dredged from the present 40' to as much as 70'.

University Affairs

Anne Studholme and Bori Olla, currently at the Marine Science Center of Oregon State University, met to discuss ongoing cooperative behavioral research and the development of future contaminant effects studies on selected benthic invertebrates.

The Benthic Energetics task supplied energy equivalency data to scientists from Rutgers University to support a cooperative study on tilefish ecology.

Public Affairs

In July, Bob Reid was interviewed by the Newark Star Ledger concerning plankton blooms in area waters.

In early August, Frank Steimle was interviewed by the Asbury Park Press concerning the dissolved oxygen situation along the New Jersey shore this summer. Comments from an earlier interview by the National Fishermen on the risks of dumping at the 106-mile site were published in the August edition of that magazine.

Chris Staley of EG&G Idaho, Inc., visited Jack Graikoski to talk about research needs in anaerobic bacteriology. He is involved in a study supported by the Department of Energy whose objective is to use anaerobic bacteria for waste degradation and energy production, other than ethyl alcohol and methane.

On 26 August, Mrs. Anne Studholme, Mr. Robert Ballou, and Dr. John Pearce participated in the taping of an educational television program concerned with marine science and habitat conservation. This program will be viewed later in September on New Jersey Channel 68.

Personnel

Dorothy Jeffress Holden received her 15-year service pin this summer.

On Monday, 25 July, Cdr. Carl Berman successfully defended his dissertation for his terminal degree. The presentations were made at the Virginia Institute of Marine Science. Cdr. Berman received his Ph.D. degree on 15 August 1983.

EEO Activities

A. Calabrese participated in the Milford Laboratory's EEO Committee meetings on 1 August and in the Center EEO meeting at Milford on 22 August.

Frank Steimle and Dorothy Jeffress Holden provided volunteer assistance for various fund raising activities to support the Sandy Hook Child Care Center.

AQUACULTURE DIVISION

submitted by

Dr. James E. Hanks, Chief

ASPECTS OF NUTRITIONAL REQUIREMENTS OF MOLLUSKS INVESTIGATION

Algal Growth Experiments

An extensive series of experiments has been undertaken to determine which nutrient or nutrients are responsible for differences in growth and chemical composition of *T. maculata* cultured in standard and reduced nutrient formulations designated E, N/P and X₁. Initial experiments indicate that vitamins (B₁₂ and thimine) in the media probably do not account for differences in growth of *T. maculata*; whereas the combined effects of nitrate and phosphate concentrations in the formulations do account for some or all of the growth reductions observed in this alga. An experiment with a 7x7 factorial design testing 49 combinations of nitrate and phosphate in growth media for *T. maculata* has been initiated. Results will be subjected to analysis of variance.

Oyster Feeding Experiments

We are repeating experiments in which the nutritional values of two chlorophycean flagellates, *Dunaliella euchlora* and *Tetraselmis maculata*, cultured in three enriched seawater media are being determined using juvenile oysters in the experimental rearing chamber system. Current experiments are being conducted to substantiate results obtained previously. One experiment was terminated after only six weeks because a contaminant had entered the rearing chambers. A more efficient filtering design has successfully removed all nutritionally useful particles from the seawater flowing into the chambers as evidenced by an elimination of growth in the unfed control oysters.

In addition to the above experiment, we are also investigating three different daily rations of one food source, *T. maculata*, cultured in the reduced-nutrient X₁ formulation, using small juvenile oysters in the experimental rearing chambers.

Open Tank Culture

Mixed algal species cultured in open 500-liter tanks containing reconstituted seawater growth medium have been remarkably stable and have provided large volumes of high-density algal suspensions for juvenile and adult food sources. We have postulated that the culture stability and paucity of contaminants have resulted from an increase in the salinity of the medium formulation that we have recently modified. Some common contaminants of open cultures, e.g., ciliated protozoans and some fungi, are thought to be inhibited at increased salinities. Tank cultures with the green flagellate *Dunaliella euchlora* predominating have been particularly successful; members of this genus are considered to be extremely euryhaline. Net harvests from tank cultures during the period

covered in this report were 950 liters at an average packed cell volume of .017. These cultures have been utilized primarily by the Aquacultural Genetics Investigation.

Semicontinuous Algal Cultures

Weekly harvest of algal cultures yielded volumes of 1580 liters and 4000 liters at a packed cell volume of .003 ml packed cells/10 ml suspension for larval and juvenile molluscan foods, respectively. Algal food cultures from carboys were provided to the Milford Laboratory Investigations as follows: Spawning and Rearing of Molluscs, 1665 liters; Aquacultural Genetics, 2002 liters; Physioecology, 1430 liters; and Pathobiology, 3 liters.

Of the 32 carboys usually harvested in the semicontinuous culture system, eight are now being used for experimental purposes only. Carboy cultures of experimental algal strains have provided dependable daily harvests for oyster feeding studies currently being conducted by this Investigation. Modifications in air-filtering apparatus for the compressed air/CO₂ mixture entering (and leaving) the carboy are also being tested on these experimental carboys to determine if additional protection against microbial contaminants entering a culture from the air/CO₂ system can be achieved. Thus far, all carboys incorporating the modified filter apparatus have remained axenic.

AQUACULTURAL GENETICS AND MUTAGENICS INVESTIGATION

Oyster Breeding

Oyster spat from the second generation of American oysters *Crassostrea virginica* selected for large and small size are being reared in outdoor raceways. A summary of these bi-direction growth selection experiments has been prepared as an International Council for the Exploration of the Sea paper, as have the results of studies assessing prospects for obtaining successful gynogenesis, and androgenesis and parthenogenesis in the oyster and other shellfish (see below). Work on this latter is now concentrating on minimal exposures to stimulants necessary to produce the desired effects. Higher exposures are not compatible with long-term larval survival and setting. Because some oyster crosses may be predisposed to elevated levels of spontaneous parthenogenesis - as full-sib crosses - gametes and zygotes of inbred lines are presently being used in further experiments on the induction of gynogenesis and parthenogenesis. At the same time, second and third generation full-sib oysters are being produced.

Mutation and the Environment

Mutation (micronuclear) counts in immature erythrocytes have now been completed on all remaining samples of Atlantic mackerel kidney tissue (from about 450 fish). These data on immature erythrocytes are presently being used to explore further any relationships between frequencies and maturation state of the fish.

About 50 winter flounder were sampled in Massachusetts Bay (in cooperation with Massachusetts State Fisheries) to add another site to the survey earlier done on sample sites in the north Atlantic. All such data

accumulated to date were summarized and discussed in an International Council for the Exploration of the Sea paper (see below).

The spermatogonia of surf clams from three field locations are being scored for micronuclei in an adaptation of the micronucleus test to the gametogenic cells of this sedentary group. Chromosome mutation frequencies scored as micronuclei appear to occur at frequencies in clam spermatogonial cells that make feasible their use in field surveys.

Copies of biological, physical oceanographic, and analytical chemical (hydrocarbon and heavy metal) data from the *Annandale* 1977 and *Dolphin* 1978 data have been turned over in table form to S. Chang, NMFS Sandy Hook Laboratory, for statistical study of associations between chemical indicators of environmental pollution and mackerel egg health using combined-year data. Additional copies of these data, and also complete sets of biological data on mackerel egg development in the New York Bight in 1974 are also being sent to J. O'Connor, Marine Ecosystems Analysis Program, Stony Brook Office, for use in contract studies at the Brookhaven National Laboratory comparing various proposed measures of environmental degradation.

SPAWNING AND REARING OF MOLLUSKS INVESTIGATION

An experiment is in progress to evaluate the growth of surf clams, *Spisula solidissima*, in wire mesh cages at different sites in Long Island Sound. Clams are being reared in 2'x2'x10" cages made from .3 inch wire mesh. Cages were partially buried and staked at three depths and in different bottom substrate types. Additionally, cages were established at different planting densities. Significant growth was observed at all sites although clams at shallow depths (6-10') and in loose, fine sand grew most rapidly. Comparable growth was observed at densities up to 100/ft². Throughout the experiment, the cages have remained stable, have had only slight biofouling and have effectively excluded predators. These preliminary results suggest that intensive, subtidal cage culture of surf clams may be a viable method for grow-out. Growth rates are comparable to those recorded in a land-based pumped system. The cost of field grow-out methods with respect to yield seems more favorable than pumped systems. The experiment will continue through October when the seasonal growth period ends.

The major summer grow-out experiment with bay scallops, *Argopecten irradians*, was deployed in June. In this test, 20 mm hatchery-raised bay scallops are being grown in suspended nets in Long Island Sound at densities between 500 and 1500/m² initially, with a planned net change and density reduction in early September. The results from this study will enable us to make some specific recommendations for a commercial protocol for raising bay scallops in lantern nets, and will show us how close we are to producing market-size scallops in a single growing season.

We have also begun a cooperative project with shellfish groups in Connecticut, Massachusetts, and New York that will compare growth of a Milford stock of scallops at 12 locations in these states. This will provide information to a number of potential user groups on the relative growth of scallops in various areas, will give us data we can use to make grow-out projections for various sites and, coupled with some basic data on temperature, currents, salinity and chlorophyll-*a* concentration, may enable us to make a first attempt at quantifying the factors that contribute to bay scallop growth.

Work is also in progress in an experiment testing hard clam, *Mercenaria mercenaria*, survival and growth at various densities and in different depths in bottom cages in Long Island Sound. Early samples indicate a more rapid growth in shallower areas, but a more definitive statement cannot be made until seasonal growth is complete in November.

PUBLICATIONS

- Naevdal, G., A. Longwell, along with other Genetic Working Group members. 1983. Report of the Working Group on Genetics, International Council for the Exploration of the Sea. C.M. 1983/F: 2 Mariculture Cttee., Ref. Anacat Cttee.
- Longwell, A. 1983. Recently reported, currently funded or proposed U.S. studies in aquaculture genetics, or on genetics of natural or stocked populations of some relevance to concepts of stock management. C.M. 1983/F: 11 Mariculture Cttee.
- Longwell, A., S. Dudley, S. Halvonik and S. Stiles. 1983. Results of a bi-directional growth selection experiment in the American oyster presently in its third selected generation. C.M. 1983/F: 9 Mariculture Cttee., Ref. Shellfish Cttee.
- Stiles, S., J. Choromanski and A. Longwell. 1983. Cytological appraisal of prospects for successful gynogenesis, parthenogenesis and androgenesis in the oyster. C.M. 1983/F: 10 Mariculture Cttee., Ref. Shellfish Cttee.
- Longwell, A., D. Perry, J. Hughes and A. Hebert. 1983. Frequencies of micronuclei in mature and immature erythrocytes of fish as an estimate of chromosome mutation rates - results of field surveys on windowpane flounder, winter flounder and Atlantic mackerel. C.M. 1983/F: 55 Marine Environmental Quality Cttee., Ref. Demersal and Pelagic Fish Cttees.

