

# NORTHEAST FISHERIES CENTER

## NEWSLETTER

SEPTEMBER 1982 - FEBRUARY 1983

**SPOTLIGHT:**

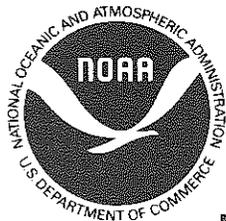
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**US DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL MARINE FISHERIES SERVICE**



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
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NORTHEAST FISHERIES CENTER

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"NORTHEAST FISHERIES CENTER NEWSLETTER"

The "Northeast Fisheries Center Newsletter" is an informal bimonthly report on Northeast Fisheries Center (NEFC) activities, primarily for NEFC employees. Submissions to this report are prepared by the above administrators, and compiled and edited by Jon A. Gibson, Center Information & Publications Officer. This report does not constitute a publication and is for information only. All data should be considered provisional. Reference to trade names does not imply endorsement. 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.



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE

Northeast Fisheries Center  
Woods Hole, Massachusetts 02543

March 15, 1983

F/NEC: JAG

To: Northeast Fisheries Center Staff  
From: Jon A. Gibson  
Subject: *Northeast Fisheries Center Newsletter*

The Center's informal bimonthly report, the *Northeast Fisheries Center Newsletter*, now comes out so long after the time period it covers, that its usefulness is limited. This newsletter still accomplishes one of its two objectives--to document the progress of the Center's research and associated activities and events. However, it doesn't accomplish its second objective--to provide this information to Center staff in a timely fashion.

I am going to try to overcome the latter problem by two steps. The first step is clearing up the backlog of overdue issues by: (1) combining them into one issue, and (2) performing no style editing, just necessary format editing. This issue of the newsletter, covering September 1982 through February 1983, completes the first step. The second step is ensuring the timely distribution of future issues by: (1) setting a cutoff date for receipt of programmatic writeups (with all late submissions being run in the next issue), and (2) again performing no style editing, just necessary format editing. A memo will soon be sent to program heads to set the cutoff date and to establish style guidelines for programmatic writeups.

Future issues of the newsletter will continue to carry a "spotlight" article on one aspect of one program's activities. These "spotlights," as opposed to the rest of the newsletter, are widely read. To obtain the most benefit from these "spotlights," all nine (one for each Center program) so far produced will be combined into an upcoming issue of the *NOAA Technical Memorandum NMFS-F/NEC* series ("Marine Fisheries Research in the Northwest Atlantic: Nine Popularized Perspectives") and distributed to interested individuals or groups.

This editorial "midcourse correction" will better achieve the newsletter's objectives and reduce the Center's use of time, people, and money in its production.



## CENTER DIRECTORATE

No reports received.

### RESOURCE ASSESSMENT DIVISION

submitted by

Dr. Bradford E. Brown, Chief

#### SEPTEMBER-OCTOBER

In September Brad Brown completed the first draft of his chapter for the Georges Bank book and submitted it to Marv Grosslein. Much of Brad's time during October was spent working on future vessel scheduling problems. He also prepared a review of an article by Spencer Apollonio for *Oceanus*.

Emma Henderson reviewed the progress report AFC-13-1 on the Connecticut River shad study.

#### Resource Surveys Investigation

Activities within the Resource Survey Investigation centered around a variety of cruises. Andy Thoms and Thomas Azarovitz completed Part II of the clam survey which covered the Georges Bank and Scotian Shelf areas on September 3. Linda Despres-Patanjo, Eva Monteiro and Don Flescher participated on Part I of the Bottom Trawl Survey from the Virginia Capes to Cape Fear on 13 September to 1 October. Malcolm Silverman and Rose Concha took Part II of the survey from 4-15 October which covered the mid-Atlantic and S. New England area. Georges Bank was surveyed from 18-29 October with Tom Azarovitz and Loretta O'Brien on board. Chuck Byrne and John Nicolas took Part I of the Fishing Power Survey on the *Delaware II* which occupied the same stations as the *Albatross IV* in the S. New England area. Linda Despres-Patanjo, Don Flescher and Dennis Hansford covered a portion of Georges Bank on Part II of the Fishing Power Survey from 18-29 October before proceeding to complete a Food Habits Survey within the same time frame. Dennis Hansford returned on 26 September from a squid survey on the C/V *Kiyo Maru*.

Prior to the autumn survey, all members of both Units attended a pre-cruise orientation on 9 September where Don Flescher spoke on how to distinguish between similar appearing fish species and the latest changes in the sampling booklet. Loretta O'Brien prepared a slide presentation on maturity stages of finfish and Linda Despres-Patanjo gave an update on pathology protocols and a slide presentation on disease conditions.

Pat Twohig purchased various videotape instruments and assembled these with other pre-existing Center video equipment into a compact studio for the purpose of producing video shows. Don Flescher produced a 10-minute videotape on bottom trawl surveys. This is a preliminary version since animation and graphic designs are still needed. Pat also assembled four videotapes which reviewed various Center projects. These tapes were shown at the Marine Technology Conference "Oceans 82" in Washington, D.C., from 20-22 September.

Pat Towhig installed hydroacoustic equipment on the *Delaware II* for use on the Fishing Power Survey. Pat Towhig also completed interfacing to telephone facsimile link from the National Earth Satellite Service to the laboratory for the reception of satellite images. He also completed cable installations at various locations within the lab which allow a high speed data and video link into the Woods Hole Oceanographic Institution/Northeast Fisheries Center (WHOI/NEFC) VAX computer.

Loretta O'Brien has transferred all of the 1982 data files from the ADP account to the survey account in anticipation of station and biological audits. Loretta has also created a help file that enables one to determine the status of a cruise during auditing process. She has also generated sand lance spring and autumn distribution plots from 1963-1981. This is preliminary to cooperative work with Manomet Bird Observatory concerning the feeding habits of whales in the North Atlantic.

Rose Concha attended "Introduction to FORTRAN" from 26-28 October. Loretta, Linda and Malcolm attended several meetings with ADP Unit personnel to discuss audit programs for the survey data.

Linda Despres-Patanjo and Lorraine Belfiore have been appointed as co-chairpersons of the Federal Women's Program (FWP) for 1983.

### Fishery Biology Investigation

Kris Andrade aged 2nd quarter 1982 commercial haddock and sent coded sheets to assessment personnel. She spent time teaching Blanche Jackson to summarize and code age sheets (572 fish). Kris also aged 4th quarter 1979 commercial redfish for the second quarter (385 fish).

Vi Gifford aged 4th quarter 1979 commercial redfish for the first time (385 fish). She also checked Doris Brennan's aging of cod from Massachusetts survey vessel R/V *Gloria Michelle* cruise 929 (200 fish) and 2nd quarter 1982 commercial cod (971 fish). Some time was spent looking at cod otoliths with visiting scientists from Argentina. Vi and Gary Shepherd began learning to age yellowtail flounder by aging 4th quarter 1981 commercial yellowtail (501 fish). Fred Lux who has retired came in and was most helpful with his comments about yellowtail aging and biology.

Melinda Grace impressed approximately 1,500 yellowtail scales and sectioned approximately 420 redfish otoliths. She summarized 4th quarter 1981 commercial yellowtail (501 fish) and constructed graphs of length frequencies for yellowtail survey samples representing spring 1981 and fall 1982. She also put on sheets and summarized haddock cruise samples from Massachusetts survey R/V vessel *Frances Elisabeth* (116 fish) and pollock samples (101 fish). Melinda also found time to look at 2nd quarter 1982 commercial cod samples in order to learn aging techniques of cod.

Blanche Jackson and Kris Andrade aged 2nd quarter 1982 haddock and Blanche put on sheets, coded and summarized 572 fish. Blanche also put on sheets, coded, and summarized 3rd and 4th quarter 1979 commercial redfish (669 fish). She logged incoming cruise and commercial samples, impressed approximately 1,000 haddock scales and approximately 1,000 yt scales and sectioned 150 redfish otoliths.

Gary Shepherd, in addition to working with Vi on learning to age yt flounder participated in a three week leg of the fall groundfish survey - ALB IV 82-11 - and assisted Ambrose Jearld in editing a chapter on age determination to be included in a fishery technique manual. He also aged samples 46-48, 51, 54-56 (371 clams), UMES surf clams and 50 surf clams from a sea sampling trip off New Jersey. Gary, too, assisted visiting

scientists from Argentina on aging anarctica species and gave a guided tour to a group of school children from Falmouth, Massachusetts. After all this, he took a needed one week vacation.

Brenda Fields aged 1981 commercial summer flounder, recorded and summarized their ages and sent completed sheets to the assessment data mangement group (623). She also aged and recorded ages of summer flounder from the 82-01 and 82-02 surveys (388). She completed sample selection and scale measurements of 1978-81 survey summer flounder to be used in a backcalculation study. Brenda also participated in the second leg of the *Delaware II* 82-11 gear comparison cruise.

John Ropes' activities were as follows: shells of *Spisula* from the *Delaware II* cruise were dried out on the lawn for storage in the cottage basement. Shells of marked *Arctica* from the same cruise were gathered in the freezer. Gonadal samples collected for Canadian biologists on Georges Bank of selected stations where *Arctica* were abundant and were mailed to them.

Photography for a manuscript, "Documentation of annual growth lines in ocean quahogs, *Arctica islandica* Linne," was completed. This manuscript describes shell growth, and age/growth line formation in marked *Arctica* recovered one and two years after release at a site off Long Island, New York. A series of optical and scanning electron microscopy (SEM) photographs show clearly the annual periodicity of age/growth lines. SEM research on the microstructure of marked and unmarked clams by one of the co-authors, Dr. Douglas S. Jones, added validity to the formation of the lines. Copies of the manuscript are in the hands of all authors and Dr. Ida Thompson for their final comments.

DiJohn McGruder, beginning hs co-op work term in September, assisted Sherry Sass with the preparation of larval winter flounder otoliths for SEM photography and continued through these months with the maintenance of summer flounder larvae and juvenile fish for Ambrose Jearld. With Alicia Kelly, 1982 survey and commercial mackerel, herring, alewife samples (and other species) were processed for routine biological data and age structures. Spring 1982 yellowtail and winter flounder scales were impressed, and data for a mackerel age validation study was assembled for Louise Dery.

In addition to being in charge of frozen fish processing, up-to-date logging in of all "finfish" commercial and cruise samples and xeroxing, Alica Kelly searched literature in September for information on "age and growth." She also impressed 1982 spring yellowtail flounder scale samples. Ms. Kelly also assisted L. Dery in assembling data for the mackerel age validation study.

Leslie DeFillippis was primarily responsible for sectioning the otoliths of silver and red hake. She completed silver hake otoliths of the 1982 spring survey, sectioned otoliths of both species from the State of Massachusetts surveys, and began red hake of the 1982 fall survey.

Louise Dery assembled and edited age and growth information for Ambrose Jearld. An article was completed and submitted for publication concerning the use of laminated plastic to impress fish scales. Also begun was an age validation study concerning otoliths of Atlantic mackerel and problems of aging the 1977 and 1978 year classes. Several 1981 fall commercial samples of mackerel were aged and summarized. Several days were spent in early September with Dr. Aldo Tomo and Esteban Barrera Ova of the Instituto Antartico Argentino (Buenos Aires, Argentina) studying the otolith growth patterns of several Antarctic species.

Ambrose Jearld completed the final draft of a paper on age determination to be included in a fishery technique manual to be published by the American Fisheries Society. In addition to supervisory responsibilities, attending meetings and reviewing several manuscripts, Ambrose participated in the Autumn Bottom Trawl Survey as a member of the scientific party - AL IV 82-11 (III) from 18-29 October, 1982.

### Offshore Fishery Resources Investigation

Emory Anderson updated the mackerel assessment including an extensive analysis for the purpose of re-estimating natural mortality. Emory also reviewed cod, herring and squid assessments and assisted Gordon Waring in developing a new analytical assessment on butterfish. He also prepared, with Anne Lange, estimates of potential landings from mid-Atlantic fisheries available to the port of Wanchese, North Carolina. Emory also provided advice to Joint Trawlers, Inc., and Scan Ocean, Inc., relative to proposed mackerel fisheries, specifically joint ventures. During September Emory met with Fatima Cardador, from Portugal, to discuss assessment methods.

Anne Lange and Gordon Waring coordinated survey work with the Japanese squid jigging vessel *Kiyo-Maru*. The survey was intended to provide information on distribution, feeding, size and maturity of *Illex illecebrosus*, and on their relationship to environmental factors. Anne also updated Division sampling requirements with the Foreign Fishery Inspector Program, and coordinated, with the Southeast Fisheries Center (SEFC) and Canadian scientists, NEFC participation in the joint USA-Canadian squid survey to be conducted in January-February 1983.

Gordon Waring discussed spiny dogfish research with Tim Slugan, a Masters candidate at State University of New York, Stony Brook, who is working on age, growth and fecundity of spiny dogfish in the Northwest Atlantic.

### Gulf of Maine/Georges Bank Fishery Resources Investigation

Steve Clark provided Dr. Eugene Sims of Louisiana Tech University, with source listings and documentation for a variety of assessment related programs.

In October, Bill Overholtz assumed the lead role in NEFC haddock assessments. Bill also worked with Chris Hammond, a Woods Hole Oceanographic Institution computer consultant, concerning implementation of SIMCON, a computer simulation model processor package.

Mike Fogarty advised the Regional Office and the Maine Department of Marine Resources regarding the status of herring stocks. Mike also conducted research on environmental influences on herring recruitment.

Margaret McBride is conducting an informal survey of attitudes and opinions of yellowtail fishermen in major New England ports, concerning the current conditions of the fishery.

### Publications

Fogarty, M.J. (ed.). 1982. Distribution and relative abundance of American lobster larvae: New England investigations during 1974-1979. NOAA, NMFS, Tech. Rept. SSR-F. (A)

- Fogarty, M.J., R.A. Cooper, J.R. Uzmann, and T. Burns. 1982. Assessment of the USA offshore American lobster (*Homarus americanus*) fishery. ICES C.M. 1982/K:14. Shellfish Committee.
- Lange, A.M.T. 1981. Yield per recruit analyses for squid, *Loligo pealei* and *Illex illecebrosus*, from the Northwest Atlantic. J. Shellfisheries Res. 1(2), 197-207. (P)
- Murawski, S.A., J.W. Ropes and F.M. Serchuk. 1982. Growth of the ocean quahog, *Arctica islandica*, in the Middle Atlantic Bight. Fish. Bull. 80(1):21-34.
- Ropes, J.W. 1982. Procedures for preparing acetate peels of embedded valves of *Arctica islandica* for ageing. Woods Hole Lab. Ref. Doc. No. 82-18, 8 p.
- Ropes, J.W. 1982. The Atlantic coast surf clam fishery, 1965-1974. Mar. Fish. Rev. 44(8):1-14.
- Ropes, J.W. and D. Pyoas. 1982. Preliminary age and growth observations of ocean quahogs, *Arctica islandica* Linne. Inter. Con. Explor. Sea., Shellfish Comm., C.M. 1982/K:15, 6 p.
- Sissenwine, M.P. 1982. ICES Demersal Fish Document G.

### Reports

- Clark, S.H., R.K. Mayo, and A. Green. 1982. Georges Bank and Gulf of Maine haddock stock status - 1982. Nat. Mar. Fish. Serv., Woods Hole Lab. Ref. Doc. No. 82-32, 39 p.
- Lange, A.M.T. 1982. Status of the squid (*Loligo pealei* and *Illex illecebrosus*) populations off the Northeastern U.S.A. Nat. Mar. Fish. Serv., Woods Hole Lab. Ref. Doc. No. 82-27, 20 p.

### Miscellaneous

#### Travel, Meetings, and Presentations

- September 1 - Emory Anderson attended the Mid-Atlantic Council's Scientific and Statistical Committee Meeting in Philadelphia, Pennsylvania.
- September 7 - John Boreman met with the Corps of Engineers on the Westway Project. John also met on this subject on 9/30 and 10/14.
- 7-10 September - Mike Sissenwine attended the Fisheries Ecology III meeting in Florida.
- 7-11 September - Emory Anderson, Mike Fogarty, Frank Almeida attended the North Atlantic Fisheries Organization Scientific Council meeting and the special session on Stock Discrimination in Dartmouth, Nova Scotia.
- 13-14 September - Mike Sissenwine and Emma Henderson attended the Ecosystem Modeling meeting at the Narragansett Lab.
- 14-15 September - Brad Brown participated in the review meeting on recreational fisheries statistics survey, at the Washington office.
- September 15 - Mike Sissenwine attended the New England Fishery Management Council Scientific and Statistical Committee meeting in Boothbay.
- 16-17 September - Mike Sissenwine and John Boreman attended the Ecosystems Division meeting at the Narragansett Lab.
- September 21 - Brad Brown attended the Oceans '82 conference and served on a panel of the Education Committee on Opportunities for Minorities in Marine Affairs.
- 21-25 September - Mike Sissenwine, Steve Clark, Emory Anderson, Brad Brown, John Boreman, Bill Overholtz, Gordon Waring, Margaret McBride,

Ambrose Jearld, and Brenda Fields attended the 112th Annual Meeting of the American Fisheries Society. Mike presented a paper entitled, "The Uncertain Environment of Fishery Harvesters, Scientists, and Managers." Emory presented a paper on the current status of mackerel in the Northwest Atlantic. Brad Brown chaired a session on uses of assessment advice and presented a report of his committee on long range planning at the Marine Section meeting. Steve Clark presented a paper, co-authored by Brad, entitled, "Fishery and Resource Trends from the Gulf of Maine to Cape Hatteras, 1963-1981, a Broad Perspective." John Boreman presented a poster session entitled, "Status of the Major Finfish and Shellfish Stocks off the Northeastern Coast of the U.S." John also co-authored three presentations: "Decline of Striped Bass Stocks on the East Coast," "Comparison of Methods for Estimating Entrainment and Impingement Conditional Mortality Rates," and "Mitigative Measures Required by the Hudson River Power Case Settlement."

September 29 - Steve Clark attended a meeting of the Northern Shrimp Technical Committee in Gloucester to plan gear evaluation studies.

29-30 September - John Boreman attended a meeting of the Technical Advisory Panel of the Hudson River Foundation.

September 30 - Brad Brown participated in the regular meeting between the Center Director and the Regional Director.