MISCELLANEOUS

Travel, Meetings, and Presentations

August 3-5 Jim Widman and Ed Rhodes assisted shellfish people in Nantucket, Orleans, and Duxbury, Massachusetts, in planting bay scallops as part of a cooperative study.

Visitors

A high school graduate spent most of one day gaining exposure to work experience in the Aquacultural Genetics Program. Fourteen other high-school-age youth from the Summer Youth Employment Program were given a brief description of our research as part of a tour of the laboratory.

Aspects of genetic and population differentiation in oysters were discussed with two researchers from the Stony Brook University Sea Grant Program.

Drs. Albert Eble and David Vaughn, South Jersey Aquaculture, Tuckerton, NJ.

University Affairs

Ed Rhodes provided 35 mm slides of scallop culture procedures to Bob Graham, Virginia Tech., Blacksburg, Virginia. Ed Rhodes provided scallop salinity tolerance data to the University of Connecticut. Ed Rhodes reviewed a mariculture proposal from the State University of New York.

Steve Tettelbach, University of Connecticut, did some cooperative bay scallop tagging as part of a P.H.D. research project. Ed Rhodes presented an overview of laboratory activities to P.G. Rodhouse and Patrick Gaffney of SUNY, Stony Brook, New York, and Ron Goldberg gave them surf clams for genetic analysis.

Young *Mercenaria* sp were provided to Wendy Wiltse, University of Connecticut, for her study of substrate selection.

Public Affairs

Axenic starter cultures were provided upon request to Ms. Pauline Duerr, University of Moncton, New Brunswick, Canada, and Jerry Milmoie, Northport Environmental Research Center, Long Island.

Dr. Ukeles reviewed a manuscript submitted for publication in *Marine Biology-Progress Series* at the request of the editor.

Ed Rhodes hosted a student group from the Fairfield County Cooperative Education Services during a laboratory tour. Ron Goldberg gave a laboratory tour to gifted students in the ACES program, Seymour, Connecticut. Ed Rhodes explained laboratory activities to a student group from Project Oceanography, Groton, Connecticut. Jim Widman, Ron Goldberg, Ed Rhodes, Joyce Bowling, Kathy Chiba, Tonianne French and Jackie Lacroix assisted in the laboratory's Oyster Festival display at Milford's annual event. Carl Harrison selected photos and prepared captions for the Genetics part of a laboratory display at the Milford Oyster Festival.

Personnel

Tracy Cole, summer employee, left to enter college at Southhampton. Elizabeth Grinbergs resigned a one-year technician appointment. Summer employees Tonianne French, Jackie LaCroix, and Joyce Bowling left to return to school.

EEO Activities

S. Stiles attended three EEO meetings held at the laboratory (two laboratory-level and one Center-wide). Ron Goldberg attended the Center EEO meeting at the laboratory.

PATHOBIOLOGY DIVISION

submitted by

Dr. Aaron Rosenfield, Chief

COMPARATIVE INVERTEBRATE PATHOLOGY INVESTIGATION

Samples of oysters held in trays in an MSX epizootic area of Chesapeake Bay are being monitored for mortality and eventual *Minchinia nelsoni* diagnosis. Salinity and temperature observations are also being made. On the 7th of July, the salinity was 8 o/oo, temperature was 23°C, and mortality was 6%. On 21 July, salinity was 8.1 o/oo, temperature was 29°C, and mortality was 3%. On 29 July, salinity was 8.6 o/oo, temperature was 28°C, and mortality was 0. Data from 11 August were: salinity, 9.3 o/oo; temperature, 29°C; and mortality 2%. On 22 August, salinity was 10.2 o/oo, temperature was 27°C, and mortality was 1%. Salinity currently is at a very low level but high levels of mortality in June were indicative of *M. nelsoni* effects. The next two months will be crucial in determining continuing *M. nelsoni* problems in this area. Histological examinations will be made to correlate effects of MSX with mortalities.

In cooperative studies, Fish and Wildlife officials in Wisconsin provided samples of freshwater clams from the Mississippi River. Clams from the sample site were experiencing high levels of mortality. Gram positive bacillary infections were seen in histological sections in about 20% of the samples. Additional studies will attempt to determine the cause of the mortality.

The histology laboratory processed and stained over 1,500 sections of several fish and shellfish tissues for examination by fish and shellfish pathologists.

Tissues of *Carcinus maenas*, experimentally injected with *Paramoeba perniciososa*, and of control crabs, have been examined. As would be expected, time to death of infected crabs varied according to both environmental temperature and amount of inoculum. Disease ran the shortest course in Group I, consisting of crabs injected with a large number of amoebae and held at 80°F or higher. This group began dying of fulminating paramoebiasis in 6 days. Group II, injected with large numbers of amoebae but held at 75°F or lower, began dying 23 days after injection. Group III, injected with a small number of amoebae and held at 75°F or below, did not begin dying until 46 days after injection. (Tissues are not yet available from this group.) Group I crabs showed strong host defense reactions (phagocytosis, encapsulation, and degradation of free amoebae) 3-10 days post injection, but tissues of animals dissected 12-23 days post injection contained only old encapsulations. There was no evidence of recent host reaction. Group II crabs, held at lower temperatures, still showed some recent reaction at 23 days. Encapsulations, etc. found in control crabs dissected to date were mainly associated with distinct pathological conditions such as shell disease, gut necrosis, etc. This suggests that most host defense reactions seen in *Paramoeba*-infected crabs were due to that infection and not to conditions inherent in the environment.

The University of Maryland Seafood Laboratory, Crisfield, Maryland, consulted with Dr. Johnson concerning 80-90% mortalities occurring in two

crab shedding operations on Kent Island. Both operations use recirculating systems that depend on well water with added artificial sea salts. Apparently normal crabs were dying during or directly after molting. Tissues of several of these crabs were examined macroscopically and will be examined in tissue sections. The crabs appeared normal except for "bleeding" externally or into the branchial cavity. This may indicate that more water was being taken into the tissues than normal, thus causing rupture and/or such fast expansion of the body that the crab could not escape the old shell. Salinity in the recirculating tanks was quite low (5-7 o/oo). Because of drought conditions, salinity in the natural environment may be higher than usual, and higher than salinity in the shedding tanks. Crabs are normally kept only two-three days in the tanks of these operations before they molt, and probably would not be completely acclimated to lower salinities in that short period. Tissues of these crabs are not yet available for microscopic examination.

On two occasions, the Maryland Marine Police requested opinions on the molt status of certain confiscated undersized crabs, purported to be "green peelers." Results of macroscopic and microscopic examination showed that all these crabs were intermolt animals. Reports stating these facts have been submitted to the requesting officers.

A paper and accompanying graphics were prepared on viral diseases of marine invertebrates for presentation at the Helgoland Symposium on Diseases of Marine Organisms (September 1983).

FISH PATHOLOGY INVESTIGATION

Manuscript preparation continued to be the dominant activity of Dr. Murchelano and Mr. Ziskowski. Dr. Murchelano completed preparation of a manuscript entitled "A histologic evaluation of gross lesions excised from integumental, respiratory, and visceral tissues of marine fishes." The manuscript was to be presented at the International Helgoland Symposium on Diseases of Marine Organisms in September 1983 and published in the Symposium Proceedings. Since it now is not possible to attend the symposium, the manuscript will be revised for submission to the *Journal of Fish Diseases*. Mr. Ziskowski has completed the collation and analysis of disease prevalence data (with Ms. Despres-Patanjo of the Resource Assessment Division) collected since 1979 on the season bottom fish survey cruises. Although originally the manuscript was to be submitted to the International Council for the Exploration of the Sea (ICES), it recently was decided to modify the manuscript for presentation to the *Marine Pollution Bulletin*. The data presented is part of a five-year time series covering a broad geographic area; therefore, a publication with wider circulation than the ICES reports is desirable.

About two dozen samples have been added to our data base of skeletal anomalies. There are now over 160 samples consisting of data from over 6,000 individual fish. Samples of fish selected from sites having a very high or very low prevalence of skeletal anomalies have been submitted to the Sandy Hook Laboratory for chemical analysis. Data on heavy metals will be correlated with data on skeletal anomalies.

Discussions are underway with biologists at the University of Massachusetts for possible studies of mutagenic compounds which might be present in *Ammodytes*.

Studies conducted by NMFS and FWS personnel on mass mortalities of estuarine species in North Carolina and in the Chesapeake Bay have

identified two distinct strains of infectious pancreatic necrosis virus from five species of fish. One of these strains has proven to be extremely virulent while the other appears to be avirulent. Extensive laboratory investigations are underway characterizing these viruses. Antibody to these viruses has been found in serum of menhaden during the most recent mass mortality. A survey is planned for the spring of 1984 to determine antibody levels present in menhaden before and after the mass mortalities. This may shed some light on the question of when and where infection takes place.

With the cooperation of the staff of the Narragansett Laboratory, a large sample of young-of-the-year Atlantic mackerel was obtained in the vicinity of Newport, Rhode Island. This year class has heretofore been absent from our sampling and was needed to help determine when mackerel become infected with *Haematraetidum*. If this sample proves to be largely uninfected, an effort will be made to obtain another sample of young-of-the-year fish in early fall. We hope these examinations will provide clues to how mackerel first encounter this parasite and whether there is an acute stage of infection during which the host may be compromised.

Haddock collected from Georges Bank and Gulf of Maine areas in 1981 and 1982 have been examined for protozoan parasites in the blood and gastrointestinal tract. Three hundred and five blood smears and 86 gut smears, prepared from the large intestine and the duodenum, were examined. Fish from which blood smears were prepared measured 10-80 cm forklength (FL) and of this group, those from which gut smears were made measured 10-50 cm FL.

Only three (1.0%) specimens had trypanosome infections and nine (2.9%) specimens showed a condition resembling viral erythrocytic necrosis. Intensities were much less than 1%. Hemogregarines resembling *H. aeglefini* were observed in 9.2% (28/305) specimens. It should be noted that in two specimens hemogregarines were observed extracellularly and not adjacent to lysed erythrocytes. The three trypanosome infections occurred as coinfections with hemogregarines, as might be expected with a common vector (leeches). Intracellular bodies resembling piroplasms were observed in 31 (10.2%) of the specimens usually at intensities less than 1%.

Intracytoplasmic inclusions of unknown identity ("blue bodies") which occurred most commonly in haddock erythrocytes may represent parasitic organisms. Seventy-five percent (230/305) of the specimens had blue bodies with intensities ranging from <1% to over 50%. The distribution of blue bodies within the haddock appears to be related to size (age) of the fish. Fish were arbitrarily divided into three groups in increments of 30 cm FL, and the data on erythrocytic blue bodies were arranged in tabular format:

Number (percent) haddock in forklength group having various blue-body intensities in erythrocytes.			
Intensity	<30 cm FL	30-60 cm FL	>60 cm FL
0%	46 (58.9)	21 (15.2)	3 (6.4)
<1%	10 (12.8)	15 (10.9)	5 (10.6)
1-3%	11 (14.1)	33 (23.9)	2 (4.3)
4-10%	8 (10.3)	35 (25.4)	7 (14.9)
10-25%	1 (1.3)	26 (18.8)	13 (27.7)
>25%	2 (2.6)	8 (5.8)	17 (36.2)
Total haddock in size group:	78	138	47

Data have not been examined by location of collection; however, haddock of various sizes collected at the same station fit in to this pattern for the occurrence of blue bodies. The blue bodies have been observed in other species of fishes as well as haddock.

Further examinations of *Hexamita* in blood and gut smears indicate that the flagellate is very abundant in the posterior intestine but is less consistent in its occurrence in the anterior intestine of haddock. In addition, haddock measuring <20 cm FL have much lower infection rates than larger fish: 10-29 haddock <20 cm FL were not infected whereas all but 2 of 57 haddock >20 cm were infected. This may be indicative of a transition in feeding habits by the smaller fish toward the type of food and site of feeding of the larger haddock. Examinations of blood smears from the same fish strongly suggest that *Hexamita* occurring in the blood is a contaminant due to faulty sampling technique. This is evidenced by the frequent occurrence of bacteria and occasionally of other gut protozoa, e.g. *Bodo* and *Monodactyloides* types, along with *Hexamita* on the blood smears.

Ultrastructural observations on the degeneration of the nuclei within erythrocytes of yellowtail flounder have been completed. Necrosis of the nucleus appears to be a stepwise phenomenon in which heterochromatin separates from the euchromatic regions and becomes segregated either in a large spherical protruberance or smaller aggregates along the periphery of the nuclear membrane. Further dissolution of the dense regions results in the migration of heterochromatin-containing bodies into the cytoplasm accompanied by a breakdown in the nuclear membrane. Finally, some of the heterochromatin-containing dense bodies are extruded at the surface of the cell. Although similar modifications in red cell nuclei have occasionally been observed in other marine fish, this condition can readily be found in yellowtail flounder (e.g. 30 out of 65 fish sampled from Georges Bank and the coast of Maine). Presently, there is no good evidence to suggest that the observed nuclear modifications are pollution related, nor, as has been indicated previously, does there appear to be any biological agent (i.e. virus) involved. A literature search is being conducted regarding senescence in fish erythrocytes and their removal from the peripheral blood with the hope of finding more information about the atypical karyorrhexis that has been observed in yellowtail flounder.

MICROBIAL ECOLOGY AND PARASITOLOGY INVESTIGATION

Rock crabs and winter flounder were collected at the "Mudhole" station in the Hudson Shelf Valley on 31 August. Crabs were not examined for "black gill" studies since they were collected for heavy metal studies. Several specimens were dead, however, and both crabs and fish were covered with black muck. Flounder were collected for gill disease studies and evidence of parasite infections of the intestine. Very heavy infections by microsporidan parasites *Glugea stephani* were noted in 2/17 (12%) of flounder and in all specimens the intestine contained almost no food. The microsporidan survey was made as part of a cooperative study with Drs. Ann Call and Peter Takvorian to identify local inshore areas of serious disease in winter flounder populations.

Three years of data on "black gill" disease in rock crabs caught at the inactive Philadelphia-Camden sewage disposal site were analyzed. The study is part of an ongoing effort with FDA and EPA to measure the "recovery" of the site subsequent to the cessation of sludge disposal. Results of three years of study are as follows:

Condition	Cruise		
	Rebound	Dovetail	Seamoss
	May 1981	June 1982	June 1983
No. crabs examined	296	123	62
No. with black gills	4/296 (1.5%)	1/123 (0.8%)	1/62 (1.6%)
No. with black spots	29/296 (10%)	8/123 (6.5%)	8/62 (13%)
No. with polychaetes	6/296 (2%)	6/123 (5.0%)	6/62 (10%)
No. for histology	50	68	50
No. with copepods	25/50 (50%)	33/68 (50%)	28/50 (56%)
Max. no. copepods per 6- μ m section	24	61	28

The incidence of "black gill" during 1981-1983 was less than 2% in contrast to values of up to 10% during the period of sludge disposal. Black "spots" in otherwise clean gills showed an incidence of only 2% (8/411) during dumping in contrast to 13.6% (23/168) after dumping. The increase is associated with a decline in gill blackening, a condition which obscures scattered or localized black foci. A change also was noted in the presence of polychaete worms entwined between the gill lamellae, i.e., worms were not observed during the period December 1975 to August 1980 when sludge was being dumped at the site. In contrast, worms were found on the gills of 18/481 crabs (3.7%) caught during 1981-1983 when the site was inactive. The polychaetes belong to the family Iphitimidae Fauchald, 1970 and may be useful indicators of pollution in future studies. The incidence of copepods on gills as seen in histological sections was approximately the same before and after sludge disposal, and high counts of 25 or more per 6- μ m section were not unusual.

Data on sediment samples used for isolating potentially pathogenic protozoa from the Philadelphia-Camden site also were analyzed for the period 1981-1983. Earlier studies showed that 55% of the stations within a 5-mi radius of the center of the sludge site, and 15% of those outside the site were positive for protozoans. In contrast, during the period 1981-1983, only 4/33 within the site (12.0%) and 10/86 outside the site (12%) were positive. It now appears that the current patterns that carried sludge, sewage bacteria, and protozoans away from the site during sludge dumping are partly responsible for the recovery of the site.

DISEASES OF LARVAL MOLLUSKS INVESTIGATION

The development of a lytic-fluorometric technique for counting phagocytic cells of marine bivalve mollusks has proved to be a useful aid in studies on disease susceptibility in these animals. In the course of refining and analyzing the accuracy of the technique, we have learned a great deal about in vitro handling of hemocytes.

To determine whether phagocytic cells vary in size seasonally or among animals, cell counts were compared by both lytic-fluorometric and electronic cell counting methods supplemented by hemacytometer counts. The first two methods were found to require very clean, undamaged, phagocyte populations free of hemolymph. If these conditions are met, they are more accurate than the hemacytometer method. However, our method of obtaining cells by elution from monolayers in the cold with 0.02 M chloral hydrate

was found to periodically result in cell damage. Hence, an alternate technique was sought. Several density gradient centrifugation techniques were explored. Initial work suggested that centrifugation through Percoll (a coated silica suspension) containing buffered sodium chloride would allow isolation of the desired cell population. This work will continue.

Additional work was done to statistically analyze the use of sucrose with the lytic-fluorometric cell counting method. A concentration of 1.0 M sucrose in the sodium dodecylsulfate cell-lysing fluid significantly increased the sensitivity of the method.

In cooperative microbial isolation and diagnostic work, assistance was provided the Milford Physiological Effects of Pollutants Stress Investigation (PEPS), the Spawning and Rearing of Mollusks Investigation (SRM), two commercial shellfish hatcheries (Bluepoints and F.M. Flowers), the Beardsley Park Zoo, and the State of Connecticut Aquaculture Division.

Two bacterial strains were isolated from internal organs of a dying striped bass taken from experimental stock of the PEPS Investigation after mortalities had decimated the population. Susceptibility tests were performed for 15 antibiotics and reported to the PEPS group. A treatment regimen was established using oxytetracycline for the surviving fish.

During July and August in previous years, juvenile *Spisula* reared by SRM have unexpectedly died from a condition termed floating disease. Fortunately, the problem did not occur this year, but water and sediment samples were plated to monitor the bacterial levels before and after the Milford seawater system was cleaned. Last year afflicted *Spisula* responded to prophylactic doses of chloramphenicol, but bacteria responsible for the disease have eluded isolation. Total counts of *Vibrio* bacteria were at 10^5 in sediment which compared favorably to last year's data. Bimonthly checks of *Spisula* will continue until the fall when the disease historically abates until the following summer.

A follow-up trip to sample the clam hatchery at the Bluepoints Co., West Sayville, Long Island, was made on 30 June. Their microbiologist reported high *Vibrio* levels in Bay water samples at Lot #3, Bergen Point and the hatchery intake. Counts ranged from $1.2-6.5 \times 10^2$ colony forming units (CFU's) and resulted in 12 isolates from the three sample areas (nine *Vibrio*, two *Pseudomonas*, and one *Aeromonas*). Results were reported to the hatchery manager.

Due to high mortalities of *Mercenaria* pediveligers at Bluepoints Co., another field trip was completed on 23 August. Affected larval samples were brought back and aseptically macerated to isolate suspect bacteria. The *Vibrio* count averaged 2×10^8 CFU and the total count 6.4×10^8 CFU. Their microbiologist reported a mold problem earlier in August which was treated by an HCl wash. Mold media revealed no presence of yeasts or molds associated with the moribund clams. A challenge experiment to test the colonies isolated against Milford clam veligers is presently underway.

The F.M. Flowers Co., Bayville, New York, was also visited on 23 August. The Division provided advice on building a depuration system for coliform contaminated eastern oysters (*Crassostrea virginica*). The hatchery plans to depurate oysters in 1985 after growing this year's hatchery-reared seed in polluted waters. The Beardsley Park Zoo asked for assistance to identify the microorganism(s) responsible for causing malaise and loss of hair from sea lions. Water samples were taken of their pool and a swab was taken from one of the sea lions. All samples were plated on TCBS and nutrient agar. No growth occurred on TCBS and only one spreading

colony was found on the 10^{-1} plate. Bacterial analysis is incomplete at this time, but will be reported at a later date.

A live *Spisula* collected at Bayview, Milford, on 28 July was found to have an outgrowth under one adductor muscle. The specimen was sent to Austin Farley at the Oxford Laboratory for analysis. Results have not yet been received.

Last month *Mercenaria* samples with calcium pustules on the inside shell were sent to Oxford for analysis and Fred Kern found no significant difference in the histological appearance between the normal and affected clams. This information was given to John Volk, Connecticut State Aquaculture Division Chief, who has monitored this area closely for clam disease problems followed by mass mortalities each spring.

In other Pathobiology research, the characterization of agglutinins and opsonins in sea scallop hemolymph was continued. It appeared that a number of factors in scallop hemolymph may contribute to agglutination of bacteria. Some of these remain in solution after absorption with bacteria and are either blocked or enhanced by the addition of complex carbohydrates. Further work is required to evaluate these relationships.

Antibiotic sensitivities using Kirby Bauer techniques were completed on the 19 isolates collected from the shell-associated pathogen study. The pathogens were sensitive to chloramphenicol (30 mcg) but not to Penicillin (10 mcg), Clindamycin (2 mcg), Vancomycin (30 mcg), and Cloxacillin (1 mcg).