4-5 October - Mike Sissenwine attended the Factor IV Meeting.

6-7 October - Brad Brown met in St. Petersburg, Florida, with representatives of the Corp of Engineers, the State of North Carolina, and the Southeast Regional Office concerning Northeast Center input to the Wanacheese, North Carolina, Fishery Development Program.

6-8 October - Mike Sissenwine met with John Beddington on research planning at Logan Airport.

7-8 October - Brad Brown attended a meeting of the American Institute for Testing Materials on Statistical Ecology in Philadelphia, Pennsylvania.

9-16 October - Mike Sissenwine and Steve Clark attended the 70th International Council for the Exploration of the Sea Statutory meeting in Copenhagen. Steve presented a series of papers dealing with the assessments and biology of northern shrimp, offshore lobster, ocean quahogs, and sea scallops.

12-14 October - Brad Brown attended the Atlantic States Marine Fisheries Commission meeting with particular emphasis on working to develop a cooperative state-federal statistical program.

October 14 - Emory Anderson attended the meeting of the Mid-Atlantic Fishery Management Council's Bluefish Committee in Baltimore, Maryland.

October 15 - Brad Brown attended the NMFS Research Council meeting which discussed, primarily, vessel allocations and national versus regional computer roles.

October 19 - Emory Anderson and Gordon Waring attended FISH EXPO.

October 20 - Mike Sissenwine attended the New England Fishery management Council Scientific and Statistical Committee meeting in Saugus, Massachusetts.

October 20 - Mike Fogarty attended FISH EXPO and presented a seminar on the current status of the American lobster.

October 20 - Brad Brown represented the Center at a meeting with the New England Regional Office of Personnel Management.

October 21 - Anne Lange met with other members of the Northeast Fisheries Center Joint Venture Review Team in Gloucester to discuss proposed changes to the Foreign Fishing Regulation.

21-22 October - John Boreman attended the Shad/River Herring Scientific and Statistical Committee meeting.

October 25 - Mike Sissenwine attended the New England Fishery Management Council Scientific and Statistical Committee meeting in Danvers, Massachusetts.

October 26 - John Boreman met with the staff of the American Littoral Society in Sandy Hook, New Jersey.

25-28 October - Brad Brown participated in the Northeast Fisheries Center Board of Director's meeting, Promotion Committee meeting, and a Personnel Management Advisory Committee meeting.

October 27 - Mike Sissenwine attended the Promotion Committee meeting in Woods Hole, Massachusetts.

#### Visitors

September 2 - Emory Anderson met with Dr. Aldo Tomo of Argentina to discuss hake assessments and general assessment methods.

September 20 - Mike Sissenwine met with Jeremy Collie from Woods Hole Oceanographic Institution.

September 29 - Brad Brown spoke with a group of visiting scientists from mainland China.

October 13 - Emory Anderson and Steve Murawski met with Ken Bela and Carol Kilbride of the Regional Office on analysis of data for use by the Region's Fishery Management Plan Priorities Committee.

October 21 - Mike Sissenwine provided Jeremy Hatch with data on fish abundance.

#### University Affairs

October 18 - John Boreman presented a seminar entitled, "Problems in research and management of coastal migratory fish stocks," at the University of Massachusetts.

October 28 - Steve Clark and Steve Murawski met with University of Massachusetts faculty members and graduate students to plan future research work on witch flounder in the Gulf of Maine.

October 22 - Mike Sissenwine presented a paper entitled, "The uncertain environment of fishery harvesters, scientists and managers," at the University of Massachusetts.

28-29 October - Mike Sissenwine presented a seminar entitled, "Structure of the Georges Bank," and lectured to classes in Advanced Fishery Management at the University of Iowa.

#### Public Affairs

October 13 - Anne Lange discussed the status of squid stocks with Robert Evans of the New Jersey - New York Port Authority.

October 14 - Anne Lange discussed the status of the *Loligo* squid stock with Dick Allen of the Atlantic Offshore Fishermen's Association.

October 15 - John Boreman was interviewed by Channel 7 NEWS (Boston) regarding the new size restrictions on striped bass in Rhode Island and Massachusetts.

#### EEO Activities

September 1 - Steve Clark attended the Woods Hole Laboratory EEO Committee meeting.

September 9 - Emma Henderson attended the Federal Women's Program meeting.

September 14 - Brad Brown, along with Maurice Ward, represented the National Marine Fisheries Service at a reception held by the National Association for Equal Opportunity in Higher Education for the retiring and new Assistant Secretary of the Department of Education for Higher Education.

September 21 - Emma Henderson, John Boreman, Vaughn Anthony, Emory Anderson, Steve Clark, and Fred Serchuk attended the Federal Women's Program management seminar with Meta Greenberg.

September 30 - Brad Brown and Mike Sissenwine attended the Center EEO Committee meeting at Milford, Connecticut.

October 5 - Steve Clark, Emma Henderson, Fred Serchuk, and John Boreman attended the Woods Hole Laboratory EEO Committee meeting.

October 14 - Brad Brown visited the co-op director and science faculty at Morgan State University in Baltimore, Maryland.

October 25 - Brad Brown attended the Massachusetts Civil Leadership Conference on Racial and Religious Violence, sponsored by the Massachusetts Committee Against Discrimination.

#### Sea Duty

September 19 - Emma Henderson participated, with Commonwealth of Massachusetts personnel, in a survey to study subsampling procedures aboard R/V *Gloria Michelle*.

4-15 October - Gordon Waring and Margaret McBride participated on the Northeast Fisheries Center autumn trawl survey aboard R/V *Delaware II*.

18-29 October - Frank Almeida and Joan Palmer participated on the Northeast Fisheries Center autumn bottom trawl survey.

25-26 October - Steve Clark participated in the northern shrimp gear evaluation work aboard R/V *Gloria Michelle*.

#### NOVEMBER-DECEMBER

No report received.

#### JANUARY-FEBRUARY

##### Resource Surveys Investigation

Cruise activity conducted during January and February 1983 included: participation in the 1983 Industry-Rhode Island-NMFS cooperative yellowtail flounder bottom trawl survey; the completion of one leg of the 1983 winter Atlantic herring bottom trawl survey; and the initiation of the second half of the winter Atlantic herring survey.

During January 2-5, 1983, Chuck Byrne participated in a cooperative effort with State of Rhode Island biologists and the Pt. Judith Fisherman's Cooperative Association in the successful conduct of a bottom trawl survey designed to study the relative abundance of yellowtail flounder off southern New England. The fishing vessel *Shirley S.* (Captain Peter Sprague) was used and the area surveyed included from Shinnecock, New York, to the Nantucket Light Vessel.

The first part of the winter Atlantic herring bottom trawl survey was conducted February 14-24, 1983, aboard the R/V *Delaware II*. Linda Despres-Patanjo was chief scientist and the area surveyed was from Chincoteague, Virginia, to Marthas Vineyard, Massachusetts. Since Atlantic herring was the priority target species the survey was primarily coastal in nature.

However, a number of offshore ichthyoplankton stations were occupied, principally south of Hudson Canyon.

The second and final part of the winter Atlantic herring bottom trawl survey began on February 28, 1983. The planned area of operation is from Martha's Vineyard, Massachusetts, to Penobscot Bay, Maine. The R/V *Delaware II* is being used during this part and Chuck Byrne is the chief scientist. Personnel from the C.S. Draper Laboratory are also aboard the vessel and are collecting hydroacoustic data during the survey. This data will be used in the development of new equipment and methodology which may be used as part of future surveys.

During this period Loretta O'Brien and Rose Concha worked on the transformation of Canadian survey data into the Northeast Fisheries Center survey data format for catch and station records. The finished product will be a summation of these data which will be considered by US investigators in discussing the US-Canada boundary dispute. Loretta and Rose also worked on Soviet trawl data and prepared it for similar use.

On January 4, 1983, Loretta O'Brien, Don Flescher and John Nicolas assisted with the training of a group of newly appointed Foreign Fisheries Observers. Loretta presented procedures and criteria for the maturity staging of finfish while at sea, Don presented fish identification techniques and John discussed marine mammal identification and data collection.

Linda Despres-Patanjo spent a week in Oxford, Maryland, studying the identification of fish diseases and parasitic infestations. Linda, in turn, will train members of research vessel scientific complements in the identification of these conditions at sea.

Dennis Hansford completed variable volume dry-suit scuba diver training in Norfolk, Virginia, and now meets the requirements to be certified as a limited NOAA diver.

Linda Despres-Patanjo, Malcolm Silverman, and Don Flescher discovered some problems with the new survey data audit programs recently completed. Working through the Northeast Fisheries Center ADP Unit, these problems were identified and corrected. The auditing of the backlog of data resulting from the conversion to the VAX computer is now well underway.

Jim Crossen worked on the preparations necessary for the deployment of the hydroacoustic gear being used aboard the R/V *Delaware II* by the personnel from the C.S. Draper Laboratory during the second part of the winter Atlantic herring survey.

#### MANNED UNDERSEA RESEARCH AND TECHNOLOGY PROGRAM

No reports received.

## MARINE ECOSYSTEMS DIVISION

submitted by

Dr. Kenneth Sherman, Chief

SEPTEMBER-OCTOBER

### Larval Fish Dynamics Investigation

#### Experimental Studies

A group of summer flounder that have been held in the laboratory for the past four years were induced to spawn by hormone injection. These fish have been spawned each fall since capture. One group of eggs was fertilized using sperm that was stored at  $-70^{\circ}\text{C}$  for one year. Fertilization rate and growth of larvae was comparable to that obtained with fresh sperm, thus demonstrating the utility of sperm preservation for this species. Studies of the changes in nucleotide content as an index of condition of summer flounder eggs and larvae during growth, development, and starvation are in progress. We are using high performance liquid chromatography (HPLC) to separate and quantify a variety of nucleotides.

Several thousand sand lance were captured in the Merrimack River estuary and transferred to holding tanks in the laboratory. These fish should spawn within one month. The eggs and larvae will be used for studies of the effects of environmental variability on growth and survival.

Larry Ruckley presented results from the joint National Oceanic and Atmospheric Administration (NOAA) and Fish and Wildlife Service study of the effects of contaminants on striped bass viability at the annual meeting of the American Fisheries Society in Hilton Head, South Carolina. Two manuscripts describing the laboratory spawning of sand lance and their growth and development at several temperatures and feeding levels are in preparation.

Geoff Laurence initiated work on modeling, using field and laboratory empirical data to examine whether larval cod and haddock are food limited on Georges Bank. Two approaches are being used: one, a deterministic energetic model; and the other, a stochastic population growth and survival model. Geoff also presented two invited papers on larval fish trophodynamics at Fish Ecology III, sponsored by CIMAS, University of Miami, in Miami, Florida, and in a special larval fish program during the American Fisheries Society Annual Meeting in Hilton Head, South Carolina.

#### Population Processes

George Bolz and Greg Lough revised a manuscript on cod and haddock larval growth for internal review. Both larval cod and haddock growth in the field can be accurately described by an exponential curve fit of length to daily ring increments in their otoliths. When adjusted for seasonal differences in temperature, they both have similar average rates of growth of about 3% per day at  $7^{\circ}\text{C}$ . George also prepared juvenile cod otoliths for collaborative work with Dr. Richard Radtke, Pacific Gamefish Foundation, on Sr/Ca ratios as indicators of their past temperature environment.

Dave Potter worked on data sets from the 1978 Patch Study. He summarized the multiple opening-closing net and environmental sensing system (MOCNESS) haul data from the larval herring patch and produced computer plots of standardized larval herring length-frequencies. He also

entered into the computer some 25,000 length measurements of *Sagitta elegans* from the MOCNESS series on northeast Georges Bank and developed several computer routines to summarize this data. A manuscript on our rapid shipboard method of subsampling and identification of zooplankton was revised by Greg Lough and Dave Potter and submitted for publication.

Roz Cohen has begun to sort some of the fine-mesh zooplankton samples from the 1978 Patch Study. On 16 September, Greg Lough and Roz Cohen attended an Ecosystems Division program reviews in Narragansett.

Sample processing and analysis of the spring 1981-82 larval cod-haddock cruises continued. Peter Donnelly completed a laboratory reference document on the use of the HIAC particle size counter to determine the fine-scale distribution of particulates/phyto-zooplankton on Georges Bank in the areas of larval fish abundance. Peter also participated on the R/V *Antelope* cruise, 25-29 September, to help evaluate the possible impact of radioactive nucleides on fish stocks in Massachusetts Bay.

21 October, Greg Lough attended an Ecosystems Division meeting at Narragansett on recruitment processes.

### Ichthyoplankton Investigation

The early autumn ichthyoplankton survey began in late September as an adjunct to the traditional autumn trawl survey. At the end of October, sampling had been completed in the Middle Atlantic, Southern New England, and Georges Bank subareas. The species composition of the larval fish community in the Middle Atlantic Bight remained near the high diversity levels observed during the summer. Preliminary observations of bongo samples indicated that larval triglids and several species of bothid flatfishes were most abundant. In samples taken off Southern New England we observed larval hakes, *Urophycis* sp., silver hake, *Merluccius bilinearis*, and fourspot flounder, *Hippoglossina oblonga*. For the third consecutive year, herring, *Clupea harengus*, larvae were not observed in samples taken on Georges Bank in October, or the period of peak spawning during the early 1970's. Our next survey begins in mid-November when we will again be closely watching the distribution and abundance of herring larvae in the Gulf of Maine-Georges Bank region.

Despite our active cruise schedule, we continue to keep pace with laboratory aspects of our program, largely because of teamwork and the individual dedication of investigation personnel. Alyce Wells recently completed mapping the distribution and abundance of cod, *Gadus morhua*, and haddock, *Melanogrammus aeglefinus*, larvae from cruises completed between fall 1980 and winter 1982. These maps show an increase in cod larvae in the Southern New England and Middle Atlantic subareas with their distribution extending southward to Chesapeake Bay. Since completing his "Guide to the Identification of Larval Fishes," Mike Fahay has been occupied with archiving historical Marine Resources Monitoring, Assessment, and Prediction Program collections and preparing for the ELHL Ahlstrom Symposium in August 1983. His symposium contributions include descriptions of larval cyclopterids and gadiforms. Tom McKenney has assumed responsibility for instituting quality control measures on all incoming logs and samples from the Polish Sorting Center. He is assisting in archiving our larval fish collection and continuing to update survey information on the distribution and abundance of larvae of five taxa. During this reporting period, he worked with Ms. Mary Lewis from the Bedford Institute.

## Ecosystem Dynamics Investigation

Marv Grosslein initiated a series of seminars on multispecies modeling in the NEFC to provide in-depth descriptions of the several models currently being developed. Wendell Hahm presented three seminars on the model GEORGE describing: (1) biological assumptions and structure of the model, (2) outputs (tabular, graphic) of the model and the general method of flow analysis for clarifying model behavior, and (3) how to use the simulator. GEORGE is designed to evaluate the relative importance of post-larval predation in controlling variability of recruitment. Steve Murawski and Bill Overholtz (Assessment Division) also presented seminars on other multispecies models. Murawski described a yield/per/recruit simulation of a mixed-species fishery where there was little trophic interdependence among the species; the objective of that model was to estimate effects of various levels of fishing effort and gear selectivity. Overholtz described a multispecies simulation model for a shallow-water species assemblage on Georges Bank, which incorporated interspecific competition as well as predation as biological control mechanisms.

Wendell continued work on documentation of the simulator GEORGE and Ed Cohen continued evaluation of the control functions and input data for GEORGE. Two versions of the basic feeding function are being developed: (1) a food unlimited system where growth of survivors is considered constant, and (2) a system where growth depends upon available food and rations above minimum requirements are needed for growth and reproduction.

Ed Cohen, Wally Smith, and David Mountain began an analysis of the abundance of early life stages of silver hake in relation to indices of shelf water advection (Warm Core Rings, Ekman transport and shelf/slope front positions) and in relation to recruitment success. Among the major fish species on Georges Bank, silver hake is the one for which advective processes are most likely to affect recruitment because of the close proximity of the spawning grounds to the shelf edge.

Mike Pennington continued work on the statistical analysis and design of Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) surveys, and he spent two weeks in Morocco consulting with biologists at the (U.N.) Food and Agriculture Organization project in Casablanca on the analysis of their trawl survey data base. Mike also worked with a visiting investigator, Ms. Fatima Cardador (Fisheries Research Institute of Portugal) on analysis and design of the Portuguese trawl surveys. Mike Pennington, Marv Grosslein, and Ray Bowman also collaborated on developing an empirical estimate of stomach evacuation rate utilizing a site-specific experiment on silver hake feeding.

Roger Theroux completed checking the galley proofs of the bivalve manuscript and returned them to the Government Printing Office for publication. John Hauser generated computer listings of the benthic data to be used in the chapter on benthic animals in the Georges Bank book, and Roger completed graphics and tables for the chapter and began writing the first draft of the chapter.

Ray Bowman and Bill Michaels continued work on the food habits of 17 major species from the 1973-1976 data series. A comprehensive list of prey was prepared for the 17 species and tallies of diet composition by length of predator were begun. Ray, Bill, James Myette, and Tom Morris participated on the gear comparison portions of the fall groundfish survey aboard *Albatross IV* and *Delaware II*, to help augment food habits sampling

and to take advantage of the opportunity on *Delaware II* to piggyback some special food habits sampling at Bureau of Land Management monitoring sites.

Tom Morris collected mouth morphology measurements on an additional species, Gulf Stream flounder, to round out his study of mouth morphology of flounder in relation to other diet and distribution. Tom also began work on a summary of the diet of bluefish as input for the multispecies model.

Charlie Wheeler completed a report on the 1982 lobster larval surveys in Buzzards Bay, and noted that the production of larvae was about average for the five-year period 1978-1982, in spite of the unusually cold temperatures in June 1982 which delayed the spawning about two weeks and also resulted in slower development of larvae. Charlie also continued work on summarizing diet composition of cod by size of fish for the 1973-1976 data series.

John Hauser set up DATATRIEVE for use with the zooplankton data base at Woods Hole and modified the cluster analysis and Fager programs for use on the VAX.