We completed four oyster larval challenges during this narrative with isolates from our shell-associated pathogen study. None of the organisms tested appeared pathogenic. This completes larval work for this project and the data are being incorporated into a research paper and Master's Thesis for Ms. Tettelbach.

A bacterium isolated from a moribund eel caught near Sandy Hook was found to be pathogenic for eels at intraperitoneal doses of 4×10^5 and 2×10^5 viable cells. The testing of lower doses is pending the capture of additional eels. The bacterium will be biochemically identified.

To analyze an extensive experiment on the timed uptake of bacteria by phagocytic cells of Cu^{++} and Cd^{++} exposed scallops, it was necessary to differentiate internalized bacteria from those simply attached to the outside of the cell. An enzyme-linked immunoassay procedure was developed for this purpose. The many microscopic cell counts needed to complete this work have been slowed by the loss of a technician.

Time was spent isolating *Gonyaulax tamarensis* cysts from Mohegan Island, Maine, for a detoxification experiment planned for 1984.

On 12 August, another trip was made to Palmer Cove, Noank, Connecticut. Water and sediment samples were taken for the analysis of paralytic shellfish poison-producing dinoflagellates and cysts. None were observed at this time.

PUBLICATIONS

- Blogoslawski, W.J. Influence of water quality on shellfish culture. Int. Counc. Explor. Sea C.M. 1983/F:8. (A)
Blogoslawski, W.; Petti, L.M.; Tettelbach, S.T.; North, E.; Nawoichik, B.; Gilson, L. The occurrence of bacterial pathogens of oyster larvae: a Long Island Sound study. (Abstract). J. Shellfish Res. 2:89; 1982. (P)

- Johnson, P.T. A rickettsia of the blue king crab (*Paralithodes platypus*.
 J. Invertebr. Pathol. (S)
- Johnson, P.T. Viral diseases of marine invertebrates. Helgol.
 Meeresunters. (S)
- Newman, M.W.; Christensen, N.O. *Eustrongylides ignotus* (Jagerskiold, 1909)
 in American eels (*Anguilla rostrata*) from Chesapeake Bay. J. Wildl.
 Dis. (S)
- Reid, L.K.; Margulis, L.; Stolz, J.; Obar, R.; Sawyer, T.K. A new strain
 of *Paratetramitus jugosus* from Laguna Figueroa, Baja California,
 Mexico. Biol. Bull. 165:241-264; 1983. (P)
- Robohm, R.A.; Rose, W.E. A novel lytic-fluorometric method to count
 molluscan phagocytes in monolayers or suspensions. (Abstract). Int.
 Soc. Develop. Comp. Immunol., 2nd Int. Congr., p. 64; 1983. (P)

MISCELLANEOUS

Travel, Meetings, and Presentations

Gretchen Roe participated aboard the *Albatross IV* Ocean Pulse cruise from 1-15 July.

On 6 July, the Laboratory was visited by U.S. Congresspersons Dyson and Mikulski of the Merchant Marine and Fisheries Committee of the House of Representatives. The staff provided a briefing on Laboratory activities and ocean and Chesapeake Bay environmental research.

Jay Lewis participated aboard the *Antelope* EPA cruise from 6-12 July.

Martin Newman performed studies on infectious pancreatic necrosis virus at the National Fish Health Research Laboratory in Leetown, West Virginia, on 12-13 July.

Dr. Rosenfield attended the Pacific Marine Fisheries Commission workshop in Portland, Oregon, 13-18 July.

Dr. Rosenfield and Sharon MacLean attended the PMAC meeting in Woods Hole on 26 July.

Mr. Newman performed studies on infectious pancreatic necrosis virus at the National Fish Health Research Laboratory in Leetown on 26-27 July.

Susie Hines attended the Center Awards Committee meeting in Woods Hole on 26-28 July.

On 27 July, Dr. Rosenfield held a Pathobiology staff meeting at the Milford Laboratory.

Dr. Rosenfield, Dr. Murchelano, and Ms. MacLean attended the Board of Directors meeting in Woods Hole on 28-30 July.

Dr. Rosenfield, Dr. Johnson, and Fred Kern attended the Society for Invertebrate Pathology annual meeting at Cornell University in Ithaca, New York, from 7-11 August.

Brad Palkovic participated aboard the *Albatross IV* cruise during 8-19 August.

Dr. Robohm (Milford) attended sessions and presented a paper at the 2nd International Congress of the International Society for Developmental and Comparative Immunology at the University of California, Los Angeles, from 14-19 August.

On 18 August, visiting staff members from the Fish and Wildlife Subcommittee of the U.S. House of Representatives Committee on Merchant Marine and Fisheries were given a briefing on cancers and tumors in fish and shellfish.

On 18 August, Bif Cuthbert visited Dr. Blogoslawski at the Milford Laboratory and discussed the progress of the Mulberry Farm Clam Hatchery, Guilford, Connecticut.

Dr. Blogoslawski visited the Bluepoints Co., West Sayville, and Frank M. Flowers, Bayville, Long Island, on 23 August to discuss depuration and to take bacterial samples of moribund *Mercenaria mercenaria*.

Ms. Roe participated in a five-day research cruise aboard the EPA vessel *Antelope* beginning on 28 August.

Dr. Rosenfield and Ms. MacLean attended the Board of Directors meeting in Woods Hole on 30-31 August.

Visitors

Visitors to the Oxford Laboratory during the reporting period were: Tsutomu Takenchin, Department of Parasitology, Keio University School of Medicine, Tokyo, Japan; Harley Sheffield, National Institutes of Health, NIAID, Bethesda, Maryland; Mr. and Mrs. Lyman Lanver, Hays, Kansas.; members of the American Littoral Society; Tracey Wolfe, University of Puerto Rico; Robert Sellers, Food and Drug Administration, Washington, D.C.; Donald and Marion Denion, NOAA (retired), Rockville, Maryland; H.L. and B.M. Hughes, Naval Research Laboratory, Washington, D.C.; William Finan, U.S. Department of Commerce (Japan), Washington, D.C.; Tim Cole, Center for Environmental & Estuarine Studies, Cambridge, Maryland; Thomas Nerad, American Type Culture Collection, Rockville, Maryland; Rufus and Peter Day, National Cancer Institute, NIH, Bethesda, Maryland.; Dr. Eugene Bass, University of Maryland Eastern Shore campus, Princess Anne, Maryland.; Dr. Angelovic, NMFS, Washington, D.C.; John Bovard, NOAA General Counsel Office, Washington, D.C.; Richard Hennemuth and Carolyn Brown, NMFS, Woods Hole, Massachusetts.; Dale Delaney, Majority Counsel, W. MacKenzie, Minority Counsel, and R. Roots, House of Representatives, Washington, D.C.

University Affairs

Cooperative paralytic shellfish poison work continues with Dr. Julius Kuck and Fairfield University. On 14 July, Milford Pathobiology presented a tour for Dick Harris and a group of high school students from a Fairfield cooperative program.

Phil Platcow of Quinnipiac College, Hamden, Connecticut, completed his term project evaluating ozone as an alternative disinfectant for U.S. drinking water.

On 22 July, Milford Pathobiology conducted a tour for an adult group of summer students from Fairfield University taking Marshland Ecology.

Public Affairs

On 13 July, Bruce Friedman, Ecological Analyst, Indian Point Power Station, Peekskill, New York, solicited advice from Dr. Robohm on means to reduce mortalities of striped bass raised by aquaculture methods at the power station.

Dr. Robohm reviewed a manuscript for the *Fishery Bulletin* and a proposal from the Hudson River Foundation.

Ten specific reprint requests for Milford Pathobiology publications were filled during July and August.

On August 7, the American Littoral Society held its annual picnic at the Oxford Laboratory.

On 18 and 28 August, Milford Pathobiology took water and swab samples at Beardsley Zoo, Bridgeport, Connecticut, upon their request. They were experiencing problems with hair loss and sores on the sea lions. No significant bacterial levels were detected.

Pathobiology at Milford contributed time and artistic ability for the preparation of the City of Milford's 9th Annual Oyster Festival held on 20 August.

Personnel

Effective 10 July, Gretchen Roe was promoted to Biological Laboratory Technician (Fisheries), GS-5.

Kelly Clark (Milford Pathobiology) resigned from her temporary position on 22 July.

Renee Coulombe ended the summer's junior fellowship assignment with Milford Pathobiology to return to Connecticut College as a sophomore.

Jay Lewis, Oceanographer, was converted to career-conditional on 21 August.

On 22 August, Christina Roney, Biological Aid, began a temporary one-year appointment.

EEO Activities

Dr. Carolyn Brown attended the FEW annual meeting in Honolulu, Hawaii, from 10-17 July.

Dr. Brown and William Rose attended the Center EEO Committee meeting at Milford on 22 August.

Dr. Murchelano and Ms. MacLean attended the EEO Committee meeting at Milford on 22 August.

The May-June report, which was received late,
is included below for documentary purposes.

COMPARATIVE INVERTEBRATE PATHOLOGY INVESTIGATION

In cooperation with the Maryland Department of Natural Resources, 683 oysters from 11 river systems and 26 sampling sites in Chesapeake Bay were examined for the presence of the oyster pathogen MSX *Haplosporidium nelsoni*. Infection levels have remained high through the winter months. As predicted from historical data, a June mortality was detected in oysters from the Choptank River system. Approximately 22% of the oysters from this area of heavy infections were dead and/or gaping open.

Salinities have returned to their "normal" levels in the upper Chesapeake Bay, which should reduce the chances of spreading MSX into previously uninfected oyster populations.

The histology unit prepared over 1,100 stained sections of oysters, clams, crabs, mussels, and fishes for microscopic examination by resident pathologists. Sample materials used in making these preparations came from Ocean Pulse, Ichthyoplankton, and Resource Assessment cruises of opportunity in cooperation with the Food and Drug Administration, Environmental Protection Agency, and other Center elements, and from environmental studies conducted in cooperation with university and foundation laboratories.

Studies of the histology of paramoebiasis in crustaceans continued. In June, with cooperation from David Campbell of Johns Hopkins University, a group of *Carcinus maenas* were injected with *Paramoeba* from an infected blue crab captured in Chincoteague Bay. A second group was injected with sterile seawater as a control. The purpose is to determine whether nodules, hemocyte aggregations, and encapsulations seen in earlier *Paramoeba*-injected *Carcinus* are due to host reaction to the amoebae or to laboratory conditions. The experiment is now complete, and tissues have been fixed and embedded for histological examination. Sections are not yet available for examination.

In other cooperative studies on the Alaskan blue king crabs, tissues of 10 barren female crabs collected near the Pribilof Islands by NMFS personnel, Northwest and Alaska Fisheries Center, were examined histologically to determine whether rhizocephalan parasite might be responsible for the lack of sponges (egg masses). The population appeared to be normal, according to previous ecological surveys, and no parasites were present in tissues of the 10 barren individuals examined. Tissues of 26 male and female crabs from another normal population in the vicinity of St. Matthews Island, eastern Bering Sea, were also examined. With exception of one crab with a light infection with microsporidians in the hindgut epithelium, and several crabs with Eccrinales ("gut fungus") in the lument of the hindgut, tissues from all animals appeared normal.

A manuscript, titled "A rickettsia of the blue king crab, *Paralithodes platypus*," was prepared during the period. A paper for *Marine Ecology*, and a Sea Grant proposal were reviewed.

MICROBIAL ECOLOGY AND PARASITOLOGY INVESTIGATION

Monitoring for the incidence of "black gill" in rock crabs, *Cancer* spp., has been discontinued at the New York Bight sewage disposal site. Ten years of data showed that the incidence of the condition did not exceed 10%. However, two collections will be made each year at the "Mudhole"--an area in the Hudson Shelf Valley where water depths range up to approximately 60 m and sediments consist of blackened muds. The incidence of "black gill" has ranged up to 30% in crabs examined at this location. Two 30" tows at depths of 47-60 m were made at the "Mudhole" in July 1983. Among 187 specimens caught, 143 (76%) were less than 6.5 cm in carapace width, 132 males and 11 females; 50 of them ranging from 6.5-12.5 cm were examined for gill color. Black gills were noted in 3/50 (6%), shell and appendage blackening in 16 (32%), and shell ulcers in 9 (18%). Polychaete worms belonging to the family Iphitimidae were present on the gills of two crabs. The "papershell" condition was noted in nine crabs (18%) indicating that some of them had undergone a recent molt. Earlier observations showed that a low incidence of gill blackening occurs during molt and post-molt periods. The "Mudhole" has been substituted for the sewage site since it represents a trough or "sink" where bottom sediments are black silty muds of poor quality.

In dumpsite rehabilitation studies, a second collection of rock crabs was made near the Philadelphia-Camden sewage site which has been inactive for over two years. Gill blackening was noted in only 1/62 crabs (1.5%), shell or appendage blackening in 8/62 (13%), shell ulcers in 5/62 (8%), and polychaetes in 6/62 (9.7%); 61/62 were in the intermolt condition. Collections made at the Philadelphia-Camden site during the past three summers have shown that gill blackening has almost disappeared with the cessation of sludge disposal at the site.

Sediment samples were taken at 63 stations during the same cruise in which rock crabs were collected for observations on black gill. Eleven stations were sampled near Ocean City, Maryland, and the remaining 52 were historical stations that have been studied before, during, and after the cessation of sludge disposal. Potentially pathogenic amoebae belonging to the family Acanthamoebidae were found at only one station within the former sludge site, and at one station to the southeast of the site. Ocean City outfall sediments yielded amoebae from 4/11 stations. Preliminary results indicate that prevailing currents that carried sewage bacteria and amoebae away from the disposal site during sludge disposal are now carrying residual amoebae seaward. The recovery of amoebae from only 2/53 (4%) stations represents the lowest incidence of the organisms to be observed at the site to date.

In our parasitological studies, gills from 30 winter flounder were collected during the cruise to the "Mudhole" to look for epitheliocystis-like lesions in histological sections. The lesions were observed in winter flounder for the first time in a collection from the "Mudhole" last year. The lesions have been reported from a variety of fresh - and saltwater fish and are believed to be caused by organisms in the rickettsia-chlamydia group. The disease was also noted in 30% of the winter flounder caught at Ocean Pulse station #13 (seaward from the Merrimac River) in late 1982. Further disease studies are planned with respect to fish size, geographical location, and yearly seasons.

FISH PATHOLOGY INVESTIGATION

Much time has been spent collating data and preparing photomicrographs for a manuscript on the histopathology of gross lesions excised from fishes sampled on Western and Eastern North Atlantic bottom fish survey cruises. The paper will be submitted for presentation at the International Helgoland Symposium on Diseases of Marine Organisms to be held in Helgoland, Germany, from 11-17 September 1983.

John Ziskowski participated on the Massachusetts spring inshore groundfish survey on 10-11 May. Almost 100 blood smears were taken from juvenile Atlantic cod to determine the prevalence of viral erythrocytic necrosis. Adult cod in the inshore areas north and south of Boston were observed with heavy infections of the large gill copepod parasite, *Lernocera branchialis*, and skeletal anomalies such as scoliosis and dwarfism. Large numbers of plaice were caught and many distortions of the axial skeleton were seen. Disease data collected on these inshore surveys since 1979 were forwarded to Sandy Hook and will be entered into the maturity-pathology data base for analysis along with similar observations from offshore groundfish survey cruise.

We continue to build our data base of mackerel blood parasites and ectoparasites. At present we have collected two years of data on parasites in overwintering offshore populations. We are now gathering data on inshore fish and are making a concerted effort to increase our sample of one-year-old fish and to obtain our first samples from young-of-the-year mackerel.

With the aid of a temporary summer employee we hope to have the data ready for computer entry by fall so that analysis can be completed by the end of calendar year 83.

Work continues with the National Fish Health Research Laboratory, U.S. Fish and Wildlife Service, on characterization of recent isolates of virus from several marine species--hogchoker, silverside, spot, and summer flounder. Dr. McAllister has completed work on antigenic relationships of the southern flounder virus. A paper has been submitted to the *Journal of the European Association of Fish Pathologists*.

Efforts to successfully stain virus in paraffin sections of fish tissue continue. Optimum fixation and reduction of background staining are receiving our greatest attention at present. Enzymatic digestion of collagen prior to use of the enzyme-linked immunological staining methods is currently being evaluated.

Samples of *Ammodytes* from fall and winter Resource Assessment cruises have been processed and are being added to the data base. Selected samples showing high and low prevalences of skeletal anomalies have been submitted to the Sandy Hook Laboratory for heavy metal analysis.

In conjunction with Mr. James Tave and Dr. B.S. Roberson at the Microbiology Department of the University of Maryland, experiments were conducted on the phagocytic cells found in the pronephros of juvenile striped bass. These investigators have developed an assay (chemoluminescent) which allows them to study the kinetics of bacterial uptake by isolated phagocytes in vitro. The purpose of the cooperative study was to provide a morphological analysis of the dissociated cells at various stages during the assay in order that their identity and viability could be assessed. Light microscopic examination of the cell preparations is being conducted prior to examination with electron microscopy. The

observed cells appear to be viable and large numbers of the bacterium, *Aeromonas hydrophila*, were observed within the cytoplasm of monocyte-macrophage type cells.

Several toxicant experiments on striped bass larvae were conducted during this reporting period. Using a multicomponent toxicant developed by Dr. Paul Mehrle (U.S. Fish and Wildlife Service, Columbia, Missouri), eggs and resulting prolarvae were exposed continuously until the time of yolk-sac resorption (seven days) and then sampled for histo- and cytopathological changes. The exposures were performed by Mr. Lenwood Hall from the Applied Physics Laboratory, Johns Hopkins University. Experiments were also conducted on four-week-old larvae that were exposed to 50 ppb Cu⁺⁺ for 24 hours and then placed in clean water for one or seven days. Our previous studies have shown that comparable exposure results in corneal lesions. This study is intended to test the capacity of the corneal epithelium to regenerate.

Fifty blood smears from mackerel captured in summer and fall in Nova Scotia have been examined for *Haematractidium scomberi*; 18 (36.0%) were infected with this parasite. Fourteen (77.8%) of the 18 infected fish had less than 1% of the erythrocytes infected and only four fish (22.2%) had 1-3% of the erythrocytes parasitized. None of these fish had greater than 3% of the blood cells infected. By comparison, data obtained from 1982 mackerel overwintering offshore from New Jersey showed 23.5% (112/477) overall infection rate; 91% of these infected fish had less than 1% of the erythrocytes infected, 8% had 1-3% infected erythrocytes, and one fish (0.9%) had greater than 3% of its erythrocytes parasitized.

Gills from 39 of the 50 Nova Scotia mackerel were examined for gill parasites. *Kuhnia scomberi*, a monogene, was found on 12 (30.8%) of the fish ranging from one to 16 trematodes per fish. As in the overwintering mackerel, the *Kuhnia* infestations principally were light (8 of the 12 (66%) *Kuhnia*-infested fish had one or two trematodes). Nodules of uncertain origin (NUO) were quite common in the gills of these fish as in those of the overwintering mackerel; 32 (82.1%) gill samples had these nodules. Twenty-one (65.6%) of these 32 had less than 20 nodules and 9 (28.1%) had nodules totaling 21-80 per fish.

The samples from Nova Scotia constitute the northernmost samples of mackerel in this study; however, these are not necessarily representatives of Sette's "northern contingent." Only samples from the Gulf of St. Lawrence will be considered members of that group, and as yet, no samples have been obtained from that region. Meanwhile, more detailed analyses of the present data on *H. scomberi*, *K. scomberi*, and NUO distribution and prevalence within the Atlantic mackerel population will continue.

Preliminary examination of the follow-up sampling of overwintering mackerel shows 63.3% (62/98) mackerel infected with *H. scomberi*. This high prevalence to some extent is due to sampling smaller (younger) mackerel which are more likely to be infected than larger (older) fish. Comparison of *H. scomberi* prevalence in overwintering mackerel at two years may reveal shifts of infection within the population according to age of the fish and then may lead to clues regarding the effect of the parasite on the mackerel population.

Forty haddock (14-50 cm FL) collected on the spring groundfish survey have been examined for the presence of *Hexamita* in the blood and/or gut. *Hexamita* was found in 35 of 39 gut smears, but no *Hexamita* was found in 27 corresponding blood smears. Indications are that the occurrence of *Hexamita*

in blood smear preparations is due to sampling contamination rather than to severe infections with organisms entering the vascular system.

DISEASES OF LARVAL MOLLUSKS INVESTIGATION

Five exposure experiments were conducted and analyzed to determine the nutritional requirements for toxin production by a shellfish-pathogenic *Vibrio* sp. The pathogenic microbe grows in a minimal broth medium consisting of glucose, various salts, and asparagine dissolved in distilled water (synthetic medium J). Experiments showed that filtrate from a synthetic medium for *Vibrio cholerae* described by Thind (Ind. J. Med. Res. 49: 189-193; 1961) was more toxic than filtrate from an undefined marine broth, even though the latter supported 10 times more cell growth. Further experiments showed that the pathogen produced toxin in synthetic medium C (i.e., supplemented with hypoxanthine) when either sodium thiosulphate, glutamic acid, or histidine was added. The filtrate was most toxic when sodium thiosulphate was added to synthetic medium C and least toxic when it was supplemented with histidine.

An earlier study suggested that hypoxanthine might inhibit toxin production. Present experiments failed to support this; bacterial cells continued to be pathogenic in the presence of hypoxanthine and/or asparagine.