### Plankton Ecology Investigation

Jack Green worked with Ray Maurer, John Pijanowski, and Leon Belouski on the integration of new hardware components for the image analysis system. Pump samples through 1981 have been processed including *Albatross IV* 81-05. Data analysis is currently underway by Joe Kane on all pump samples in a pooled data base to complete his study of larval fish feeding. Jack Green has been compiling information for an updated Deepwater Dumpsite 106 zooplankton report. Other projects include providing data to the University of Rhode Island for the Cetacean and Turtle Assessment Program and basking shark studies, and analysis of the MARMAP and historical data in the literature to study the variation in plankton composition, distribution, and abundance over the past 70 years. The MARMAP and zooplankton data are being analyzed for a revised secondary production estimate for the Georges Bank area.

Jerry Prezioso arranged the shipment of vials and mechanical counters to the Plankton Sorting Center in Szczecin, Poland. In October, he participated in the R/V *Challenge* 82-01 Gelatinous Zooplankton Cruise conducted in cooperation with the State of Maine. He also transferred over the plankton archival data from the University of Rhode Island's IBM computer to the PCP-1170 at the Environmental Protection Agency (EPA) and has been familiarizing himself with this system in preparation for running analyses and graphics of image analysis data.

### Image Analysis

On 18-29 October, Ray participated in a bottom trawl survey, ALB 82-11.

During September and October, the computer components for the Automated Plankton Processing System were completed and system documentation was finalized. Costas Katsinis and Mark Berman (University of Rhode Island) demonstrated the digital processing software to Perry Jeffries and Ray Maurer on 15 October. The high resolution video camera and Zeiss microscope were delivered to Applied Science Technology, Inc., who will incorporate them into the Automated Scanning Subsystem console. Completion of that task is scheduled for March 1983. A prototype of the plankton silhouette camera was delivered to John Pijanowski (NOAA, Office

of Ocean Technology and Engineering Services) and design changes for the final version discussed.

### Biostatistics

Julien Goulet spent most of September and October working with Kevin Kolodzy and Sandy Lundin of the System Support Group on the structure of the MARMAP Ecosystem Data Base (MEDB) and the software needed to input, quality control, and edit it.

On 8 September, the Executive Board of the MEDB User Group met and allocated the new terminals and modems. Robert Payne (EPA) reported on future system and application softwares for the PDP-11.

16 September, Julien Goulet, attended a general Ecosystem Division meeting in Narragansett.

17 September, Julian Goulet met with Wally Smith and Ken Sherman to discuss the processing of ichthyoplankton data. It was agreed to set up a module that Patty Schaeffer could run from Sandy Hook to extract MARMAP Information System (MIS) data and pass it to a SAS file that Wally Morse could process.

Tom Plichta spent most of September and October becoming familiar with SAS/GRAPH and with PDP-11--both the DATMAN data manager and the MAPIT graphics package. He also spent a good bit of time generating statistical runs upon request.

Robert Kenney spent some time in September generating plots and histograms for the U.S./Canada boundary issue.

Julian Goulet met with Tudor Davies (EPA), R. Payne (EPA), E. Heyerdahl (Woods Hole), and Ken Sherman to review the cooperative agreement with EPA concerning ADP support for Marine Ecosystems research.

Julian Goulet reviewed the documentation for the Image Analysis System to be installed in the Narragansett Laboratory.

### Fishery Oceanography Investigation

During September the Fishery Oceanography Investigation completed the fourth and last Warm Core Ring cruise of the year aboard the *Delaware II*. Steven Ramp was chief scientist. This marked the first time that *Delaware II* has been used for commercial item description and current meter mooring operations. Considerable preparation of the vessel was required, including the installation of regulated power supplies for electronic equipment and the construction of a cover over the trawl ramp to allow recovery of current meter moorings. The hard work put in by Port Captain Frank Arbusto is gratefully acknowledged. Eight of the nine moorings deployed on the August ring cruise were recovered without incident. On the ninth mooring, after the surface float was brought aboard, the mooring wire apparently caught on the bumpers leadings to the trawl ramp causing excessive strain on the wire. The wire parted and one current meter was lost.

David Mountain and Ronald Schlitz began working with personnel from the Charles Stark Draper Laboratory on a project for the U.S./Canada boundary issue. The purpose of the study is to investigate the possibility of measuring or inferring ocean currents from satellite imagery.

Steven Ramp has been working to make operational a conductivity-temperature-depth processing system on the VAX computer.

Ronald Schlitz is proceeding with steps to establish an ATS satellite communication system for the Center and the R/V's *Albatross IV* and *Delaware II*.

The manuscript on the Northeast Channel measurements was submitted for publication. It is entitled: "On the deep transport of mass, heat and nutrients through the Northeast Channel, Gulf of Maine," by Steven R. Ramp, Ronald J. Schlitz, and W. Redwood Wright.

Brisdell Hunt replaced Catherine Jewell as the Investigation's COOP student. She is from Southampton College and will remain with us until January.

### Apex Predators Investigation

Wes Pratt and Jack Casey finished the final draft of "Age and Growth of the Shortfin Mako, *Isurus paucus*" using vertebral rings, length frequency, and tag recaptures. In contrast to the sandbar shark, growth of the mako was fast--30-40 cm/yr--with maximum sizes reached in 4.5 yr for the male and 11.5 yr for the female. The paper was submitted to the *Journal of Fisheries and Aquatic Sciences*.

Jack Casey and Wes Pratt continued work on "The Age and Growth of the Sandbar Shark, *Carcharhinus plumbeus*," both final analyses and last manuscript drafts. Growth was determined using analysis of vertebral rings, length-frequency distributions, and tag-recaptures. Mean growth rates of 7.3 cm/yr for vertebral data and 5.2 cm/yr for tag returns indicate sandbars are relatively slow-growing sharks that may live for 30 years.

Nancy Kohler helped us fit a 5th degree polynomial to the growth data which follows natural inflections in growth better than the von Bertalanffy function which was also presented.

Chuck Stillwell continued work on the first draft of a manuscript on the food and feeding ecology of the swordfish in the Northwestern Atlantic.

Blue shark food habits data collected in 1982 was coded by Nancy Kohler and is being added to the food habits data base.

During September and October tags were returned from 31 sharks representing 10 species. One of these was the first return from a tagged shark to show movement across the equator. This return came from a blue shark tagged off the Cape Verde Islands, by the crew of the R/V *Wieczno*, that was recaptured 1200 mi south of the tagging site after 65 days. Another blue shark was recaptured twice, once after 35 days and again after 101 days. Other blue sharks were recaptured after up to 4 years at liberty and over distances of 2500 mi (Block Island to French Guiana, S.A., in 180 days).

Another long return came from a sandbar shark that was tagged off New York and recaptured in the Bay of Campeche, Mexico (1500 mi) after 6 yrs at liberty. The other returns were from sharks at liberty for less than 1 yr that were recaptured within 100 mi of the tagging site.

Tagged swordfish have been released under both the NEFC (sharks) and SEFC (billfish) tagging programs. Recapture data from 35 swordfish have been combined and standardized by Nancy Kohler as a first step toward a joint publication with the SEFC.

In September and October, John Hoey continued working on the rewrite of "A Comparison of Species Composition and Catch Rates from Pelagic Longline Fisheries in the Western North Atlantic." The comparison relies on records from over 2500 sets of longline gear from U.S. fisheries for swordfish, tuna, and sharks. These individual set records are compared to observer records of the Japanese tuna fishery within the U.S. fishery conservation and management zone. The major differences between the

fisheries are temporal (fishing period) and spatial (fishing depth and geographical effort distribution). Other differences which are discussed include hook type, gear saturation, competition, hook spacing, set duration, and bait loss.

John Hoey developed a coding form for swordfish weight data and set information from 1974 through 1980 was coded. Longline records from 1981 and 1982 are being reviewed and coded for possible addition to the longline data base.

### Publications

- Lough, R.G., Potter, D.C. Rapid shipboard identification and enumeration of zooplankton samples. MARMAP Contribution MED/NEFC 82-53. J. Plankton Res. (S)
- Pratt, H.L., Casey, J.G. Age and growth of the shortfin mako *Isurus paucus*. MARMAP Contribution MED/NEFC 82-3. J. Fish. Aquat. Sci. (S)
- Ramp, S.R., Schlitz, R.J., Wright, W.R. On the deep transport of mass, heat and nutrients through the Northeast Channel, Gulf of Maine. MARMAP Contribution MED/NEFC 82-07. J. Phys. Oceanogr. (S)

### Reports

- Bolz, G.R., Lough, R.G. Larval cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) growth on Georges Bank, late winter and spring 1981. MARMAP Contribution MED/NEFC 82-64. 31 p. (To be submitted to *Fish. Bull.*) (1982)
- Donnelly, P.J. 1982. Particulate size distributions on Georges Bank during spring 1981 and 1982. MARMAP Contribution MED/NEFC 82-70. NEFC Woods Hole Lab. Ref. Doc. No. 82-38. (1982)

### Miscellaneous

#### Travel, Meetings, and Presentations

7-10 September, Kenneth Sherman and Geoff Laurence attended the CIMAS Univ. of Miami/NOAA sponsored Fish Ecology III meetings at Key Biscayne, Florida.

10 September, Mike Fahey met with members of the Northwest Atlantic Fisheries Organization publications staff at Dartmouth, Nova Scotia, to discuss final details for publishing his larval fish guide.

19-23 September, Dave Potter attended the Oceans '82 meeting in Washington, D.C.

6-9 October, Kenneth Sherman traveled to London, England, to meet with John Beddington (IIED) to discuss new concepts in fisheries ecosystem modeling; then from 9-10 October, he met with Vagn Hansen at the Nordsocenterel, Hirtshells, Denmark (North Sea Center); he then travelled to Copenhagen 11-15 October for the International Council for the Exploration of the Sea Annual Statutory Meetings and stopped by the U.N. Educational, Scientific, and Cultural Organization from 16 to 19 October in Paris, France, to visit with Mario Ruivo, General Secretary of IOC to discuss the organization of an IOC Working Group on Plankton Sampling and Processing Methods.

12 October, Dave Potter and Hal Merry visited the NOAA Office of Ocean Technology and Engineering Service, (Washington, D.C.) to inspect surplus equipment.

### Seminars

13-14 September, Dr. Taivo Laevastu (NMFS, Northwest and Alaska Fisheries Center) presented a Multispecies Ecosystem Modeling Workshop at Narragansett. The following were in attendance: Kenneth Sherman, Julian Goulet, Chuck Stillwell, Donna Busch, Mary Grosslein, Ed Cohen, Dave Mountain, Fred Serchuk, Vic Bierman (EPA), Jack Casey, John Hoey, Mike Pennington, Mike Fogarty, John Green, Emma Henderson, Ray Maurer, and Ted Durbin (University of Rhode Island Graduate School of Oceanography).

On 27 and 28 September, an Office of Personnel Management course was held on Japanese Management Methods at the Narragansett Laboratory for 26 of the Division personnel.

Kenneth Sherman attended the Board of Directors and PMAC meetings 25-28 October.

### Visitors

Ray Maurer met with the Chinese Oceanographic delegation in Woods Hole and discussed digital image processing and its application to plankton processing.

On 14 October, Ray Maurer gave a briefing of laboratory activities and a tour to John Alabaster, a pollution expert from England, who was presenting a seminar at EPA.

### University Affairs

Daniel Patanjo began training on FORTRAN programming at Southern Massachusetts University.

10 September, Ray Maurer attended a seminar at the University of Rhode Island Graduate School of Oceanography by John Warmouth (Texas A&M). John presented preliminary results of the First International BIOMASS Experiment in the Antarctic cruise, comparing net caught Euphausid distributions to acoustical recordings.

Ray Maurer and Al Blott met with Bridgett Cunningham (University of Rhode Island) to discuss possible subjects for a video presentation which would highlight use of underwater video systems.

15 October, Costas Katsinis and Mark Berman (University of Rhode Island) demonstrated the digital processing software to Perry Jeffries (University of Rhode Island) and Ray Maurer (NEFC).

Jack Green has provided data to the University of Rhode Island for the Cetacean and Turtle Assessment Program and basking shark studies, analysis of MARMAP and historical data in the literature to study the variation in plankton composition, distribution, and abundance over the past 70 years.

### Public Affairs

On 27 October, David Mountain lectured on fishing oceanography to a group of visiting cadets from the U.S. Coast Guard Academy.

### Personnel

On 29 October, Peter Donnelly terminated his second year temporary appointment with the Larval Fish Dynamics Investigation.

### EEO Activities

9 September, Roz Cohen attended an FWP meeting in Woods Hole.

28 September, Bob Benway attended the training meeting for Laboratory EEO members.

29 September, Kenneth Sherman made a presentation on Divisional EEO policies to a Center EEO training meeting at Milford, Connecticut. Bob Benway and Tom Halavik were in attendance.

### NOVEMBER-DECEMBER

#### Ichthyoplankton Investigation

The late autumn MARMAP I survey was carried out on *Delaware II* between 15 November and 22 December. Survey coverage was completed in the Gulf of Maine, Georges Bank and Southern New England subareas, and continued southward into the Middle Atlantic subarea as far as Chincoteague Island, Virginia. In contrast to the hostile weather conditions which seriously impacted on sampling success during the past several late autumn surveys, weather on most of our final cruise of 1982 was relatively mild with only moderate winds. We completed 153 of 175, or 87%, of the scheduled stations. Preliminary observations of the 0.505 mm bongo samples indicate that Atlantic herring larvae were scattered in coastal waters of the Gulf of Maine but again were absent over the historically productive spawning beds on Georges Bank. Gadid eggs were abundant on the Bank but fish larvae were in short supply. Sand lance and silver hake larvae were frequently observed in samples taken off Southern New England, while larvae of several flatfishes (i.e., summer flounder, windowpane, Gulf Stream flounder and smallmouth flounder) dominated catches in the Middle Atlantic subarea. Our winter survey, scheduled to begin in mid-January, will provide us with the first opportunity in the 7 year MARMAP data base to collect ichthyoplankton samples in January.

Wally Smith and Wally Morse collaborated with Ken Sherman and Donna Busch to complete an analysis of spawning strategies of coastal fishes, using the MARMAP I data base. Their results show temporal and spatial relationships between phytoplankton production, pulses in zooplankton density and the abundance of fish larvae, and examine the competitive advantages and disadvantages of recognized spawning strategies. Wally Smith also worked with Ed Cohen and Dave Mountain on a paper that investigated the influence(s) of warm core rings on the distribution of fish larvae on Georges Bank. Both of these papers were presented at the December 1982 American Geophysical Union/American Society of Limnologists and Oceanographers meeting in San Francisco.

Ms. Ellen Johnson, biological technician, joined our staff for a one year period in mid-November. She will participate in MARMAP ichthyoplankton surveys and assist staff biologists in analytical aspects of their research.

Wally Smith met with Ken Sherman on 3 and 4 November at the Narragansett Laboratory to analyze MARMAP I survey data in preparation for presentation at the American Geophysical Union/American Society of Limnologists and Oceanographers meeting.

Wally Smith attended a two-day discussion of ecosystem modeling techniques at the Narragansett Laboratory on 13-14 December.

## Larval Fish Dynamics Investigation

### Experimental Studies

Summer flounder eggs obtained at the Narragansett Laboratory through hormone induction were successfully fertilized with frozen sperm. The sperm was kept in the laboratory's sperm bank for one year before being utilized.

A major problem has always been obtaining sufficient amounts of sperm to fertilize the great numbers of eggs usually obtained. The paucity of sperm from running ripe males in the laboratory in the past and our ability to tell the sexes apart prompted studies into the possibility of freezing summer flounder sperm and storing it for use when required.

After several years of experimenting, a suitable extender (Mounibs) has proven to give consistent good results. Fertilization rates of approximately 90% and hatch rates of approximately 80% have been achieved, and larvae from these experiments have been reared through metamorphosis. The techniques developed at Narragansett eliminate the storage and freezing in liquid nitrogen and involve storage at  $-80^{\circ}\text{C}$  in a biofreezer.

The availability of a suitable method for the successful preservation of summer flounder and other marine fish semen would be valuable from a research point of view. If males ripen before females, sperm could be stored until needed, great numbers of males would not have to be maintained and sperm could be transported to other laboratories and investigations, if needed. Summer flounder is one of only a few marine species for which cryopreservation of sperm has been achieved.

Two groups of summer flounder embryos were supplied to the EPA laboratory for acute toxicity studies. In a preliminary study summer flounder larvae exposed to varying concentrations of contaminated sediments for 96 hr were analyzed for RNA, DNA and protein content. Work on the estimation of larval nucleotides using high-performance liquid chromatography was continued. Sand lance collected in the Merrimack River estuary spawned in the laboratory at the end of December. Preparations are being made for studies of temperature and salinity tolerance and determination of the "point of no return" at various temperatures. Renovations to the aquarium facility were continued.

The annual report to the Northeast Monitoring Program-Ocean Pulse program was completed. Preparations were made for presentation of results from the joint NOAA-U.S. Fish and Wildlife Service study of the effect of contaminants on the viability of the early life stages of striped bass of the ESBS/Atlantic States Marine Fisheries Commission workshop in early January.

Geoff Laurence attended the annual winter meeting of the American Geophysical Union/American Society of Limnologists and Oceanographers in San Francisco and presented a paper entitled, "Ichthyoplankton in Entrained Water of Warm Core Rings" with Bruce Burns as co-author.

### Population Processes

Greg Lough and George Bolz worked with Marv Grosslein and Vaughn Anthony to revise the larval herring egg production estimates in relation to spawning stock size, 1971-75 seasons. George completed revision on the larval cod and haddock manuscript and submitted it to *Fishery Bulletin*. He also prepared juvenile cod otoliths for a joint study with Dr. Richard Radtke on daily growth in relation to environmental history.

Dave Potter produced standard computer summary tables of MOCNESS larval herring vertical distribution data from the 1978 Patch Study. Larval gadid data from the spring 1981 cruises are presently being entered on computer files and summary tables produced for cod. Dave also prepared HP-85 programs for Roz Cohen to be able to load, quality control, and retrieve larval gadid gut-content data from the same spring cruises. Dave has been involved in numerous laboratory meetings of the Space Study Committee and Library Transition Committee.

Roz Cohen spent the major part of her time examining fine-mesh zooplankton samples from the 1978 Larval Herring Patch Study and made a preliminary run of the data in a copepod production model. The remainder of the larval herring gut content data was entered on HP-85 files, and she began entering 0.333 mm mesh zooplankton data on computer files from the same study. Time was spent training Peter Auditore on larval gut content processing and zooplankton identification. She also prepared an abstract for the June 1983 American Society of Limnologists and Oceanographers meeting on a comparison of larval cod and haddock prey selection in stratified vs. well-mixed environments.

Philip LeBlanc continued analysis of zooplankton from silhouettes made on *Albatross IV* Cruise No. 82-05. He completed the identifications and length measurements of all ichthyoplankton from the first 28 bongo hauls made on *Albatross IV* Cruise No. 81-03. Sorting of ichthyoplankton continues from *Albatross IV* Cruise 81-03 bongo and MOCNESS hauls. Phil participated in the Ocean Pulse Survey, *Albatross IV* Cruise No. 82-09 (29 Nov-10 Dec).

Peter Auditore began his temporary assignment on 29 November and started processing larval cod and haddock gut contents from *Albatross IV* Cruise No. 81-05. Hal Merry repaired three MARMAP meter blocks to meet cruise requirements; repaired and tested MOP III digitizer, repaired PET computer, and set up and tested the HP-85/VAX computer data transfer system. Hal also met with BESS representatives to define our requirements for conversion of MOCNESS to the new 12-bit electronics system. Time also was spent preparing a list of spare parts for our MOCNESS units.

### Ecosystem Dynamics Investigation

Marv Grosslein worked on writing the chapter on Fisheries Ecology for the Georges Bank book as well as serving as editor on other chapters. Marv also prepared an NEFC issue paper on a research strategy for recruitment processes. An integrated approach is discussed combining laboratory, field and simulation studies for the first year of life of selected Georges Bank species. In addition, Marv proofed the final galleys for the New York Bight Atlas.

Wendell Hahm spent 29 November to 10 December aboard the *Albatross IV* assisting the Food Habits Group to take stomach samples. Wendell reviewed Dr. Laevastu's Bulk Biomass Model prior to a seminar by Nic Bax (Northwest and Alaska Fisheries Center, Seattle). Nic's seminar cleared up some questions about Laevastu's model, but there is still considerable concern about the iterative aspects of the model. Wendell also had discussions with Ken Sherman and Julian Goulet (NEFC, Narragansett) and Candice Oviatt (MERL, University of Rhode Island) about applications of GEORGE.

During December, Ed Cohen attended the joint American Geophysical Union/American Society of Limnologists and Oceanographers meetings in San Francisco. Ed presented a talk in the special larval fish section on

"Physical Processes and Year-Class Strength of Commercial Fish Stocks on Georges Bank," by E. Cohen, D. Mountain and W. Smith. The paper was also presented in a poster session.

After the American Geophysical Union meeting, Ed went to Seattle to work with people at the Northwest and Alaska Fisheries Center on modifications to various aspects of GEORGE and a method of population size estimation called POPFIT, developed by C.M. Lynde and L.J. Bledsoe. Ed also presented the American Geophysical Union paper at a special seminar at the Northwest and Alaska Fisheries Center, and had discussions with Dr. K. Banse and W. Arons on our work on the relationship between physical oceanography and year-class strength. Mike Pennington continued work on the statistical analyses of the MARMAP survey procedures. Roger Theroux completed the first draft of the Georges Bank book chapter on "The Bottom Animals." He also worked on pasting-up the galleys of the bivalve manuscript and continued work on moving the decapod collection to the Museum of Comparative Zoology at Harvard University. William Michaels, James Myette, Thomas Morris and Ray Bowman worked on preparing the food habits data on priority species for 1978-80 for data entry. Ray and William completed the first draft of a paper, "Food of Seventeen Species of Northwest Atlantic Fish." Ray and Mike Pennington continued work on a paper describing the calculation of daily ration for field stomach contents data. Charles Wheeler continued work on the food habits of cod during 1973-76. He also did further work on the green crab study. He noted that green crabs continued their recovery from the severe winter of 1980-81 in Sippewissett Marsh. Thomas Morris continued work on a computer program for reference listings by various key words (KWIC).

#### Plankton Ecology Investigation

Investigation personnel attended a Marine Ecosystem Division meeting held at Narragansett.

Jack Green continued compilation and analysis of zooplankton data over the last 70 years for comparison with MARMAP data as part of a study of the long-term trends in the plankton of the northeast U.S. shelf. In early December, Jack participated in the modeling work with Nic Bax from the Seattle Laboratory of the Northwest and Alaska Fisheries Center. Also during November and December, he continued analyses of the MARMAP data for a report on the zooplankton in Southern New England and the Mid-Atlantic Bight for a study of the potential impact of dumping in the area of Deepwater Dump Site 106.

Joe Kane was at sea from 1-11 November on the last leg of the fall groundfish survey and from 13 to 22 December on a MARMAP Survey. The balance of November and December was spent analyzing prey selectivity of larval fishes (cod and haddock from *Eureka* Cruise No. 80-02).

Jerry Prezioso sent off the following overseas shipments: plankton samples from MARMAP Cruises *Albatross IV* 81-11, 81-12, 82-08, 82-11; *Delaware II* 82-05; and a shipment of vials, caps, and supplies to the Plankton Sorting and Identification Center at Szczecin, Poland. Frozen halibut samples from Seattle were sent to the Polish Sorting Center for parasite studies and frozen cod samples to Jarle Morke at the Trondheim Biological Station in Norway. Jerry also continued work with the computer services group in building a DATMAN data base for krill and Antarctic zooplankton samples that were measured with the image analysis system.

During November and December, Donna Busch began work on a remote sensing project for the U.S.-Canada issue, worked on an American Society of Limnologists and Oceanographers presentation with Ken Sherman and Wally Smith, investigated possibilities for recording surface chlorophyll underway during MARMAP cruises for Robert Edwards, and reviewed manuscripts for the Division Chief. On 2 December Donna met with Dave Mountain and Ken Sherman to discuss integration of remotely sensed imagery with Marine Ecosystem Division investigations. From 13-17 December, she worked with Nic Bax from the Northwest and Alaska Fisheries Center on SKEBUB, a biomass model for Georges Bank. During the final week of December, she and Carolyn Griswold moved from their offices in the main laboratory building to a trailer behind the present laboratory. Donna and other members of the Solar Committee met with SUNSAV regarding construction of solar modifications for the Narragansett Laboratory.

Carolyn Griswold reviewed a manuscript for the *Fishery Bulletin* and also provided Aaron Rosenfield with comments on a series of Marine Sanctuary Proposals. She worked on a joint NEFC, Harbor Branch Foundation and United States Navy proposal for water column studies using the Johnson/Sea Link system. That proposal was submitted to the NOAA MURP office. Carolyn participated in a MARMAP cruise on the *Delaware II* from 29 November-10 December.

On 16 November, R.C. Hennemuth visited Narragansett to review Marine Ecosystem Research with Ken Sherman.

#### Image Analysis

On 16 November, Perry Jeffries (University of Rhode Island) met with Ken Sherman, Jack Green, Ray Maurer, and Mark Berman (University of Rhode Island) to discuss actions for completing development of the Automatic Plankton Sorting System.

During the month of December (1-20) Ray Maurer participated in a GOMEX-II cruise aboard the *Oregon II*. The GOMEX surveys, supported by NOAA, Office of Marine Pollution Assessment, are conducted by the Beaufort Laboratory in cooperation with the Atlantic Oceanographic and Meteorological Laboratory in Miami. These studies focus on the effect of the Mississippi River plume on the growth and survival of spot, menhaden and croaker larvae. The initial three days were spent making extensive surface maps of chlorophyll, temperature, and salinity to define the horizontal gradients over a 150 sq mi area of Southwest Pass. Chlorophyll values were provided to the University of Miami to calibrate their algorithm for processing coastal zone color scanner images. Two scenes were selected during the cruise and enhanced. The enhanced satellite images showed highest chlorophyll occurred in broad bands between salinities of 30 and 31 ‰. These were large areas of well-mixed water. The chlorophyll algorithm "broke down" in areas of extremely high silt (i.e., river water <10 ‰).

Two density fronts were detected by the mapping exercise. On either side of the primary front, salinities were 16 ‰ and 26 ‰, respectively. A much less well-defined secondary front was found about 15 mi seaward. Salinity ranged from 32 ‰ to 36 ‰ across the secondary front.

Both salinity and chlorophyll maps matched remarkably well with coastal zone color scanner images. After the mapping was complete, intensive sampling began inside and outside the river plume. Activities included: collection of larval fish for gut analysis, otolith aging,

morphometric analysis, and trace metal bioaccumulation. Shipboard experiments were conducted with lab-reared larval spot to determine feeding success of larvae. Mike Dagg (LUMCON) and Jeff Turner conducted shipboard grazing experiments using species of copepods which are known to be larval prey. Fine-scale resolution of horizontal patchiness and vertical distribution of larvae and prey were studied using both the MOCNESS and the plankton camera. Although the MOCNESS experienced minor problems, most were easily remedied. The plankton camera performed without problem throughout the entire cruise. Dianne Stoecker (WHOI) participated on the second leg collecting and culturing microzooplankton. Carol Kreader (Atlantic Oceanographic and Meteorological Laboratory) measured  $^{14}\text{C}$  primary productivity and collected zooplankton for RNA/DNA analysis.

"Eyeball" examination of MOCNESS samples revealed high densities of menhaden larvae ( $500/200 \text{ m}^3$ ) on the seaward side of the primary front. Larvae ranged between 15 and 35 mm in size. Subsequent analysis of MOCNESS and plankton camera film will provide a detailed description of larval distribution.

On 1 December, Ray Maurer met with Andy Kemmerer (SEFC) and Will Seidel (SEFC) to discuss progress and status of several projects, including: automated plankton processing system, midwater sampling for post-larval and juvenile fish, automated scale reading device, and RUFAS I and II.

### Biostatistics

2 December Herb Stern and Gene Heyerdahl visited the Narragansett Laboratory to discuss the ADP funding shortfall for FY 1983.

### Fishery Oceanography Investigation

The Oceanography Investigation welcomed two new people on board in November and December. Benjamin Marshall is an oceanographer who will work primarily on the analysis of the warm core ring data. Jack Thiel is our new electronics technician. Dana Densmore also returned to the investigation as a permanent intermittent for doing hydrographic work on MARMAP cruises. The last MARMAP cruise of the year was accomplished between 15 November and 22 December on *Delaware II* Cruise No. 82-09. Dan Patanjo, Brisdell Hunt, Ben Marshall, Steve Ramp and Dana Densmore were all involved in the hydrographic sampling. Steve Ramp has been testing a new conductivity-temperature-depth data processing system for the VAX computer. When completed, the system allows final processing and plotting of the high density (30 samples per second) conductivity-temperature-depth data from the warm core ring cruises. The Unifax recorder which receives images from polar orbiter and GOES satellites is finally operating properly. Sam Nickerson is maintaining a file of the images received.

### Apex Predators Investigation

All 1982 tag and recapture data which includes approximately 4600 tagged sharks with 140 recaptures, has been coded and entered into the EPA computer. Fred Lurch and Pat Hadfield have prepared preliminary distribution maps and tag and recapture data for the 1982 newsletter, "The Shark Tagger." In the past two months, tags have been returned from blue (6), tiger (1), sandbar (1), and dusky (3) sharks. These included blue sharks that were at liberty for over two years and travelled up to 2500 mi

between New Jersey and the Cape Verde Islands. The sandbar was at liberty for five years and showed movement from off New York to Tampico, Mexico (2000 mi).

In November and December, John Hoey completed a revision of "A Comparison of Species Composition and Catch Rates from Pelagic Longline Fisheries in the Western North Atlantic." The draft was circulated for in-house review. Modifications were suggested and a revision is underway. Swordfish weight data was coded and entered into a new data base. The weight data summarized records from 659 sets from 1970 to 1982 and accounted for over 14,000 individual swordfish. Recent swordfish longline records (1981 and 1982) were also coded and added to the main longline data base. An outline was completed for a paper tentatively entitled, "The New England Swordfish Fishery 1963-1982: Trends in Catch and Effort." The paper combined the analysis of the individual set records with the analysis of the weight data. Summary tables and figures were prepared and a first draft was started. The paper will discuss effort distribution, seasonal distribution of catch, temperature and its influence on distribution and abundance, size stratification on the longline grounds, frontal zones and their influence on abundance, and trends in the catch rates over time.

Wes Pratt developed an ADP format and began coding all raw shark reproductive field data excepting the blue shark, which has been worked up previously. Enough new biological material and information has accumulated to make contributions toward the reproduction of shortfin mako, thresher and several other shark species. To this end, Gregg Skomal began histological processing of selected tissues of the above species already in the paraffin block stage.

Chuck Stillwell completed the first draft of a manuscript on the food and feeding ecology of the swordfish in the Northwest Atlantic. Nancy Kohler is currently editing the length-weight and total length-fork length data bases for sharks, swordfish, and tuna, and is concurrently generating new regressions for them.

Wes Pratt, Chuck Stillwell, and John Hoey attended the Southern New England Chapter of the American Fisheries Society meeting in Warwick on 13 December. We assembled 35 mm slide presentations on apex predators for two New York sportsmen shows. These were prepared for the Montauk Captains Association and NEFC and regional office personnel, which represented our interests.

### Publications

- Bolz, G.R., Lough, R.G. Larval cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) growth on Georges Bank, late winter and spring 1981. MARMAP Contribution MED/NEFC 82-64. Fish. Bull. U.S. (S)
- Buckley, L.J. RNA-DNA ratio: an index of larval fish growth in the sea. MARMAP Contribution MED/NEFC 82-54. Science. (S)
- Casey, J.G., Pratt, H.L., Stillwell, C.E. Age and growth in the sandbar shark (*Carcharhinus plumbeus*) from the Western North Atlantic. Can. J. Fish. Aquat. Sci. (S)
- Lough, R.G., Pennington, M., Bolz, G.R., Rosenberg, A.A. Age and growth of larval Atlantic herring, *Clupea harengus* L., in the Gulf of Maine-Georges Bank region based on otolith growth increments. MARMAP Contribution MED/NEFC 81-6. Fish. Bull., U.S. 80(2):187-199. (P) (1982).

- Pratt, H.L., Jr., Casey, J.G. Age and growth of the shortfin mako, *Isurus  
oxyrinchus*. Can. J. Fish. Aquat. Sci. (S)
- Sherman, K., Green, J.R., Goulet, J.R., Ejsymount, L., Sushin, V.A.  
Zooplankton coherence in a large Northwest Atlantic Ecosystem. MARMAP  
Contribution MED/NEFC 82-68. Science (in preparation).
- Smigielski, A.S., Halavik, T.A., Buckley, L.J., Drew, S.M., Laurence,  
G.C. Mar. Ecol.-Progr. Ser. (in preparation).
- Smith, W. Surveys reveal Atlantic herring larvae missing from Georges  
Bank. Coastal Oceanography and Climatology News 5(1):7 p. (1982).

### Reports

- Buckley, L.J., Laurence, G.C. NEMP Annual Report. Narragansett Laboratory  
Ref. No. 82-66.
- Sherman, K. BIOMASS: Organization of a large scale ecosystem study.  
MARMAP Contribution MED/NEFC 82-74. Prepared for NOAA Briefing,  
Washington, D.C., 30 Dec. 1982. Narragansett Laboratory Ref. No. 82-  
75. (1982).

### Miscellaneous

#### Travel, Meetings, and Presentations

- 19 November Carolyn Griswold attended a meeting of the Atlantic  
Fisheries Biologists in Newport, R.I.
- 22-23 November, Dave Mountain attended a meeting at Bigelow Laboratory  
concerning the U.S./Canada boundary dispute.
- 5-14 December, Geoff Laurence, Roz Cohen, Ed Cohen, Dave Mountain, Ron  
Schlitz, and Ken Sherman attended the annual winter meeting of the American  
Geophysical Union/American Society of Limnologists and Oceanographers in  
San Francisco. Geoff presented a paper, "Ichthyoplankton in Entrained  
Water of Warm Core Rings," by G.C. Laurence and B. Burns. Ken Sherman  
presented a paper, "Spawning Strategies of Fishes in Relation to  
Circulation Patterns, Phytoplankton Production, and Pulses in Zooplankton  
Abundance off the Northeastern United States," by K. Sherman, W. Smith, and  
D. Busch. Ed Cohen presented a talk in the special larval fish section on  
"Physical Processes and Year-Class Strength of Commercial Fish Stocks on  
Georges Bank," by E. Cohen, D. Mountain, and W. Smith. Ron Schlitz  
presented a talk, "Observations of Shelf Water Entrained by Gulf Stream  
Warm Core Rings," by R.J. Schlitz, D.G. Mountain, S.R. Ramp, and T.A.  
Laughton.
- 15 December, Carolyn Griswold attended a meeting of the Southern New  
England Chapter of the American Fisheries Society held in Warwick, Rhode  
Island.
- 16 December, Carolyn Griswold travelled to Washington, D.C., to meet  
with personnel from the Office of Research Coordination and Assessment  
concerning the call for information for outer continental shelf Lease Sale  
No. 82.

#### Seminars

- Ken Sherman chaired a meeting at Narragansett to review NEFC studies  
in recruitment.
- 9 November, Tudor Davies (EPA) and Robert L. Edwards met with Ken  
Sherman to discuss joint NEFC-EPA/Narragansett studies on the effects of  
ocean disposal of urban wastes on the northeast shelf ecosystem.

16 November Ken Sherman participated in an *ad hoc* Environmental Coordination Committee meeting convened by Dick Hennemuth at the Milford Laboratory.

17 November Ken Sherman travelled to the Woods Hole Laboratory to discuss NEFC implementation of RAP plans.

1 December, George Ridgway, Brad Brown, Mike Sissenwine, Jack Pearce, Frank Steimle, Bob Pawlowski, Wally Smith, Ken Sherman and Carl Sindermann met at the Narragansett Laboratory with representatives of the Regional Office (Robert Hanks, Ruth Rehfus and Robert Lippson) to discuss implementation of the RAP process.

20 December, a general staff meeting was held to review research progress.

22 December, a meeting was convened at Narragansett to discuss application of satellite imagery to fisheries ecology studies. Attendees included: R.L. Edwards, Donna Busch, Andy Tvirutas, Jay O'Reilly, Jim Thomas, Helen Mustafa, Ken Sherman and Julien Goulet.