Prior to testing the effects of copper and cadmium on scallop immunity, several systems were tested for analyzing the uptake and killing of bacteria by hemocytes held in vitro in cell suspensions. Separation of cells from bacteria and cell washing by centrifugation at the end of bacterial exposure periods caused considerable cell damage. This made viable counts of intracellular bacteria unreliable. Consequently, modifications were necessary in a planned study of bacterial processing by scallop hemocytes following long-term trace metal exposure. Since measurements of viable bacteria were not possible, experiments were set up to analyze only bacterial ingestion at timed intervals in hemocytes held in monolayers under cell culture fluid. Cells were taken from animals that had been exposed seven weeks to 0 and 20 ppb Cu^{++} or Cd^{++} (trace metal exposures were done by the Physiological Effects of Pollutant Stress Investigation). Bacterial uptake experiments were performed on cells from scallops at the end of the seven-week exposure period and throughout a five-week clearance period. Microscopic counting in these studies will take considerable time to complete.

In another study related to the development of the in vitro methods for analysis of phagocytosis in mollusks, eight types of tube surfaces (glass, teflon, stainless steel, polypropylene, polycarbonate, polyallomer, polysulfone, and polyethylene) were examined for their ability to resist attachment of scallop cells. A pure population of phagocytic cells for the study was obtained by elution of plastic-attaching cells in the presence of chloral hydrate. Results of the study suggested that the cells were effected by the eluting reagent. Work is in progress to isolate pure populations of both oyster and scallop phagocytic cells by centrifugation through Percoll density gradients. The study will then be repeated.

Microbial identification service work was performed for two organizations in Connecticut--Fairfield University and the State of Connecticut Aquaculture Division. Samples were received from a supplier of marine salts. Fifteen isolates were identified to genus and their percentages are as follows:

<i>Vibrio</i>	33.3%
<i>Achromobacter</i>	33.3%
<i>Flavobacterium</i>	26.7%
<i>Pseudomonas</i>	6.7%

This information was supplied to Ed Rhodes of the Spawning and Rearing of Shellfish Investigation who reported it to the company.

The Bluepoints Co., West Sayville, New York, reported that high levels of *Vibrio* bacteria appeared to be present in Great South Bay and asked for technical confirmation. Consequently, samples of bay water were taken on 22 June; however, they revealed low *Vibrio* levels (10^4 CFU). Data from the 25 June trip are not yet available but will be reported in the next narrative.

Dr. Julius Kuck, Fairfield University, provided three sets of toxic shellfish samples for a mouse bioassay to determine whether the paralytic shellfish poison (PSP) toxin present in extracted mussels could be analyzed. Results showed that most of the toxin passed through the membrane during dialysis while proteins were retained.

In continued monitoring of *Gonyaulax* cysts and PSP toxins, mud and shellfish samples were collected from Palmer Cove, Noank, Connecticut, on 29 April. No cysts were found in an area which previously yielded cysts ($1-10/cm^2$ mud) and mussels tested by mouse bioassay revealed no toxicity. Why the cysts have not appeared this year is an intriguing question.

A 1 June trip to Bayview, Milford, was made to collect adult and juvenile clam samples as a continuing microbial survey service for the Connecticut State Aquaculture Division. Samples showed that coliforms were not present in either of the clams (quahogs and cherrystones). Total plate counts for both clam sizes have been increasing since March, with a high in June of 10^4 cells/ml of clam meat.

Of a random sample of four Bayview quahogs, three showed calcareous, bubble-like growths on the inside of the shell. These growths were located in and around the mantle area. Some were examined microscopically, but the growths appeared hollow and not solid calcareous material. It is conceivable that a microorganism created an irritation, causing the calcareous build-up, and then decomposed over time. Samples were sent to Martin Farley at the Oxford Laboratory for further analysis.

Four oyster larval challenges against potential pathogens have been completed in this two-month period on isolates collected from shellfish beds offshore. Two experiments tested isolates never challenged before and isolates that appeared pathogenic once before. No mortalities occurred. The other two tests using our previously isolated pathogens proved that three New Haven isolates have consistently caused mortality, while there were none from Stratford. Pathogens recovered from a previous challenge and tested again showed one Stratford and three New Haven isolates to cause mortality. One more challenge will be run with these 20 environmental isolates before the data are analyzed.

PUBLICATIONS

- Wojcisiwski, W.J., V.G. Ampola, R.C. Lundstrom, E.M. Ravesi, B.E. Tuohunen, and R.W. vanTwyver. 1983. Effect of ozonized ice on preservation of squid (*Loligo pealei*). (Abstract). Proc. 6th World Congr., Int. Ozone Assoc., p. 44. (P)
- Estimer, J.E. 1983. Ultrastructural studies on the phagocytic behavior

- of peritoneal exudate cells in *Pseudopleuronectes americanus*. (Abstract). Eighth Annu. Eastern Fish Health Worksh., p. 167. (S, P)
- Brown, C. 1983. Nutritional requirements for a pathogenic *Vibrio* sp. (Abstract). 75th NSA Meet., p. 20. (P)
- Johnson, P.T. 1983. Diseases caused by viruses, rickettsiae, bacteria, and fungi, pp. 1-78. In: The Biology of Crustacea, Vol. 6 Pathobiology (A.J. Provenzano, Jr., ed.). Academic Press, New York. (P)
- Johnson, P.T. Viral diseases of marine invertebrates. (Abstract). Int. Helgoland Symp. Dis. Mar. Organ. (S, A)
- Kern, F.G. 1983. *Haplosporidium nelsoni* (MSX). A resurgence in Chesapeake Bay? (Abstract). Eighth Annu. Eastern Fish Health Worksh., p. 1. (S, P)
- Murchelano, R.A., L. Despres-Patanjo, and J. Ziskowski. A histologic evaluation of gross lesions excised from integumental, respiratory, and visceral tissues of marine fishes. (Abstract). Int. Helgoland Symp. Dis. Mar. Organ. (S, A)
- Robohm, R.A. 1983. Improvements in the sensitivity of the oxidase test for identification of marine bacteria. (Abstract). Eighth Annu. Eastern Fish Health Worksh., p. 24. (S, P)

MISCELLANEOUS

Travel, Meetings, and Presentations

On 2 May, Dr. Rosenfield returned from Europe after participating in the International Council for the Exploration of the Sea Pathology of Marine Organisms Working Group meeting held in Lisbon and holding discussions on bilateral fish activity with the Spanish Institute of Oceanography colleagues in Vago and La Coruna, Spain.

Mr. Newman performed studies on infectious pancreatic necrosis virus at the National Fish Health Research Laboratory in Leetown, West Virginia, on 5-6 May.

Ms. MacLean attended an "Introduction to Fish Health" training course at the National Fish Health Research Laboratory in Leetown, West Virginia, 10-13 May.

Dr. Murchelano and Mr. Newman attended an NEFC-sponsored meeting on risk analysis at the Sandy Hook Laboratory on 16-17 May.

Dr. Rosenfield, as a consultant to the State Department Agency for International Development and NMFS Office of International Affairs, spent three weeks in Indonesia evaluating small-scale fishery programs, from 23 May-13 June.

Dr. Blogoslawski (Milford) attended the 6th World Congress, International Ozone Association meeting in Washington, D.C., 23-27 May and presented a paper (listed under Publications). He also presented Dr. Harald Rosenthal's paper entitled, "Treatment efficiency of an improved ozonization unit applied to fish culture." Dr. Rosenthal, of Hamburg, West Germany, could not attend.

On 24, May, Dr. Robohm participated in a review of proposals being considered for funding through the Virginia Graduate Marine Science Consortium at the University of Virginia.

Dr. Murchelano presented a lecture and convened a laboratory on diseases of marine fishes at the "Aquavet" course at the Marine Biological

Laboratory in Woods Hole on 26 May.

Dr. Brown (Milford) and Dr. Murchelano attended the Board of Directors meeting in Woods Hole on 1-3 June.

Dr. Brown and Ms. Tettelbach (Milford) and Mr. Farley attended the Shellfish Institute of North America-National Shellfisheries Association joint meeting in Hilton Head, South Carolina, 5-10 June. Mr. Farley presented a paper on "Mass mortalities and related health factors in oyster culture (MSX)." Dr. Brown also presented a paper (listed under Publications).

Dr. Sawyer conferred with Dr. Sindermann at Boothbay Harbor, Maine, from 6-12 June on cooperative herring nematode parasites.

Mr. Newman attended the 9th Annual Meeting of the Advisory Committee of the Plankton Sorting Identification Center, Narragansett, Rhode Island, 7-9 June.

Ms. MacLean hosted visiting Polish scientists in Rockville and Washington, D.C., 11-13 June.

Dr. Sawyer attended the Society of Protozoologists meeting at Pace University

Mr. Lewis and Mr. Galasso participated in a cruise aboard the EPA vessel, *Antelope*, 20-29 June.

Dr. Robohm (Milford), Dr. Bodammer, Mr. Kern, Mr. Newman, and Ms. MacLean attended the Eighth Annual Eastern Fish Health Workshop in Harpers Ferry, West Virginia, 21-24 June. Dr. Robohm, Dr. Bodammer, and Mr. Kern presented papers (listed under Publications).

Dr. Blogoslawski (Milford) visited the Bluepoints Co., West Sayville, Long Island, on 22 and 30 June to sample for *Vibrio* bacteria.

Dr. Sawyer attended the NMFS-EPA planning meeting at Sandy Hook on 27-29 June.

Visitors

On 3 May, Dr. Blogoslawski (Milford) escorted a group of students from the Gunnery Preparatory School, Washington Dept, Connecticut, through the Milford Laboratory.

On 10 June, Dr. Andrzej Ropelewski, Sea Fisheries in Poland, toured the laboratory with Dr. Blogoslawski.

Olivie Pile, Paris, France, visited the laboratory on 16 June and discussed research on oysters and aquaculture.

On 17 June, Bif Cuthbert, Mulberry Farms, Guilford, Connecticut, conferred with Dr. Blogoslawski.

On 28 June, Dr. Susan Goldhor, Amherst, Massachusetts, discussed methods of disinfection with Drs. Blogoslawski and Robohm.

Visitors to the Oxford Laboratory during the reporting period were Congressional representatives Barbara Mikulski and Roy Dyson; Mr. Josep Angelovic, NOAA, Washington, D.C.; Mr. Richard Hennemuth, NMFS, Woods Hole, Massachusetts; Ms. Marjie Johnson and Mr. Craig Ruddell, Hampton Institute, Hampton, Virginia; Mr. Robert Palmatier, Zeiss, Inc., New York, New York; Ms. Esther Peters and Mr. Harry McCarty, Graduate School of Oceanography, University of Rhode Island, Narragansett, Rhode Island; Mr. Howard King, Department of Natural Resources, Annapolis, Maryland; Mr. and Mrs. Raymond Simmons, Ms. Frances Robbins, and Ms. Catherine Ruark, Hooper Island, Maryland; Shelley Jean Palkovic, Schenectady, New York; and Dr. H.T. Klein, Stamford, Connecticut.