29 December, a scientific rap session was held to review information on the seasonal development and decay of the continental shelf cold pool.

E. Cohen presented the American Geophysical Union/American Society of Limnologists and Oceanographers paper, "Physical Processes and Year-Class Strength of Commercial Fish Stocks on Georges Bank," by E. Cohen, D. Mountain and W. Smith in a seminar at the Northwest and Alaska Fisheries Center in Seattle and met with various people there about fishery oceanography and modeling of recruitment processes.

Ken Sherman presented a seminar at the Narragansett Laboratory on "Long-Term Coherence in the Zooplankton Component of the Northeast Continental Shelf of the U.S."

### Visitors

4 November, Roger Theroux met at the Woods Hole Laboratory with Page Valentine (U.S. Geological Survey) about the identification of fossil-bearing rocks recovered by fishermen.

10 November, Donna Busch briefed Ramadan El Sherif (Institute of Oceanography and Fisheries, Cairo, Egypt) on the Marine Ecosystems Division's studies at Narragansett.

Nic Bax, a private contractor working with Taivo Laevastu (Northwest and Alaska Fisheries Center) provided a briefing on the application of the Laevastu Bulk Biomass model to the Georges Bank-Gulf of Maine ecosystem.

3 December, Ray Bowman and Marv Grosslein met at the Woods Hole Laboratory with Bureau of Land Management officials concerning the food habits samples collected at Bureau oil lease study sites.

13 December, Ron Schlitz met with A. Bakon of PEG, Monterey, California, to discuss wind stress curl estimates and its relation to the Georges Bank circulation.

21 December, Greg Lough met with Dr. Richard Radtke (The Pacific Gamefish Foundation, Honolulu, Hawaii) to discuss joint juvenile cod otolith work.

21 December, Dave Mountain presented an overview of Fishery Oceanography projects to a visiting delegation of Chinese scientists.

### University Affairs

Ray Bowman arranged to have two student volunteers work in the Feeding Ecology Task during January on work/study projects. The students are Esther Howard (Antioch College) and Beth Hiler (Colgate University).

16 November, Perry Jeffries (University of Rhode Island) met with Ken Sherman, Jack Green, Ray Maurer, and Mark Berman (University of Rhode Island) to discuss actions for completing development of the automatic plankton sorting system.

19 November, Roger Theroux and Ed Cohen met with Margaret Carreiro (University of Rhode Island) about Georges Bank benthos, plankton, and fish studies.

22-23 November, Dave Mountain attended a meeting at Bigelow Laboratory concerning the U.S./Canada boundary dispute.

24 November, Donna Busch attended a remote sensing meeting at Draper Laboratory with Andy Tvirbutas, Robert Edwards and Helen Mustafa to discuss progress on imagery for the Gulf of Maine and Georges Bank.

In November, Wendell Hahm, Ken Sherman, and Julien Goulet discussed applications of GEORGE with Candice Oviatt (MERL, University of Rhode Island).

8 December, Donna Busch met with Andy Tvirbutas at Draper Laboratory to discuss ground truth for coastal zone color scanner imagery.

14 December, Ed Cohen met with Karl Banse (University of Washington) about NEFC fishery oceanography studies.

15 December, Dave Mountain met with John Steele, Mel Briscoe, and Patrice Kleine (WHOI) to discuss a project by Kleine to model biological/physical interactions on Georges Bank.

16 December, Ed Cohen met with Bruce Frost and Mark Ohman (University of Washington) to discuss a joint paper, "Reverse Diel Vertical Migration: An Escape from Invertebrate Predators."

16 December, Donna Busch, Peter Celone, Woody Chamberlain, and Amy Friedlander met with Peter Cornillon (University of Rhode Island) to observe the procedure for processing satellite images at the cooperative remote sensing center at the University of Rhode Island.

An outline of a course entitled, "Fish Population Dynamics," was developed with Dr. Saul Salla (University of Rhode Island). The course will be a team-teaching effort with Richard Hennemuth, Brad Brown, Mike Sissenwine, Marv Grosslein, Vaughn Anthoy, and Ken Sherman.

Mark Terceiro met with Ken Sherman to review his Ph.D. thesis proposal dealing with multispecies ecosystem studies in Narragansett Bay.

### Personnel

On 29 November, Peter Auditore began a one year temporary appointment with the Larval Fish Dynamics Investigation.

We said goodbye and best of luck to Amy Friedlander, who left us in November. She is pursuing her Ph.D. at the University of Rhode Island.

We said goodbye to Tom Caldwell, Machinist. He retired on 31 December, and we wish him a healthy and happy retirement. William Cheeseman is Tom's replacement, and we congratulate him on his promotion.

Glenn Gioseffi is a volunteer in the Apex Predators Investigation, assisting in the computer input of data and map making.

We welcome back Gregory Skomal. Greg is a Biological Aid working in the Apex Predator's Investigation in the Age and Growth Task.

Jennie Dunnington attended an Office of Personnel Management course, "Proofreading," in Boston 1-2 November.

Debbie Telford attended an Office of Personnel Management course, "Personnel Management for Personnel Assistants," from 8-10 November.

Jack Green attended a University of Rhode Island graduate course during the fall of '82 entitled, "Marine Fisheries Technology."

### EEO Activities

7 December, Ray Bowman and Marv Grosslein attended the monthly laboratory EEO meeting.

18-19 November, Donna Busch attended the New England Regional Conference of Advisory Commissions on Women held at Providence, Rhode Island.

A December planning meeting was held with the Environmental Protection Agency and Rhode Island Department of Education Division of Civil Rights to prepare for the 1983 summer apprenticeship program. No regular scheduled meetings of the committee were held. Donna Busch, Federal Womens Program manager, obtained space for a new bulletin board and has kept it up with current items of interest.

### JANUARY-FEBRUARY

#### Ichthyoplankton Investigation

We were winding up the winter MARMAP ichthyoplankton survey as February drew to a close. The cruise track began on Georges Bank, continued into the Gulf of Maine, then proceeded into the Southern New England and Georges Bank subareas. John Sibunka, Joe Kane, Ellen Johnson, Alyce Wells and Bob Halpin participated in the 4-part survey which utilized both *Delaware II* and *Albatross IV*. They completed 167 of 177, or 94%, of the scheduled stations. Cod and/or haddock eggs were scattered over Georges Bank along with moderate numbers of small sand lance larvae. Atlantic herring larvae were observed intermittently in samples taken around the periphery of the Gulf of Maine, and sand lance numerically dominated catches of Southern New England and Middle Atlantic states. With the exception of young sand lance, fish eggs and larvae seemed to be in short supply throughout the survey area. Our next survey begins on 7 March as part of the annual spring trawl survey. This early spring survey traditionally produces significant numbers of cod and haddock larvae on Georges Bank and we will be watching with interest for a turn-around in last year's catches, the lowest in our 9-yr data base. Trawl surveys subsequent to our late spring 1982 plankton survey substantiated our findings and provided further evidence that the year class for both cod and haddock was poor.

Peter Berrien completed an estimate of the adult spawning biomass of silver hake, which is based on MARMAP ichthyoplankton surveys in 1979. Pete found that spawning began along the southern edge of Georges Bank and off Southern New England between late March and mid-April. Spawning increased sharply during May and June, spreading throughout Georges Bank, Southern New England, and Middle Atlantic waters. Peak spawning occurred during the first half of July. By October, spawning ceased in the Gulf of Maine and was significantly reduced throughout the remainder of the survey area. The principal spawning grounds were centered over the southwestern part of Georges Bank, which accounted for 40% of the total egg production. Pete estimated that silver hake spawned 123.3 trillion eggs and that the adult spawning biomass was 212.6 thousand metric tons.

## Larval Fish Dynamics Investigation

### Experimental Studies

Research with sand lance continued. A study of the effects of temperature (0° to 15°C) and salinity (0-35‰) on hatch duration, viable hatch, and larval size including length, dry weight, yolk and oil volume is in progress. Growth, mortality, and biochemical composition of larvae reared at low densities (1 larva per liter) in 210-l tanks are being studied. This work will provide estimates of the maximum growth rate at high plankton densities and the minimum prey density required for growth and survival.

Sand lance embryos were supplied to the Environmental Protection Agency Laboratory at Narragansett for acute toxicity studies with contaminated sediments and sewage sludge. Larvae from these exposure studies are being analyzed for RNA, DNA, and protein content. Studies of larval digestive enzymes were reinitiated. Suitable assays for trypsin and chymotrypsin-like proteolytic digestive enzymes have been adapted to larval fish. We hope to determine the changes in the activity of these enzymes during early larval development and the effects, if any, of delayed first feeding on enzyme activity.

Deterministic and stochastic model development for the early life stage of cod and haddock larvae utilizing all empirical information (inhouse and published literature, lab and field) available is nearly complete. The models simulate individual larval and population growth and survival and are ready for initialization and verification with field data from Georges Bank.

Geoff Laurence and Larry Buckley attended an ESBS/ASMFC Workshop in January and presented results from the joint NOAA-U.S. Fish and Wildlife Service study of the effects of contaminants on the viability of the early life stages of striped bass. Larry Buckley presented a summary of the Task's activities at the NEMP-Ocean Pulse Annual Workshop.

### Population Processes

George Bolz completed revisions of a manuscript on the retention of ichthyoplankton in the Georges Bank region and resubmitted it to *Journal of Northwest Atlantic Fisheries Science*, and also a manuscript on the age and growth of larval cod and haddock and resubmitted it to *Fishery Bulletin*. George entered bongo ichthyoplankton data on computer from the *Albatross IV* 81-03, and 81-05 spring cruises and prepared basic data summaries.

Dave Potter completed data entry for the MOCNESS ichthyoplankton from *Albatross IV* 78-13 patch study cruise.

Roz Cohen completed a preliminary manuscript on her Ph.D. thesis proposal and has given it to various committee members for review and comment. She has completed a major portion of computer data entry from the 1978 Larval Herring Patch Study; specifically the 61B333 zooplankton data from the northeast Georges Bank grid, and the 61B333 and 20B165 data from the larval herring patch off Cape Cod.

Philip LeBlanc completed zooplankton silhouette analysis from the *Albatross IV* 82-05 cruise and completed the identification and measuring of all ichthyoplankton from the bongo samples made on the *Albatross IV* 81-03 cruise. He is now into the sorting of ichthyoplankton from the MOCNESS hauls from *Albatross IV* 81-03.

Peter Auditore processed larval cod and haddock prey items (213 guts) from three MOCNESS hauls made during spring 1981, as well as entered the available gut data on computer files.

Hal Merry spent considerable time determining replacement parts and expendables required for the MOCNESS units to order in time for our May cruise. The HP-85 computer was tested for use as a VAX data terminal and the required equipment was ordered. Work continued on the adaptation of the HIAC particle size sensor for in situ operations. Four meter blocks were repaired and calibrated for John Sibunka.

## Ecosystem Dynamics Investigation

### Ecosystem Modeling

Marv Grosslein and Ed Cohen continued work on the fishery ecology and ecosystem productivity chapters for the Georges Bank Book. Marv also spent considerable time drafting material for the NEFC recruitment initiative and incorporating it into the FY85 budget initiative.

Ed Cohen worked on modifications to the multispecies model GEORGE to include additional predator and prey species such as spiny dogfish, squid, and sand lance.

Wendell Hahm converted the user manual for the model GEORGE into a Woods Hole Laboratory Reference Document (82-07). To explain some of the utilities of Flow Analysis, a second reference document was submitted (82-13). It reports on the analysis of marine ecosystems along an environmental gradient.

The first draft of Hahm, Hoppensteadt, and Sohn (1983) was completed. The paper is a bio-economic application of the model GEORGE, studying the economic ramifications of fishing strategies. The paper having passed reviews by the economists at the Institute for Economic Analysis (NYC), is being reviewed by Management people (Steve Murawski and William Overholtz) at the NEFC.

Wendell has three simulation studies underway. The first involves simulations relevant to the management strategies. The results of this study are to be released in a joint publication with Tom Leschine (Marine Policy and Ocean Management, WHOI). The second study involves the simulation of benthic perturbations. This study is pertinent to the problem of estimating fisheries changes due to dumping. This is a staff study. The third simulation, with the help of William Overholtz, will study the structural properties of different fish population assemblages that are statistically identifiable.

Michael Pennington continued work on developing statistical techniques for analyzing groundfish and plankton survey data. Mike also worked on procedures to estimate digestion rates of fish from data collected in the field.

Roger Theroux completed the final paste-up of the bivalve manuscript (yes, it has finally come to the stage where we have to literally paste-up the final manuscript layout sheets ourselves to get such papers published--see Theroux for details!). Roger also worked on revisions to his chapter on benthos for the Georges Bank Book, and on the massive job of re-formatting and updating the benthic files onto the VAX system. He also had numerous consultations with researchers on benthic species including the recently discovered Iceland scallop, and became the COTR for a contract with the Museum of Comparative Zoology at Harvard for transfer and archiving of the NEFC mollusc collection.

Lt. JG Brian Hayden, NOAA Corps, began a 3-year assignment in the investigation. Brian will provide data processing assistance for our Division in Woods Hole and also will conduct some research projects on his own. Initially he will be involved in conversion of software for our food habits and benthic studies, and is also assisting with inventory of remote sensing products.

### Feeding Ecology

Several major projects were completed or close to completion at the end of February. Ray Bowman and Bill Michaels completed Part I of "Food of Seventeen Species of Northwest Atlantic Fish" (Part II is presently being typed and will be available shortly). Beth Hiler, a student volunteer (Colgate University), and Ray Bowman completed a Lab. Ref. Doc. entitled "Stomach Contents, Length-Weight Relationship, and Gut Morphology of Atlantic Saury, *Scomberesox saurus* (Walbaum)" (No. 83-04). Esther Howard, another student volunteer (Antioch University), and Ray have compiled detailed listings of the food of seventeen fish species common in Northwest Atlantic shelf waters. A first draft of the manuscript describing the food of juvenile fish, in detail, is nearly complete. Ray Bowman, Rene Eppi, James Myette, and Andrea Swieciki compiled information on the feeding of spiny dogfish in offshore shelf waters for the years 1977-1980. Ray has started a preliminary report on the feeding of this ecologically and potentially commercially important species. Charlie Wheeler completed drafts of three papers. The first concerns lobster larvae abundance in Buzzards Bay. The second deals with 20 years of weather observations in the Woods Hole region. The third is the examination of the food of Atlantic cod for the years 1973-1976. Charlie's retirement commences on 31 March 1983. Thomas Morris prepared final drafts on two papers; the first describes feeding strategies of 17 species of marine fish and the second examines the mouth morphology of several flatfish species. Tom also began work on a study of the food of bluefish. Bill Michaels started work on the examination of the diet of weakfish.

Ray Bowman, Thomas Morris, and Bill Michaels participated on RV *Vicenzo* Cruise No. 83-01. Part of the cruise was allocated for feeding ecology studies at BLM sampling sites in Southern New England and on Georges Bank.

### Plankton Ecology Investigation

Jack Green has been working with Ken Sherman and Julien Goulet on a manuscript describing the trends and coherence in zooplankton biomass and species numbers throughout the year based on 5 years of MARMAP surveys and a previous seventy years of sampling published by previous workers. During January Steve Kakkinakis (a student from Colgate University) worked in the plankton laboratory on an experiment to compare measurement of krill with the image analyzer vs. conventional measurement techniques.

Jack Green has been working on analysis of zooplankton data from the Southern New England and Mid-Atlantic Bight areas, for a report on the effects on the zooplankton community in the vicinity of Deep-Water Dumpsite 106.

Joe Kane completed a first draft of "The Feeding Habits of Co-Occurring Cod and Haddock Larvae from Georges Bank." In addition, Joe has been assisting Jack Green with computer processing of data from pump samples collected on *Eureka* Cruise No. 80-02 and *Albatross IV* Cruise Nos.

81-03 and 81-05. Joe was also at sea to collect plankton samples during the *Delaware II* 83-02 herring cruise.

Pat Michalik is currently sorting the *Albatross IV* 82-05 plankton pump samples and assisting in data entry for ADP.

Jerry Prezioso participated in the first leg of *Needler* Cruise No. 83-01, a joint Canadian-U.S. larval squid survey. The cruise lasted from 28 January to 14 February and surveyed the northern edge of the Gulf Stream between Cape Hatteras and northern Florida for the distribution and abundance of larval and juvenile *Illex illecebrosus* at one of the southernmost transects.

Donna Busch met with Dave Mountain at Woods Hole 23 February to discuss remote sensing applications in larval recruitment studies.

### Image Analysis

During January an Eclipse computer and other supplementary hardware were moved from the University of Rhode Island Electrical Engineering Department to the Narragansett Laboratory. The Eclipse system is the data handling portion of an image analyzer based automatic plankton sizing and identification system being assembled and tested over the next few months. Mark Berman is currently reviewing software and making program modifications to the system until the fabrication of the image producing equipment is completed. The image processing software was demonstrated to Dr. Niels Hjerslev of the University of Copenhagen during his visit to review our remote sensing methodology during the week of 16 February.

### Biostatistics

Tom Plichta and Julien Goulet worked on statistical analyses and graphic analyses for the zooplankton coherence paper. Julien also worked with the System Support Group on design of software for quality control and editing of data in the MARMAP Ecosystem Data Base (MEDB). Bob Kenney produced several data tapes and graphic outputs in support of U.S./Canada boundary issue.

On 5 January, Kevin Kolodzy, Sue Koelb, Robert Sand (System Support Group-University of W. Fla.), and Robert Payne (EPA) presented an overview of data processing capabilities for the Investigation Chiefs at the Narragansett Laboratory.

On 24 January, Wendell Hahm (Woods Hole), Ken Sherman, and Julien Goulet met at Narragansett to discuss analyses scenarios on the model GEORGE needed for an ecosystems modelling book.

On 4 February, the System Support Group, the Biostatistics staff and Ken Sherman celebrated the first successful test of the first module for data base processing on the PDP11.

Kevin Kolodzy left the System Support Group at the end of January for greener pastures in the commercial world.