University Affairs

On 5 May, Phil Platcow, Quinnipiac College, visited with Dr. Blogoslawski (Milford) concerning the completion of his ozone project.

Dr. Julius Kuck of Fairfield University has been at Milford working on a continuing cooperative project to measure PSP in shellfish using a chemical assay.

Dr. Robohm (Milford) prepared written critiques of six research proposals at the University of Virginia on 24 May.

Public Affairs

On 14, 21, 23, and 27 June, Dr. Nabel presented a statistics workshop for the Milford Laboratory staff. Drs. Blogoslawski and Robohm, Lisa Tettelbach, Bill Rose, and Kelly Clark attended the workshop.

Nineteen specific reprint requests for Milford Pathobiology publications were filled during May and June.

Reviews

Dr. Blogoslawski reviewed a Maine Sea Grant proposal.

Personnel

Jane T. Wade was promoted to Biological Laboratory Technician (Fisheries), GS-9, effective 29 May.

On 31 May, Renee Coulombe, a Junior Fellow from Connecticut College, New London, Connecticut, started a summer appointment with Pathobiology at Milford.

David J. Kent, Biological Laboratory Technician (summer temporary), entered on duty 31 May at the Oxford Laboratory.

Carl Harrison completed his one year temporary assignment with the Pathobiology group in Milford on 10 June.

Mark Galasso, Research Assistant (summer temporary), Bradley Palkovic, Biological Laboratory Technician (summer temporary), and James Turek, Biological Laboratory Technician (summer temporary), reported for duty at the Oxford Laboratory on 13 June.

Dr. Brown (Milford) began an assignment with the NEFC at Woods Hole on 15 June.

EEO Activities

Ms. MacLean conducted the Center EEO meeting at Woods Hole on 2-4 June; Dr. Brown (Milford) and Dr. Murchelano also attended the EEO meeting.

Ms. McLean and Ms. Swann attended the "Management Awareness Seminar" in Towson, Maryland, on 7 June.

NATIONAL SYSTEMATICS LABORATORY

submitted by

Dr. Bruce B. Collette, Director

SYSTEMATICS OF FISHES

Began revision of the monograph on the 18 species of Spanish mackerels *Scomberomorus*. Ran analysis of covariance on morphometric characters for populations of 13 species of Spanish mackerels finding significant geographic variation in many cases.

Revised draft manuscript on beloniform fishes following the Ahlstrom Symposium on Ontogeny and Systematics of Fishes.

Worked with Dr. James Tyler (National Science Foundation) and Dr. Kazuo Nadamura (Kyoto University) on a manuscript removing the louvar from the suborder Scombroidei and placing it as a sister group to the argyrolfishes (Acanthuridae).

Added information on additional specimens of the Australian doubled-lined mackerel *Grammatorecynus bicarinatus* and on underwater color patterns of an undescribed species of toadfish to manuscripts in press.

SYSTEMATICS OF CRUSTACEANS

Continued preparation of a monograph of the American Pacific rock shrimps genus *Sicyonia*. Completed studies of *S. brevirostris*, including detailed description of the species, analyses of morphometric and meristic data, graphical representation of carapace length/total length, and distributional map. This shrimp, apparently rare in the eastern Pacific, is very abundant in the western Atlantic, reportedly, the numerically dominant species on the Continental shelf of the South Atlantic Bight. It is commercially exploited both off the south Atlantic coast of the United States and in the Gulf of Mexico.

Continued preparation of a manuscript on mudshrimps of the eastern Pacific. Read galley proof on "Shrimps, lobsters, and crabs of the eastern United States, Maine to Florida."

SCIENTIFIC SERVICES

Information was provided on: rearing shrimps to Alberto Lonardi, Senior Specialist, Department of Scientific Affairs, Organization of American States (OAS); identification of penaeoid shrimps from the Caribbean to Adelfa Fernandez, Spanish Editor, Revista Américas, OAS; bibliographic references on shrimps and crabs to Michel E. Hendrickx, Instituto de Ciencias del Mar y Limnología, Estación Mazatlá, Universidad Nacional Autónoma de México; structure of thelyca and spermatophores of *Sicyonia* to Ray Bauer, Universidad de Puerto Rico; the mud crab *Panopeus herbstii* complex to Dr. R.S. Fox (Lander College, Greenwood, South Carolina); distribution and economic potential of spiny lobsters in the western Indian Ocean to Dr. I. Ellis, (Consultant, Seattle, Washington); maximum sizes of Indo-West Pacific Belonidae, Scombridae, and Hemiramphidae to Dr. R. Bauchot (Université de Paris); correct identification of scombrid host of parasitic copepod to Dr. J. Randall (Bishop Museum, Honolulu).

Identifications were made of: two photographs of Indonesian Spanish mackerels for T. Gloefelf-Tarp (FAO), frozen Gulf of Thailand snapper *Lutjanus* for T. Halstead (Frionor, New Bedford). Manuscripts were reviewed for the Australian Journal of Marine and Freshwater Research (2) and for authors in the U.S., Japan and India at their request. A proposal was reviewed for the American Philosophical Society.

PUBLICATIONS

- Collette, B.B., G.E. McGowen, N.V. Parin, and S. Mito. Ontogeny and Systematics of the Beloniformes. Ontogeny and Systematics of Fishes, Proc. Ahlstrom Symposium (s).
- Collette, B.B. and J.L. Russo. Ontogeny and Systematics of Scombroidei. Ontogeny and Systematics of Fishes, Proc. Ahlstrom Symposium (s).
- Perez Farfante, I., and H.H. Hobbs, Jr. Obituary. Alejandro Villalobos Figueroa, 1918-1982. J. Crust Biol. 3(3): 492-495. (P)

MISCELLANEOUS

Travel, Meetings, and Presentations

B.B. Collette attended the annual meeting of the Society of Systematic Zoology at the University of North Dakota in Grand Forks, August 8-11 and participated in a symposium "Contemporary Issues in Biogeography" by presenting a paper entitled "Interrelationships of the Spanish mackerels *Scomberomorus*." Dr. Collette then travelled to Los Angeles to confer with Gerald McGowen of the Los Angeles County Museum about their paper on the Beloniformes for the Ahlstrom Symposium and with Dr. Daniel M. Cohen, former Director of the Systematics Laboratory. From August 15-18, Dr. Collette participated in the Ahlstrom Memorial Symposium on Ontogeny and Systematics and presented two papers, one on the Beloniformes and one on the Scombroidei. A.B. Williams collected fossil crustaceans in North and South Dakota July 8-17 to compare Cretaceous crustacean communities with their modern counterparts. Dr. Williams met with the American Fisheries Society on Common and Scientific Names of Aquatic Invertebrates in Milwaukee, Wisconsin, August 15-16, as the coordinator for the crustacean order Decapoda.

Visitors

Dr. Williams was visited by: Madelaine Jacobs, Smithsonian Institution Press for interview of an author of a Smithsonian Institution Press book; J. de Vauglas, Marine Science Station, Aqaba, Jordan, to discuss biology of fossil and living callianassid crustaceans; Judy Long, University of Texas, to discuss identity of and references to mud shrimp, *Upogebia*, species in the Caribbean Sea; Dr. Rowland Shelley, North Carolina State Museum, Raleigh, to discuss computerized cataloging methods for the modern museum.

University Affairs

Dr. Collette taught his summer graduate course in ichthyology for the 17th year at the Marine Science and Maritime Studies Center of Northeastern University in Nahant, Massachusetts in July 1983.

Dr. Williams, with Dr. Gale A. Bishop, Georgia Southern College, spent 10 days (July 8-17) in the field and in planning a field geology course that will focus on comparison of Cretaceous crustacean communities with their modern counterparts.

Scientific Society Affairs

Dr. Collette participated in a meeting of the Council of the Biological Society of Washington as past-president of the society. He also attended the annual business meeting of the Society of Systematic Zoology at the University of North Dakota.

ATLANTIC ENVIRONMENTAL GROUP

submitted by

Dr. Merton C. Ingham, Director

OCEAN MONITORING AND CLIMATOLOGY TASK

The cooperative Ship of Opportunity Program obtained eleven expendable bathythermograph transects (XBT) and five continuous plankton recorder (CPR) transects in July-August, four XBT and two CPR transects in the Gulf of Maine, three XBT off southern New England, three XBT and three CPR transects across the shelf and slope off New York, and one XBT transect across the Gulf of Mexico.

The announcements on the next two pages of eddy conditions in the Georges Bank-Middle Atlantic Bight area were sent to Commander, Atlantic Area, U.S. Coast Guard for publication in the August and September 1983 issues of the *Atlantic Notice to Fishermen*.

In cooperation with the University of Rhode Island (URI) and Rhode Island Sea Grant, AEG is participating in a demonstration project to acquire, process and distribute to fishing interests, charts (enhanced imagery) of about 1 km resolution of sea surface temperature. The first charts were developed and distributed in mid-August from specialized, computer enhancements of infra-red data from polar orbiting satellites. The charts are being distributed by the URI Marine Advisory Service to about 600 fishers and other marine users. The aim of the project is to have the chart ready for distribution within two-four days of a satellite pass. Refinement and further development of the chart are expected to continue through the spring of 1984. Peter Celone is AEG's principal participant in this project.