### Fishery Oceanography Investigation

During January the Fishery Oceanography Investigation welcomed Paul Jessen on board. Paul completed a Master of Science in physical oceanography at Texas A&M University and is in a temporary oceanographer position. In January two legs of MARMAP cruise DE 83-01 were completed with Dana Densmore, Dan Patanjo, Catherine Jewell, and Paul Jessen making the hydrographic measurements. The Unifax recorder, which receives satellite infrared images, is now working operationally. Sam Nickerson is

cataloging the images as they are received for any investigations in the Center who should desire to use them.

Ron Schlitz and Ben Marshall are beginning to make progress in processing the CTD data from the 1982 Warm Core Rings cruise. Processing had been slowed while a software processing system was developed for the VAX computer. It, too, had been slowed due to software problems associated with the conversion to the VAX. David Mountain and Paul Jessen have begun an analysis of the MARMAP hydrographic data concentrating first on a volumetric description of the deep waters in the Gulf of Maine.

### Apex Predators Investigation

There were 14 recaptured sharks during January and February. In January we received information on the recapture of 2 blue sharks, 1 sandbar shark, 1 tiger shark, and 1 dusky shark. A Mediterranean recaptured blue shark was at liberty for over 15 months and travelled from south of Marbella, Spain, to north of Algiers. The tiger shark was tagged and recaptured off Puerto Rico (at liberty for 25 mo). The dusky, out 5 mo, was tagged and recaptured off Bermuda by the same person.

During February there were 5 tag returns from blue sharks, 4 of which were at liberty less than a year and one which was out for two years. The latter travelled 823 mi from southeast of Bermuda to off the east coast of Florida. The most important return came from a sandbar at liberty for 17.5 yr (211 mo). This is the new record for time at liberty for any shark tagged by our program. This sandbar shark was tagged off Virginia and recaptured by a commercial longliner in the Gulf of Mexico off Tampa Bay, Florida, (1,156 mi).

Also in February, tags were returned from a tiger, bignose, and whitetip shark. The tiger travelled 1,853 mi in 6 mo from Hudson Canyon to Costa Rica. This is a new long-distance record for tagged tiger sharks. The bignose was tagged off South Carolina and recaptured in the Caribbean off the Yucatan Peninsula, Mexico (1,049 mi after 33 mo). The RV *Wieczno* tagged the whitetip south of the Cape Verde Islands: it travelled 998 mi west of the tagging site in almost 4 mo.

Final abstracts of the age and growth papers on the sandbar and shortfin mako sharks were submitted to the workshop convenor for publication in the proceedings of the First International Workshop of Oceanic and Pelagic Fishes, held in Miami in 1982. Wes Pratt and Greg Skomal started summarizing all available white shark capture and sighting information in an attempt to discern seasonal distribution of white sharks in the western North Atlantic.

Work was completed on our newsletter, "The Shark Tagger," and it was delivered to the printer. We hope to have it completed for mailing in early April.

Jack Casey, Chuck Stillwell, Nancy Kohler and John Hoey prepared for, and departed on the RV *Wieczno* to explore pelagic fish populations around cold core rings and gather data on blue shark food habits.

### Publications

Bolz, G. R., and R. G. Lough. Larval cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) growth on Georges Bank, spring 1981. MARMAP Contribution MED/NEFC 82-64. Fish. Bull., U.S. (A).

- Bolz, G. R., and R. G. Lough. Retention of ichthyoplankton in the Georges Bank region during the autumn-winter seasons 1971-1977. MARMAP Contribution MED/NEFC 82-05. J. Northw. Atl. Fish. Sci. (A).
- Cohen, R. E., R. G. Lough. 1983. Prey field of larval herring *Clupea harengus* on a continental shelf spawning area. MARMAP Contribution MED/NEFC 81-10. Mar. Ecol.-Prog. Ser. 10:211-222 (P).
- Laurence, G. C. 1982. Nutrition and trophodynamics of larval fish--review, concepts, strategic recommendations and opinions. pp. 123-171. In B. J. Rothschild and C. G. H. Rooth (eds.) Fish ecology III. A foundation for--REX A Recruitment Experiment. Univ. of Miami, Fla. Tech. Rep. No. 82008.
- Smigielski, A. S., T. A. Halavik, L. J. Buckley, S. M. Drew, and G. C. Laurence. Spawning, embryo development and growth of the American sand lance, *Ammodytes americanus*, in the laboratory. MARMAP Contribution MED/NEFC 82-63. Mar. Ecol.-Prog. Ser. (S).
- Sherman, K., R. Lasker, W. Richards, and A. Kendall. Ichthyoplankton and fish recruitment studies in large marine ecosystems. MARMAP Contribution MED/NEFC 82-75. Trans. Am. Fish. Soc. (S).
- Pratt, H. L., Jr., and J. G. Casey. Summary Paper, Age and growth of the shortfin mako, *Isurus oxyrinchus*. MARMAP Contribution MED/NEFC 82-3. NOAA Tech. Rep. SSRF (S).
- Casey, J. G., H. L. Pratt, and C. E. Stillwell. Summary Paper, Age and growth of the sandbar shark, *Carcharhinus plumbeus*, from the Western North Atlantic. MARMAP Contribution MED/NEFC 82-59. NOAA Tech. Rep. SSRF (S).
- Kane, J. 1982. Effect of season and location on the relationship between zooplankton displacement volume and dry weight in the Northwest Atlantic. MARMAP Contribution MED/NEFC 81-8. Fish. Bull., U.S. 80(3):631-642 (P).

### Reports

- W. Hahm. 1983. An introduction and users manual for the model: GEORGE. Woods Hole Lab. Ref. Doc. No. 82-07.
- Hahm, W. 1983. An analysis of marine microcosms along an environment gradient. Woods Hole Lab. Ref. Doc. No. 82-13.
- Hiler, B. and R. Bowman. 1983. Stomach contents, length-weight relationship, and gut morphology of Atlantic saury, *Scomberesox saurus* (Walbaum). MARMAP Contribution MED/NEFC 83-05. Woods Hole Lab. Ref. Doc. 83-04.

### Miscellaneous

#### Travel, Meetings, and Presentations

10-13 January, Dr. Richard L. Radtke (Pacific Gamefish Foundation, Honolulu) and George Bolz presented a paper at the 1983 Larval Fish Conference Committee meeting, Colorado State University, Ft. Collins, entitled "Strontium-Calcium concentration ratios in cod, *Gadus morhua*, otoliths: their utilization as life history indicators."

16-18 January, Ken Sherman attended the 7th Annual Larval Fish Conference sponsored by the American Fisheries Society, Early Life History Section Meeting, at the University of Colorado, Ft. Collins. He presented a paper entitled "Ichthyoplankton and Fish Recruitment Studies in Large

Marine Ecosystems" which was authored by Kenneth Sherman, Reuben Lasker, William Richards, and Arthur Kendall.

10 February, Kenneth Sherman presented a talk on fisheries assesment to students at the University of New Hampshire as a contribution to a zoology department course on the ecology and the management of resources of the Georges Bank-Gulf of Maine Region.

#### Administrative Travel and Meetings

6 January, a solar preconstruction meeting was held at the Narragansett Laboratory to finalize details before installation of solar equipment.

10 January, Dave Potter met with solar engineers from Rockwell International for the Woods Hole Laboratory solar project.

5-26 January, Dave Potter attended two Space Committee and two Library Transition Committee meetings.

13 January, Ken Sherman attended a mini Board of Directors meeting.

26 January, A meeting of the Narragansett Solar Committee was held to discuss window modifications and document construction problems.

1-7 February, Dave Potter and Steve Ramp travelled to Washington, D.C. to collect transferred Office of Ocean Technology and Engineering Services property.

16-17 February, Ken Sherman attended a Board of Directors meeting and a PMAC meeting at Woods Hole.

24 February, Tony Bocelle, Tom Halavik, Dick Broderick, Donna Busch, Peggy Lamoureux, Ray Maurer, Louise Andsager, and Bill Cheeseman attended a solar meeting to resolve construction problems at the Narragansett Laboratory.

#### Seminars

5 January, Kevin Kolodzy, Sue Koelb, Robert Sand (System Support Group-UWF), and Robert Payne (EPA) presented an overview of data processing capabilities for the Investigation Chiefs at the Narragansett Laboratory.

8 January, Wally Smith attended a meeting at the Narragansett Laboratory to discuss options for the FY84 vessel schedule.

11 January, Kenneth Sherman attended a RAP meeting at the Sandy Hook Laboratory.

12 January, Kenneth Sherman presented an in-house seminar on his American Geophysical Union/American Society of Limnologists and Oceanographers paper, "Spawning Strategies of Fishes in Relation to Circulation Patterns, Phytoplankton Production, and Pulses in Zooplankton Abundance off the Northeastern United States" by K. Sherman, W. Smith, and D. Busch. He also gave the same talk to EPA, Narragansett, on 14 January; to Woods Hole Laboratory scientists on 21 January; to Sandy Hook Laboratory scientists on 27 January, and to a Fish Recruitment Seminar at the Page Building in Washington, DC, on 2 February.

27 January, David Mountain, Marv Grosslein, Kenneth Sherman, Wally Smith and Wally Morse met at the Sandy Hook Laboratory to discuss data sources and distribution, and interdivisional coordination and cooperation with members of the Environmental Assessment Division.

#### Visitors

18 January, Marv Grosslein and Ray Bowman met with Eiji Imamura and Jeff Hyland of the Bureau of Land Management on a proposal to the Bureau

for funds to cover costs of processing fish stomachs collected at Bureau benthic monitoring sites for feeding selectivity data.

14-15 February, Donna Busch attended a meeting at Draper Laboratory, Cambridge, Mass., to discuss ground truth for coastal zone color scanner imagery with Niels Hojerslev (Optical Physicist, University of Copenhagen).

On 16-18 February, Dr. Niels Hojerslev (University of Copenhagen) visited at Narragansett. Discussions were held with Image Analysis personnel, the Synoptic Oceanographic Research Team, and Grayson Wood concerning the fluorometer in the UOR. Dr. Hojerslev discussed remote sensing in regard to Antarctic research policy with Ken Sherman, Donna Busch, and Jack Green.

On 11 February, Donna Busch met with Marianna Pastuszek (visiting scientist from Gdynia, Poland) to discuss cooperative fisheries research.

On 28 February, Ray Bowman met with Ed Backus from the Manomet Bird Observatory to identify squid beaks found in bird stomachs. Surprisingly, none were identified as *Loligo* or *Illex*, the two most common squid in this region.

### University Affairs

Julien Goulet visited Robert Gunter and Trina Hosmer (University of Massachusetts) to deliver a data tape and discuss data modeling and statistical analysis for the U.S./Canadian issue.

On 4 January, David Mountain, Ed Cohen, and Mary Grosslein met with John Steele, Patrice Klein, and Mel Briscoe from WHOI concerning plankton modelling being done by Patrice Klein.

On 5 January, Donna Busch attended a meeting of the Synoptic Oceanographic Research Team was held at the Remote Sensing Laboratory, Bay Campus, University of Rhode Island.

18 January, Donna Busch met with Andy Tvirbutas, (Draper Laboratory, Cambridge, Mass.) concerning ground truth for coastal zone color scanner imagery.

20 January, Donna Busch attended a meeting at the Bay Campus, (University of Rhode Island) regarding the location of an affiliate of the National Cartographic Information Center in Rhode Island.

During January, Steve Kakkinakis (a student from Colgate University), worked in the plankton laboratory at Narragansett on an experiment to determine measurement of krill with the image analyzer vs. conventional measurement techniques.

Beth Hiler, a student volunteer from Colgate University, and Ray Bowman completed Woods Hole Lab. Ref. Doc. No. 83-04 entitled "Stomach contents, length-weight relationship, and gut morphology of Atlantic saury, *Scorpaenopsis saurus* (Walbaum).

Esther Howard, a student volunteer from Antioch University, and Ray Bowman compiled detailed listings of the food of seventeen fish species common in Northwest Atlantic shelf waters. A first draft of the manuscript, which describes the food of juvenile fish in detail, is nearly complete.

10 February, Kenneth Sherman presented a talk on Fisheries Assessment at the University of New Hampshire as a contribution to a spring semester zoology course on The Ecology and the Management of Resources of the Georges Bank-Gulf of Maine Region.

10-12 February, Greg Lough, Ron Schlitz and David Mountain attended a workshop on the Warm Core Rings project at WHOI.

On 11 February, Ed Cohen, Marv Grosslein, and David Mountain met with a group at WHOI regarding modeling circulating and plankton dynamics on Georges Bank; Ed and David have provided data and information on nutrients, chlorophyll, and plankton from International Commission for the Northwest Atlantic Fisheries cruises and are part of a modeling group including WHOI personnel--John Steele, Patrice Klein (post-doc), Mel Briscoe, Brad Butman, and Cabell Davis.

### Personnel

Lt. JG Brian Hayden, NOAA Corps, began a 3-yr assignment in the Ecosystem Dynamics Investigation. He will provide data processing assistance for our Division in Woods Hole and will also conduct some research projects on his own.

Paul Jessen (MS in physical oceanography at Texas A&M) joined the Fishery Oceanography Investigation.

Mark Berman joined the Plankton Ecology Investigation in January. He's an oceanographer who is working on the image analysis system.

The Support Services Section at Narragansett said goodbye and best of luck to Tamara Sharp, who left in January because of an injury.

The Support Services Section at Narragansett welcomes aboard two new Clerk-Typists, Elizabeth Aviles-Rogers and Pamela Taylor.

On 7 February, Dave Potter received a TDY to administration to 30 days.

### EEO Activities

Jack Green was elected Narragansett EEO Chairman. Steps have been taken by Tom Halavik to begin organization of the summer minority student apprentice program in cooperation with EPA.

25 January, Roz Cohen attended a FWP meeting in Woods Hole.

27 January, a Center EEO meeting was held at the Narragansett Laboratory. Donna Busch, Jack Green, and Tom Halavik attended from Narragansett.

## RESOURCE UTILIZATION DIVISION

submitted by

Robert J. Learson, Acting Chief

### SEPTEMBER-OCTOBER

#### Fisheries Chemistry Investigation

Two separate storage studies have been initiated with dogfish. In one study, whole fish are being stored at either 46.4°F or 57°F for determination of storage life. With this information and results already obtained at 32°F, it should be possible to determine kinetics of spoilage of dogfish at temperatures above freezing and to predict quality loss due to mishandling on board the fishing boat. In the other study, irradiated (200 Krad) and nonirradiated dogfish fillets are being stored at 46.4°F to determine the relative roles of the bacterial flora and endogenous enzymes on ammonia formation. The irradiation treatment inactivated about 99.99 percent of the microflora, and any ammonia production in these samples should be due to endogenous tissue enzymes.

### Sensory Analysis

Panel training for the "edibility study" is continuing. Training has been completed in texture evaluation which is being performed at the required level (S.D. =  $\pm 1$ ). Training in flavor profiling is in progress and performance to date is satisfactory. Ultimately, two six-member panels will be formed, one each for flavor and texture evaluation by selecting those individuals exhibiting high sensory perception and precision. These panels will then be involved in a collaborative study involving the Gloucester, Charleston, and Seattle Labs scheduled for mid-November.

### Sensory Chemistry

A study of the effect of packaging material on texture of red hake fillet blocks stored at 0°F is in its 20th week. Thus far, there have been no perceptible differences between vacuum sealed polyethylene, nylon, retort pouch material, or non-evacuated polyethylene packaged blocks as measured by sensory, chemical, or instrumental methods.

After 20 weeks storage at 0°F, minced red hake blocks treated with either a fungal protease or a bacterial protease were judged as borderline in textural quality due to increased rubberiness and fibrosity. Blocks treated with a more potent bacterial protease were also judged borderline due to extreme softness. Control blocks (water added) were extremely tough after 20 weeks; whereas, reference control samples stored at -80°F were rated very good.

Protein patterns of authentic redsnapper and an "unknown" frozen fillet were compared by agarose gel isoelectric focusing at the request of the Wisconsin Department of Agriculture, Trade, and Consumer Protection. The two samples differed by only two major bands out of 23. The unknown sample originated from Brazil while the authentic sample came from Mississippi. There is some indication that there may be two species of red snapper.

Seven skinless fillets were identified as cod (*G. morhua*) for the NMFS Enforcement Division at Portsmouth, New Hampshire.

### Lipid/Nutritional Biochemistry

The last samples of mussels have been collected and placed in frozen storage for lipid and nutritional analyses. The freeze-thaw experiment undertaken in collaboration with the University of Rhode Island has been completed, and the data are in the process of being analyzed.

We are continuing to explore difference procedures for free fatty analysis for our samples and are experiencing difficulty in end point determinations due to turbidity. The methodology involving the high-performance liquid chromatography is in abeyance while new personnel are being trained.

A sample of commercial lobster salad was submitted for species identification by the Maine Department of Agriculture. Several pH ranges have been tried in the isoelectric focusing method in an attempt to determine whether or not other seafoods have been added to the salad. Although some protein bands are showing up on the gel plates, the presence of mayonnaise may be causing some problems. This work is continuing.

During this two month reporting period, four requests for speciation in cooked seafoods have been received.

## Product Safety

ICES Fifth Organochlorine Intercalibration Exercise: Polychlorinated biphenyl's (PCB's) in unspiked and spiked fish oil samples were isolated by two different methodologies. The first methodology employed was the International Council for the Exploration of the Sea deactivated Florisil cleanup. The other methodology was from Official Methods of Analysis of the Association of Official Analytical Chemists with additional cleanup by deactivated silica gel. A Perkin-Elmer Sigma-1 gas chromatograph equipped with a Ni<sup>63</sup> electron capture detector and operated in the pulsed mode was used to analyze the various fractions from each methodology. The following columns were used to analyze the various fractions from each methodology. The following columns were used to analyze the various fractions.

1. A six foot by 2 mm i.d. glass column of 3% Ovid-101 on 100/120 mesh supelcoport.
2. A six foot by 2 mm i.d. glass column of 1.5% SP-2250 + 1.95% SP-2401 on 100/120 mesh supelcoport.
3. A 25 meter by 0.25 mm i.d. wall coated open tubular glass column of Ovid-225 operated in the split mode.

Various fractions were analyzed by a gas chromatograph interfaced to mass spectrometer (gas chromatography-mass spectrometry) utilizing a 25 meter x 0.31 mm i.d. wall coated open tubular fused silica column of crosslinked SE-54. The mass spectrum of each unknown PCB (four in the International Council for the Exploration of the Sea's kit) was obtained and interpreted. Each of the generated chromatograms was carefully interpreted and the resultant data calculated. The final results were mailed to Dr. Uthe in Halifax, Nova Scotia.

Analysis of PCB's and PAH's in Sand Lance: Three sand lance samples collected from stations 25, 26, and 27 were composited and homogenized. Each sample was worked up in duplicate and analyzed by gas-liquid chromatography on a capillary column. Polynuclear aromatic hydrocarbons (PAH's) were analyzed by high performance liquid chromatography (reversed phase). Final results will be forwarded to Dr. Pearce.

Instrument Maintenance: The Perkin-Elmer Sigma 1 gas chromatograph received a large amount of maintenance. In order to use the capillary system, the Sigma 1 had to be replumbed to accommodate separate carrier gasses. A reconditioned electron capture detector was installed, and the instrument recalibrated. The Sigma 10 console was upgraded to a Sigma 15 and a Perkin-Elmer 3600 Data Station installed.

Grimmer Method Verification: Three identical spiked cod samples and one control were run to determine the reproducibility and yields of this method. Three samples of National Bureau of Standards Standard Reference Material 1580 and shale oil were also run to determine yields and adaptability of the method. The deactivated silica gel and Dephadex LH-20 chromatography steps were thoroughly checked by analyzing a reference mixture of polynuclear aromatic hydrocarbons.

Standards: Standards of PCB's, organochlorine pesticides, and polynuclear aromatic hydrocarbons were prepared. The mass spectrum of each prepared standard was obtained and interpreted.

Chromatography Intelligent Terminal (CIT): Various polynuclear aromatic hydrocarbon samples were run to determine the utility, flexibility, and accuracy of the new 3600 Data Station.

Freezer #7 Flood Cleanup: Chemicals, extracts, standards and fish samples were shipped out of the freezer and discarded or moved to freezer #6, depending on value and condition.

## Fisheries Technology and Engineering Investigation

### Product Standards and Specifications

An initial draft of a proposed U.S. Standards for Grades of Frozen Fish Blocks was prepared in response to industry demand. Later, it was revised as a result of informal discussions with an ad hoc working group consisting of industry and NMFS personnel.

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

A proposed draft U.S. Standards for Grades of Frozen Lobster and a preamble have been sent to the Washington Office for publication in the *Federal Register*.

A proposed draft U.S. Standards for Grades of Fresh or Frozen Fish Steaks and a preamble for publication in the *Federal Register* are in the Washington Office.

A proposed draft of U.S. Standards for Grades of Fresh or Frozen North American Freshwater Catfish and Products Therefrom was reviewed and comments submitted. A proposed sampling plan was prepared to test out the draft. Instructions for using the proposed draft were also prepared.

Comments received on the Proposed U.S. General Standards for Grades of Shrimp are being reviewed in preparation of a Final Rule making document to be published in the *Federal Register*.

Perry Lane participated in the NMFS exhibit at the Fish Expo from October 17-20 at the Hynes Veterans Auditorium in Boston, Massachusetts.

Fred King's manuscript, "Procedure for Cooking Seafood Products," has been granted interim first action status by the Association of Official Analytical Chemists.

Mr. H. Houwing, Institute for Fishery Products, Ijmuiden, The Netherlands, and Fred King have been appointed Co-Associate Referees by the Association of Official Analytical Chemists for the topic, "Determination of Fish Content in Coated Products (Breaded or in Batter)."

### Processing and Preservation

Engineering: All of the equipment to complete the R/V *Gloria Michelle* heating system with the exception of the heat exchanger has been received. The vessel is scheduled to be in the Gloucester area during the week of October 25, and we plan to do as much installation as possible during that time.

The suction accumulator that was ordered for freezer #6 finally arrived and was installed. A series of tests on this room were planned but have been interrupted because severe water damage to freezers #7 and 5 made it necessary to prematurely put #6 back in service. When repairs are completed, we will plan to reschedule these tests. It was noted, however, that the room would respond to cooling between +30°F and -35°F in 12 hours and in 12 hours more would go down to a minimum of -58°F. A heating curve of -13°F to +20°F was established at 45 minutes. With one valve open supplying 1/2 ton of refrigeration, the lowest temperature the room will sustain is -8°F. Therefore, it is expected that the maximum range is +80°F to -58°F, and the controller practical range is +45°F to -35°F.

We have been contracted by Mr. Snelling Brainard of Seabank Industries, Ltd. Mr. Brainard's company is planning construction of up to 15 vessels in the 77 foot class equipped for longlining. He is very much interested in energy conservation, fuel and heat, and plans to use measures

for recovering heat from engine cooling water and waste stack heat. This could be just the break we have been waiting for which will allow us to work on this project which has been impossible up to now because of lack of funds. We are looking forward to working with him and his naval architects on this project. We have also been in contact with a company in New Hampshire that is using stack heat recovery in their electrical generating plant and are planning a trip to view this operation.

A prototype bleeding apparatus is in the process of being fabricated for the purpose of possibly bleeding flounder. This will be semi-automatically, pneumatically operated.

The new concept of a freezer conveying system is temporarily in limbo. A list of possible manufacturers is being compiled to see if they have an interest in such a system.

The quarterly energy consumption results show, for the summer months, a significant decrease in electrical power and natural gas usage.

There have been continuing irradiation jobs for Worcester Polytech and Forsythe Dental Labs.

A new roof is being installed on the main part of the laboratory.

Cape Ann Plumbing has finished installing new pipes for a new air-conditioning glycol system.

An electrical contractor has been accepted to make repairs to various systems in need and upgrade laboratory electrical installations.

Performance Appraisal Plans for the engineering group were completed.

**Fish Bleeding:** Bled (heads removed) and unbled (processed conventionally) day boat cod were stored on ice and taste tested every other day to determine their quality. After six days, a portion of the bled and unbled cod was filleted and the fillets stored in ice. The fillets were also taste tested along with the gutted fish to determine their storage stability. The results show that the bled, gutted fish were acceptable up to 15 days (above 5 on the sensory rating scale); whereas, the ice stored fillets cut from unbled fish were unacceptable after 10 days in ice. The unbled whole fish fillets and the fillets from bled fish were acceptable up to 12 days on ice. The raw cod examination as judged by color and odor showed very little difference in any of the samples. All were unacceptable at the 13th iced storage day taste test.

**Vacuum Packaging:** Skinless cod fillets were vacuum packaged in a "Multivac" machine and stored at 35°F along with control fillet samples stored in a plastic fillet tin. A raw evaluation and a cooked evaluation were given on day one and on day six. All samples were judged as acceptable (graded between 6 and 7) on day one and unacceptable (below an overall score of 5) at storage day six. No conclusions can be drawn for it appears that the initial quality of these cod fillets was questionable. This experiment needs to be repeated with high quality fillets.

**Sorbate Preservation:** The second of three experiments on the shelf life of fillets cut from three day old iced cod dipped in 2.5 and 5.0 percent potassium sorbate was completed. For this work, skinless fillets cut from three day old iced cod were dipped in 2.5 and 5.0 percent potassium sorbate for 10-15 seconds, drained for five seconds, then individually packaged and sealed in air permeable 0.75 mil polyethylene or air impermeable 2 mil mylar and stored in ice. Raw and cooked evaluations were run on these samples against similarly packaged by nondipped controls. Shelf life was determined when any average organoleptic score, both for the raw and cooked evaluations, fell below 5.0 (borderline) on a nine-point hedonic scale.

The results of the first experiment show a shelf life of seven to eight days for the nondipped controls and 15 days for the sorbate treated fillets. Shelf life determinations on the second experiment show a shelf life of 11 to 12 days for the control and 18 to 19 days for the polyethylene and mylar packaged potassium sorbate treated fillets.

This experiment is presently being repeated.

**Squid Technology:** Our Model J Urschel squid slicer was loaned to Ruggiers Seafoods, Newark, New Jersey. A visit was made to their plant both to demonstrate the machine and to act as consultant to them and to personnel of New York Sea Grant at Riverhead, New York. They are going to produce breaded frozen squid rings and strips for domestic sale, and Sea Grant is going to assist in product promotion and marketing.

**Blue Crab:** Analysis of experimental results of two nine-month storage studies on pasteurized blue crabmeat in flexible pouches is continuing.

Experiments are underway to produce organoleptically acceptable sterilized canned blue crabmeat. All of our attempts, so far, have been plagued with problems concerning blueing of the meats after retorting.

**MFIS/University of Rhode Island Cooperative Fisheries Engineering Unit**

Gilles Charoussat has finished his project to test flow patterns in a model of an Isaacs Kidd Midwater Trawl and has returned to the E.N.S.A. in Rennes, France.

The new shrimp survey trawl for the Gulf of Maine was selected and procured. In cooperation with the Northern Shrimp Technical Committee of the Atlantic States Marine Fisheries Commission, tests were conducted using the R/V *Gloria Michelle*. Gear and rigging tests compared "rockhopper" and roller gear, and three types of doors. Selectivity tests were made with and without a 1/2-inch liner in the cod end and with escapement bags on the wing and the extension plate. Comparative tows were made with the new trawl and the existing shrimp survey trawl.

The speed sensor for the "Microlog" vessel instrumentation system was installed during the annual haul out of the *Gloria Michelle*, as was the dual frequency transducer for the University of Rhode Island color echosounder.

*Gloria Michelle* cruises during the period were:

Cruise No.	Title	Duration	Area
GM 82-13	Diurnal Plankton & Benthic Sampling	1 day	Narragansett Bay
GM 82-14	Inshore Bottom Trawl Trawl Survey	21 days	Massachusetts inshore waters
GM 82-15	Diurnal Plankton & Benthic Sampling	1 day	Narragansett Bay
GM 82-16	Northern Shrimp Survey Gear Development	10 days	W. Gulf of Maine

**Technical Assistance**

Information and technical assistance were provided in the following areas: total volatile bases; sodium content of swordfish; darkening of tuna; fatty acid composition of seafood; sterol content of seafoods;

proximate composition of seafoods; processing marinated seafood; lipid analytical methods; brining; ash content; information on mussels and monkfish; analysis of volatile amines by gas chromatography; review paper for U.N. Food and Agriculture Organization; toxicants in fish; tanning fish skins; data on lobstermen's associations; freezing of lobsters; brine shrimp; composition of fish; nematodes in fish; shrimp by-catch; and waste heat recovery on fishing vessels.

### Publications

- Gadbois, D.F. and R.S. Maney. "Survey of polychlorinated biphenyls in selected finfish species from United States coastal waters." Accepted for publication in *Fishery Bulletin*.
- Humason, A.W. and D.F. Gadbois. "Determination of polynuclear aromatic hydrocarbons in the New York Bight area." Accepted for publication in the *Journal of Environmental Contamination and Toxicology*.
- Licciardello, J.J., E.M. Ravesi, and M.G. Allsup. 1982. "Stabilization of the flavor of frozen minced whiting. I. Effect of various antioxidants." *Mar. Fish. Rev.* 44(8):15-21.
- Lundstrom, R.C. "Fish species identification by agarose gel isoelectric focusing: Collaborative study." Accepted for publication in the *Journal of the AOAC* (Jan. 1983).
- Lundstrom, R.C. "Identification of Pacific rockfish (*Sebastes*) species by isoelectric focusing." Submitted to the *Journal of the AOAC*.
- Lundstrom, R.C. and L. Racicot. "Gas chromatographic determination of DMA and TMA in seafoods." Submitted to the *Journal of the AOAC*.

### Miscellaneous

#### Travel, Meetings, and Presentations

Joe Licciardello, Ron Lundstrom, Linda Racicot, Betty Tuhkunen, Jurt Wilhelm, and Judi Krzynowek attended the 27th Atlantic Fisheries Technological Conference held in Portland, Maine. The following papers were presented:

1. R. Lundstrom and L. Racicot. "Gas chromatographic determination of dimethylamine and trimethylamine in seafoods." (R. Lundstrom presented the paper.)
2. L. Racicot and R. Lundstrom. "The effect of oxygen on the enzymatic production of dimethylamine and formaldehyde in red hake." (L. Racicot presented the paper.)
3. K. Wilhelm, J. Licciardello, R. Lundstrom, and E. Ravesi. "Effect of freezing rate on textural stability of red hake fillet blocks stored at 0°F." (K. Wilhelm presented the paper.)
4. J. Licciardello, E. Ravesi, B. Tuhkunen, and L. Racicot. "Effect of some process treatments on the iced shelf life of cod fillets irradiated (Co-60) with 100 Krad." (J. Licciardello presented the paper.)

Ron Lundstrom attended the 96th Annual Meeting of the Association of Official Analytical Chemists held in Washington, D.C. Two associate referee reports were presented:

1. "Identification of Pacific rockfish by isoelectric focusing."
2. "Gas chromatographic determination of DMA and TMA in seafoods"

Ron Lundstrom attended the Factor IV Committee meeting at the Narragansett Lab.

Kurt Wilhelm attended Fish Expo in Boston.

Judi Krzynowek attended the Center's Federal Women's Program meeting.

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

Fred King participated in the 27th annual meeting of the Atlantic Fisheries Technologists Conference, September 20-23 in Portland, Maine. He presented a paper on U.S. legal and technological methods for evaluation of sensory quality as part of a symposium on sensory methodology for seafoods. He was also elected to the Earl P. McFee Award Committee.

Fred King participated in the semiannual meeting of the Research and Development Associates for Military Food and Packaging Systems, October 6-7 in Natick, Massachusetts.

Perry Lane participated in a meeting of the New England Marine Advisory Council Board of Directors.

Perry Lane attended a meeting of the New England Fishery Development Foundation's New Bedford Quality Project Advisory Committee.

Perry Lane participated in a career development workshop sponsored by the Regional EEO Committee.

Perry Lane attended the meeting of the New England Fishery Management Council.

Joe Mendelsohn attended the 27th Atlantic Fisheries Technological Conference in Portland, Maine, on September 20-23, 1982. Joe presented two papers: "High quality assurance of frozen fish" and "A new frozen fish freezer-dispenser."

Burt Tinker attended the Interstate Seafood Seminar in Annapolis, Maryland, September 22-24, 1982.

Joe Mendelsohn, Dan D'Entremont, Dan Baker, and Bob Van Twuyver attended "Fish Expo" held in the Hynes Auditorium in Boston, Massachusetts.

John Kaylor and Tom Connors attended a meeting of the Research and Development Associates Committee on irradiated foods.

Al Blott attended the MTS Oceans '82 conference in Washington, D.C.

The Fisheries Engineering group visited Fish Expo in Boston, Massachusetts.

Al Blott and Vern Nulk attended the Oceanographic Winch and Wire Seminar in Providence, Rhode Island.

Al Blott and Gary Bulmer attended the Northern Shrimp Technical meeting to discuss the shrimp survey gear testing.

#### Visitors

Dr. Kevin Whittle, Torry Research Station MAFF, Aberdeen, Scotland, and Mr. Jacobus Wessels, Fishing Industry Research Institute, Cape Town, Republic of South Africa, visited the Lab September 20 and 24.

#### Public Affairs

Barbara Rasco, a graduate student at the University of Massachusetts Marine Station, spent a day at the lab using our preparative isoelectric focusing apparatus to purify an enzyme preparation.

#### Personnel

Judy Krzynowek attended an Office of Personnel Management course in Performance Appraisal: Improving Performance Standards.

Betty Tuhkunen and Judi Krzynowek attended the Career Development Seminar and Testing.

Al Blott and Vern Nulk attended a SAS training seminar, and Vern Nulk attended an Introduction to FORTRAN.

Fisheries Chemistry Investigation

Product Quality Chemistry

A study investigating the rate of deterioration of dogfish held at elevated temperatures (46.4° and 57°F) was completed. Special attention in this study was paid to the accelerated development of ammonia at these temperatures, damage which often occurs when these fish are allowed to lie around uniced aboard ship during warm summer months. Irradiated (200 Krads) fillets stored at 46.4°F were also monitored. Post-mortem formation of ammonia results primarily from enzymatic degradation of urea. Some of the microorganisms found in dogfish possess this urease enzyme. An impressive reduction in the rate of ammonia formation was shown for the irradiated samples.

Edibility Characteristics

Panel training for the "edibility study" has been completed and two panels have been formed (one each for flavor and texture). Panelists were chosen on the basis of statistical analysis of initial screening tests done and of performance during the training sessions. The collaborative study (involving the Gloucester, Seattle, and Charleston Labs as well as the U.S Army Natick Research and Development Lab) has also been completed, and the results have been summarized and statistically analyzed. Initial results have shown that the panel sessions themselves are replicable, but there appear to be some discrepancies amongst the individual panel members; further analysis should reveal whether these discrepancies are due to definition problems or to variability between the individual fish samples.

Two problems of the Instron Model 1000 are being corrected so it may be used for instruments measurements related to sensory texture evaluations. The punch and die method requires a straight downward motion of the punch during testing. Unfortunately, there is a side-to-side motion which makes alignment of the punch and die difficult. The engineers at Instron are developing a new bearing to alleviate this problem, and it is expected that this should be ready in a month.

The second problem is that the instrument comes with a 500 kg weigh beam as standard equipment. We will exchange this for a 50 kg weigh beam which will operate within the range expected for the edibility study samples.

Preliminary work using a borrowed weight beam indicated the necessity of some modification to the test protocol. These modification will be incorporated into a new version of the procedure manual.

Kurt Wilhelm has written a computer program for data entry, statistical analysis, and report generation using the 1022 ADP system. Although this program was written for the edibility study, it is generally useful for any sensory or instrumental study.

Protein Chemistry

A considerable amount of time was spent during this period running species identification analyses. Using agarose gel isoelectric focusing, we identified the following samples:

- (1) NMFS Western Inspection Office--16 Pacific halibut samples.
- (2) The Gorton Group--1 yellowfin sole sample; 2 European whiting samples; 26 haddock samples.

The final major piece of equipment, a Class 2 Laminar Flow Hood, was received and set up in the Immunology Lab. This hood will provide a sterile work area for manipulation of myeloma and hybridoma cell cultures used in producing monoclonal antibodies. We expect to begin producing monoclonal antibodies against various fish proteins early in the new year.