PUBLICATIONS

- Armstrong, R.S. Variation in the shelf water front position in 1982 from Georges Bank to Cape Romain. *Annls biol. Copenh.* 39. (S)
- Armstrong, R.S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. *Annls biol. Copenh.* 38. (A)
- Celone, P.J. and C.A. Price. Anticyclonic warm core gulf stream rings off the northeastern United States during 1982. *Annls biol. Copenh.* 39.
- Crist, R.W., and R.S. Armstrong. Bottom temperatures on the continental shelf and slope south of New England during 1982. *Annls biol. Copenh.* 39. (S)
- Cook, Steven K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1982. *Annls biol. Copenh.* 39. (S)
- Cook, Steven K. Temperature Conditions in the Cold Pool 1977-1981: A comparison between southern New England and New York Transects. NOAA Tech. Rpt. (NMFS-SSRF) (S)
- Fitzgerald, J.L. and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1981. *Annls biol. Copenh.*, 38. (A)

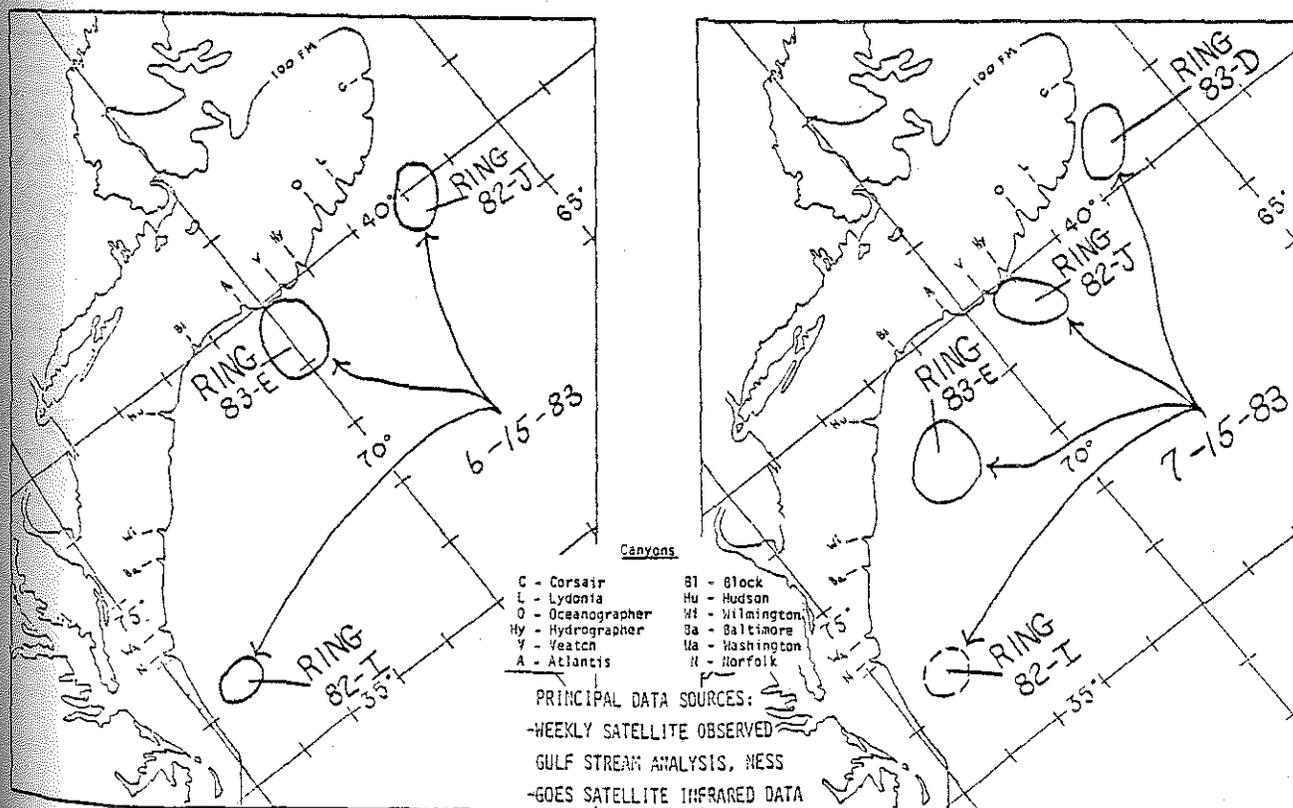
GULF STREAM RING LOCATIONS

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

Ring 82-I, its continued existence uncertain, moved northeast to a position centered at 36.3°N, 74.0°W. Ring 82-J moved Southwestward along the southern edge of Goerges Bank 195 km (105 nm) to a position centered at 39.5°N, 69.0°W, south of Hydrographer Canyon. A relatively new ring, 83-D, moved westward into the region covered by this analysis in early July. It's position is centered at 40.6°N, 66.6°W, between Corsair and Lydonia Canyons. Ring 83-E moved southwestward 195 Km (105 nm) to a position centered at 38.6°N, 71.8°W, southeast of Hudson Canyon, but offshore of the continental shelf.

During the next thirty days, 82-I should be resorbed by the Gulf Stream near Cape Hatteras. Ring 82-J can be expected to travel westward along the edge of the continental shelf to a position centered south of Block Canyon. Ring 82-D may move slowly southwestward along the edge of Goerges Bank and possibly approach Oceanographer Canyon. Ring 83-E can be expected to move southwestward to a position centered near Baltimore Canyon.

Fishermen are requested to report unusual conditions or catches occurring in the vicinity of these rings to the Director, Atlantic Environmental Group, National Marine Fisheries Service, RR 7, South Ferry Road, Narragansett, Rhode Island, 02882, by mail. Updates on ring positions and general information on Gulf Stream rings may be obtained by calling the Atlantic Environmental Group (401-789-9326). Any additional information that can be provided as to the existence and/or locations of Gulf Stream rings would be appreciated.



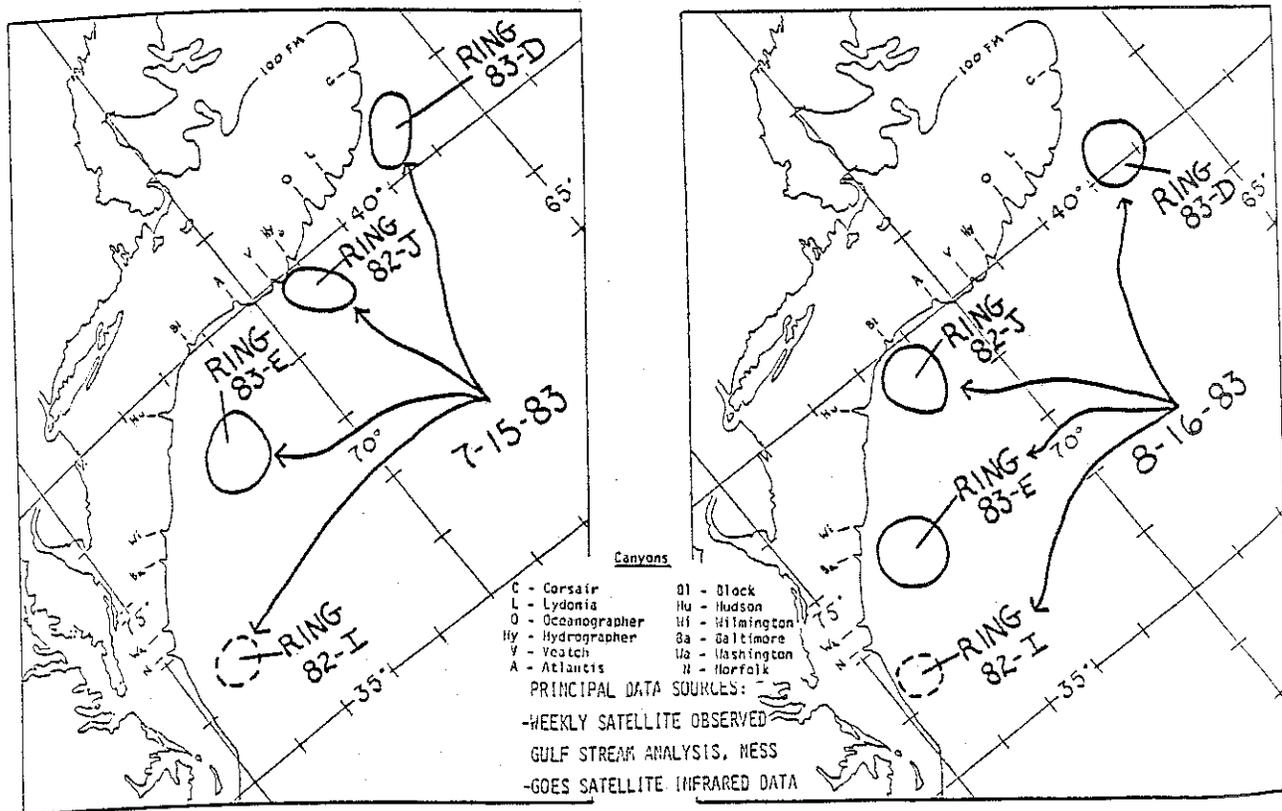
GULF STREAM RING LOCATIONS

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

Though the continued existence of ring 82-I is uncertain, it is estimated to have moved 41 km (22 nm) to a position centered at 36.4°N, 74.4°W. Ring 82-J travelled westward along the edge of the continental shelf 204 km (110 nm) to a position centered at 39.5°N, 71.4°W, south of Block Canyon. Ring 83-D moved 50 km (27 nm) southward to a position centered at 40.2°N, 66.4°W, between Corsair and Lydonia Canyons but relatively far offshore. Ring 83-E moved 162 km (93 nm) southwestward to a position southeast of Baltimore Canyon centered at 37.7°N, 73.2°W.

During the next thirty days, ring 82-I can be expected to be absorbed by the Gulf Stream. Ring 82-J can be expected to move southwestward along the edge of the continental shelf to a position near of Wilmington Canyon. Ring 83-D can be expected to travel southwestward along the edge of Georges Bank to a position near Lydonia Canyon. Ring 83-E can be expected to move southwestward to a position near Norfolk Canyon.

Fishermen are requested to report unusual conditions or catches occurring in the vicinity of these rings to the Director, Atlantic Environmental Group, National Marine Fisheries Service, RR 7, South Ferry Road, Narragansett, Rhode Island, 02882, by mail. Updates on ring positions and general information on Gulf Stream rings may be obtained by calling the Atlantic Environmental Group (401-789-9326). Any additional information that can be provided as to the existence and/or locations of Gulf Stream rings would be appreciated.



- Hughes, M.M., and S.K. Cook. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1981. *Annls biol. Copenh.*, 38. (A)
- Ingham, M.C., and D.R. Maclain. Sea surface temperatures in the northwestern Atlantic in 1981. *Annls biol. Copenh.*, 39. (S)
- Jossi, J.W., D.E. Smith, and G.A. White. Continuous plankton records: Massachusetts to Cape Sable, Nova Scotia, and New York to the Gulf Stream, 1982. *Annls biol. Copenh.*, 39. (S)
- McLain, D.R., and M.C. Ingham. Sea surface temperatures in the northwestern Atlantic in 1981. *Annls biol. Copenh.*, 38. (A)
- Smith, D.E. and J.W. Jossi. Net phytoplankton and zooplankton in the New York Bight, January 1976 to February 1978, with comments on the effects of wind, Gulf Stream eddies, and slope water intrusions. NOAA Tech. Rep. (NMFS-SSRF). (A)

MISCELLANEOUS

Travel, Meetings, and Presentations

Reed Armstrong attended a Northeast Area Remote Sensing System meeting at the University of Massachusetts on July 13.

On July 22 Reed Armstrong travelled to the Milford Laboratory for a meeting of the NEFC Factor IV Committee.

Merton Ingham attended a joint meeting of the Northeast Monitoring Program Management Team and the NOAA Ocean Assessments Division in Rockville, Maryland, on July 25.

On July 28 and 29, Merton Ingham attended meetings of the NEFC Board of Directors and Personnel Advisory Committee in Woods Hole, Massachusetts.

Merton Ingham attended a meeting of the NEFC Board of Directors on August 31 in Woods Hole, Massachusetts.