Ron Lundstrom will attend a week long training program on "Hybridoma/Monoclonal Antibody Production" sponsored by The Center for Advanced Training in Cell and Molecular Biology in January.

We analyzed 16 squid samples for content of dimethylamine for Mr. P. Nitisewoja, a graduate student at the University of Massachusetts Marine Station.

Ron Lundstrom reviewed a manuscript being considered for publication in *Journal of the Association of Official Analytical Chemists*.

### Lipid/Nutritional Chemistry

Species identification has been completed on the Maine lobster salad. Additional samples have been submitted from three other sources for species identification. These samples will require using the cyanogen bromide method perfected by Torry Research because initial workup of the samples by the Association of Official Analytical Chemists Method has yielded no species differentiation.

Due to concern over oil dumping in Gloucester's surrounding water, several private consultants have asked for assistance in developing a technique for identifying the source of these oils (i.e., marine oil and/or vegetable oil). We have done the preliminary analyses and recommend several procedures which will all have to be used to determine the culprit(s). We are contemplating submitting the method as a NOAA Technical Memorandum for other cities and towns with fish processing plants which could benefit from this experience.

### Product Safety

#### Polychlorinated Biphenyl Project (PBP)/Instrument Maintenance: To

conserve the usage of the very expensive carrier gas helium with the capillary split injection port system, it was necessary to redesign and replumb the Perkin-Elmer Sigma 1 gas chromatograph. A great deal of time was also needed to get the Ni<sup>63</sup> electron capture detector in operation.

The Perkin-Elmer 910 gas chromatograph was also redesigned to accommodate a wall coated open tubular silica column. The column is directly connected to the injection port and flame ionization detector. The column enclosure, which presented problems in the past, has been eliminated by the new system. Work was also performed to upgrade the existing carrier gas savings system. This gas chromatograph is presently operating satisfactorily and is presently used to analyze sediment extracts from the Casco Bay region for alkanes, alkenes, and cycloparaffins.

#### PBP/EPA Fat Samples:

Sixty grams of fat from adipose tissue of porcines were received from the Environmental Protection Agency. Half of this sample will be used as part of EPA's intercomparison study for pesticides, and the other half will be spiked with PCB's and used as part of our Quality Assurance Program for PCB's.

#### PBP/Freezer #7 Flood Cleanup:

Cleanup of freezer #7 has been completed. All N-nitrosamine standards and extracts were denitrosated with hydrobromic acid in glacial acetic acid and discarded.

### Polynuclear Aromatic Project (PAP)

Grimmer Procedure: The Grimmer procedure was modified slightly to obtain better yields (80-100%) of three to seven ring polynuclear aromatic hydrocarbons.

PAP/Casco Bay Sediment Samples: Thirty samples have been worked by the Grimmer method. Twenty-three samples were analyzed by high pressure liquid chromatography utilizing ultraviolet and fluorescent detection.

### Fisheries Technology and Engineering Investigation

#### Product Standards and Specifications

A proposed draft U.S. Standards for Grades of Fresh or Frozen North American Freshwater Catfish and Products Therefrom was reviewed and comments submitted. A proposed sampling plan was prepared to test this draft. Instructions for using this draft were also prepared.

Comments received on the Proposed U.S. General Standards for Grades of Shrimp are being reviewed in preparation of a final rule-making document to be published in the *Federal Register*.

A proposed draft U.S. Standards for Grades of Fresh or Frozen Fish Steaks and a preamble for publication in the *Federal Register* are in the Washington Office.

A proposed draft U.S. Standards for Grades of Frozen Lobster and a preamble for publication in the *Federal Register* are in the Washington Office. With our help, the U.S. Army Natick Laboratories have issued a Purchase Description for spiny lobster.

A revised proposed draft U.S. Standards for Grades of Frozen Fish Portions and Fish Stocks has been sent to about 40 organizations for review and comment.

A revised proposed draft U.S. Standards for Grades of Frozen Fish Blocks has been sent to the Washington Office for review and comments by about 25 organizations. Instructions for using this draft were also prepared.

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

#### Processing and Preservation

Frozen Fish: A proposal has been prepared to determine the frozen storage stability at 10°, 0°, and -10°F of fish fillets cut from gutted fish after being held in ice for zero, five, and ten days. The edibility characteristics of these frozen fish will also be determined using the protocol developed at the U.S. Army Natick Research and Development Laboratory. Not only will sensory evaluations be performed on the fish samples, but also their texture changes will be measured on the new Instron according to the instrumental design developed at the Natick Laboratory. To demonstrate how the new Instron works, two people from the Natick Laboratory spent a day in the Gloucester Laboratory measuring the texture of fish flakes.

Fillet Color: An exploratory experiment was completed to determine if there is a visual color difference among cod fillets from a given batch of fish. Fillets from a 25 lb batch of fish were separated into two groups--a white color group and a pink color group. Every other day the fish were examined and the white group still looked white to yellow during storage, while the pink group remained pink throughout iced storage. On iced

storage day one, the color of raw fish from the white group was compared to the color of the fish from the pink group on a Hunter L colorimeter. From the Hunter L, a (green to red) measurement, there appeared to be a significant difference. To confirm these results, the experiment will be repeated.

**Engineering:** The engine room zone of the *Gloria Michelle's* heating system was installed and completed at the dock in Narragansett and is now entirely operational. This means that the entire vessel is now heated with the exception of the after hold which was not done at this time. What remains to be done is the installation of the control valve, control circuits, and heat exchanger which are to be added later and will then give us the capability of engine heat recovery.

**Determination of Amount of Minced Fish in Fish Blocks:** An extensive experimental review of four methods of determining the amount of minced fish flesh in frozen fish blocks is being initiated.

Samples, comprised of blocks produced by Frigor of New Bedford, have been obtained and stored in a -20°F freezer at the laboratory. These blocks are supposed to contain approximately 20% minced flesh.

One method has been examined using 10 frozen blocks. The method is one presently used in New Bedford. The ten blocks examined did contain an average of 19.38% minced flesh. However, the range was from 11.69% to 29.77%. The three remaining methods are to be checked after the holidays.

The drive motor for the rotation of the shelves of the Vendo freezer was repaired. However, after being turned on the freezer did not function properly--never getting below +15°F. Bob Van Twuyver has been notified that it may need a charge of refrigerant.

**Facilities:** The following items have been attended to: (1) The roof repairs have been completed on the main part of the building. Plans are being made to have the northwest wing resurfaced during the spring of 1983. (2) Renovations to the electrical system have been completed. (3) Due to the water damage of October 9 and 14, freezers #5 and #7 have been taken out of operation. The floors in these rooms will be repaired during the month of January. The ceiling in rooms #30 and #31 will also be repaired at that time.

**Sorbate Preservation:** Three separate experiments on the effects of a potassium sorbate dip on fish fillets were completed. For this work, fillets cut from three and five day old iced codfish were dipped in 2.5 and 5.0 percent potassium sorbate, individually packed in air-permeable polyethylene and air-impermeable mylar pouches, and stored in ice. Organoleptic testing was conducted on the raw and cooked fillets until an attribute of appearance, odor, flavor, texture scored below 5.0 (borderline) on a nine-point objective scale. This point in time was considered as being the end of marketable shelf life. These experiments continue to confirm the efficacy of the potassium sorbate dip on shelf life, with a shelf life extension of the dipped fillets of five to seven days over the non-dipped controls.

A proposal to dip freshly caught dressed fish in potassium sorbate aboard the vessel was completed.

#### NMFS/URI Cooperative Fisheries Engineering Unit

Dan Baker and Bob Van Twuyver from the Gloucester Laboratory installed the engine room heating system on the *Gloria Michelle* which is now complete with the exception of the heat exchanger for engine heat recovery.

The design and installation of the hydraulic system to articulate the gallow frame was completed. The new arrangement, which provides an over the stern reach of nearly seven feet, was used successfully to deploy and retrieve a 2,300 pound box core for sediment recovery by the MERL labs at the University of Rhode Island.

*Gloria Michelle* cruises during the period were:

Cruise No.	Title	Duration	Area
GM 82-17	Sea Scallop Collection	1 day	Rhode Island Sound
GM 82-18	Diurnal Plankton & Benthic Sampling	1 day	Narragansett Bay
GM 82-19	Sediment Recovery	1 day	Narragansett Bay

### Publications

- Gorga, C., B.L. Tinker, D. Dyer, and J.M. Mendelsohn. 1982. Frozen seafoods: The economic feasibility of quality assurance to the consumer. *Mar. Fish. Rev.* 44(11):1-10.
- Humason, Alan W. and Donald F. Gadbois. 1982. Determination of polynuclear aromatic hydrocarbons from the New York Bight area. *In: Bulletin of Environmental Contamination and Toxicology*, Vol. 29, Issue 6, December 1982.
- Lundstrom, R.C. 1983. Identification of Pacific rockfish (*Sebastes*) species by isoelectric focusing. Accepted for publication in the July 1983 issue of *Journal of the Association of Official Analytical Chemists*.
- Moody, M., G. Flick, and B. Tinker. 1979. Processing: Methods of cooking and packing crabmeat, mechanization. Proceedings of the Blue Crab Colloquium, Oct. 18-19, 205-214.

### Reports

- 1982 Northeast Monitoring Program Annual Report. Hydrocarbon analysis of targeted fin and shellfish species and sediments collected from northeastern U.S. coastal waters. Report submitted to Dr. Sanford of the Office of Marine Pollution Assessment's Northeast Office for review.

### Miscellaneous

#### Travel, Meetings, and Presentations

Bob Van Twuyver and Dan Baker visited and toured the Foss Manufacturing Company in Hampton, New Hampshire. They operate an ebullient cooled diesel engine cogeneration plant. The primary function of the plant is to produce electrical power. The secondary function is the production of steam through the use of a waste heat vapor phase boiler. The steam is used in their manufacturing process. Mr. Paul Heald, their energy engineer, explained and discussed the system with them.

On December 2, 1982, Fred J. King participated in a meeting of the New England Fisheries Institute in Danvers, Massachusetts. The speaker was Mr. Robert Merner, Consul and Senior Trade Commissioner of the Canadian Consulate in Boston, Massachusetts.

On December 15, 1982, John J. Ryan participated in an industry-government meeting in Greenville, Mississippi, to discuss a proposed draft U.S. Standards for Grades of Fresh or Frozen North American Freshwater Catfish and Products Made Therefrom.

Perry Lane attended a meeting of the Northeast Marine Advisory Council Board of Directors at the New England Center, Durham, New Hampshire.

Perry Lane gave a talk on the fishing industry and the Gloucester Laboratory to members of the Essex Shipbuilding Museum Society.

#### Visitors

Dr. Sam Cohen, U.S. Army Natick Laboratories, to discuss fish muscle microstructure.

Dr. Joe Regenstein, Cornell University, to discuss red hake texture research.

Ken Sall, New York Sea Grant Marine Advisory Service, visited the laboratory to discuss ongoing projects and to meet others engaged in seafood technological work in this area.

On November 17, 1982, a workshop meeting was held at the Gloucester Laboratory to discuss a proposed draft U.S. Standards for Grades of Frozen Fish Blocks. The following people participated: John Ryan, Tom Connors, Fred King and Robert Learson (NMFS, Gloucester Laboratory, Gloucester, Massachusetts); Frank Piraino and Tom Moreau (NMFS Inspection, Gloucester, Massachusetts); Phil McKay (NMFS Inspection, St. Petersburg, Florida); Spencer Garrett (NMFS Inspection, Pascagoula, Mississippi); Glenn Kiel (NMFS Inspection, Bell, California); Irving Sackett and Richard Cano (NMFS Inspection, Washington, D.C.); Steve Berube (Fishery Products, Danvers, Massachusetts); Larry Silvia (Caribou Fisheries, Boston, Massachusetts); James Ackert (The Gorton Group, Gloucester, Massachusetts); Robert Tinay (Frionor Kitchens, New Bedford, Massachusetts); Nils J. Farstad (Safe Harbor Seafood, New Bedford, Massachusetts); Kris Gunnarsson (Coldwater Seafood, Cambridge, Massachusetts); and Joe Parco (Ocean Crest Seafoods, Gloucester, Massachusetts). Tom Moreau was the Chairperson and Fred King was the Rapporteur.

On December 7, 1982, a workshop meeting was held at the Gloucester Laboratory to demonstrate a procedure to determine the amount of minced fish in a mixed fillet-minced fish block. The following people participated: John Ryan, Tom Connors and Fred King (NMFS, Gloucester Laboratory, Gloucester, Massachusetts); Frank Piraino and Tom Moreau (NMFS Inspection, Gloucester, Massachusetts); Steve Berube (Fishery Products, Danvers, Massachusetts); James Ackert (The Gorton Group, Gloucester, Massachusetts); Robert Tinay (Frionor Kitchens, New Bedford, Massachusetts); Nils J. Farstad (Safe Harbor Seafood, New Bedford, Massachusetts); John Juliano, Myron L. Bloom and Irving Usen (O'Donnell-Usen Fisheries, Gloucester, Massachusetts).

Arthur Murphy, Orr's Island, Maine, provided information on shipping lobsters in insulated containers.

#### University Affairs

Manuscript in progress co-authored by Dr. Chong Lee, University of Rhode Island, and Judith Krzynowek addressing changes in fish quality over several freeze/thaw cycles.

Manuscript in progress co-authored by Dr. Carl Berg, Marine Biological Laboratory, Woods Hole, Massachusetts, and Judith Krzynowek on codakia clams.

We analyzed 16 squid samples for dimethylamine content for Mr. Nitisewoja, a graduate student at the University of Massachusetts Marine Station.

Provided information on the use of isoelectric focusing in population genetics to Ms. Mary Fabrizio, a graduate student at the University of Rhode Island, Narragansett, Rhode Island.

Ms Patricia Kelly of the University of Rhode Island, Kingston, Rhode Island, information on squid technology.

### Public Affairs

Provided information in the following areas: cusk livers; quality losses in gill netted fish; monkfish quality attributes; nutritional value of scallops; squid; sharks; eels; biological oxygen demand requirements; vessel safety; Torrymeter; chlorination; preservation; canning fishery products; ocean quahogs; butterfish; manufacture of stockfish; labeling of processed clupeids; radioactivity of export squid; labeling of fish from Uruguay; sodium level of langostinos; labeling of fish from Taiwan; and identification of black dogfish.

J. Perry Lane contacted Salvatore Camilari, D.P.S.C., and discussed the possibility of putting on a workshop for fish processors on, "How to Sell Seafoods to the Military." Prepared an agenda for the workshop.

At the request of Jerry Paquette, NEFDF's New Bedford Quality Program, J. Perry Lane visited the Parisi Fish Company in New Bedford and reviewed the plant's sanitation practices. He made recommendations for improvements.

Assistance was given to Brigid Cunningham, a University of Rhode Island student, who used some of our videotape to assemble yet another tape presentation describing the benefits from using video recording methods as a scientific tool.

Dr. Frederick J. King has been appointed chairman of Specification Review Committee A-6, Canned Seafood/Shellfish and Seafood/Shellfish Products, of the Research and Development Associates for Military Food and Packaging Systems, Inc.

### Personnel

Three people joined the Fisheries Chemistry Task during this period. Denise Peton and Bob Balaschi will work in the Lipid/Nutritional Chemistry Group under Judith Krzynowek's supervision, and Daniel D'Entremont will assume the duties of Sensory Analyst under the direction of Joe Licciardello.

Judith Krzynowek attended the American Oil Chemists short course in Lipid Analyses in Dundee, Illinois.

Gary Bulmer attended the NOAA diving course in Miami, Florida, to receive NOAA certification.

Twice a week, Al Blott and Vern Nulk are attending a FORTRAN Programming course on the Prime.

## JANUARY-FEBRUARY

### Fisheries Chemistry Investigation

#### Product Quality Chemistry

The immunology laboratory is now operational and experimental trials in producing monoclonal antibodies have been initiated. A starter culture of P3-x63-Ag 8.653, a mouse myeloma cell line, was received from the

Institute of Medical Research's Genetic Mutant Cell Repository, and the cell line was placed into continuous culture with several subcultures being frozen and stored in liquid nitrogen for future use. The myeloma cells are kept in continuous log phase growth and are periodically passaged in a selective medium to inactive revertant mutant clones. Several mice have been immunized against various heat stable proteins from cod and haddock. As soon as adequate antibody titers are detected, sensitized B-lymphocytes from the mouse will be fused with myeloma cells to form a hybrid cell (hybridoma) which secretes the monoclonal antibody. The various hybridoma clones will then be screened to identify the ones producing the antibody of interest. The first fusion will be attempted in early March.

Species identification was completed on processed crabmeat to determine whether or not the product had been adulterated with fish. This investigation led to the following study which was also completed and reported at the Annual Meeting of the National Blue Crab Industry: minced fish (cod) was incorporated into crabmeat at a concentration of either 10, 20, or 40 percent to determine the level of adulteration that could be detected by the species identification method (isoelectric focusing). All levels of adulteration were detected.

A project to determine the effects of mechanical processing on the lipid fraction of crabmeat has been repeated for the third and final time. The data were so intriguing that the experiment required replication. It would appear from a preliminary perusal of the results that the lipid portion is substantially altered. The mechanism for the alteration has not been identified, and concurrent experiments with the crabmeat have shown a similar alteration during storage.

Vitamin research has just begun with the establishment of standard curves for the fat-soluble vitamins E and K. Preliminary trials for the effects of thermal processing on their vitamins indicate a loss of 10 percent vitamin E, resulting from the thermal sterilization schedule. The effects of microwave cooking will be investigated next.

We are experiencing some difficulty with the analysis of malonaldehyde (a chemical indicator of rancidity) using high-pressure liquid chromatography. This particular analysis is involved in a part of a collaborative study with the University of Rhode Island (Dr. C. Lee); however, we have not been able to generate an acceptable standard curve. This work is continuing.

The trained flavor and texture panels have begun to evaluate fresh fish for certain edibility characteristics. The purpose of this study is to be able to identify and group fish species with similar edibility characteristics as an aid to the consumer in making a purchase or in culinary preparation. Arrangements have been made with a local dealer to obtain "day boat" fish, and seasonal variation and stage of freshness will also be monitored.

#### Product Safety

Polychlorinated Biphenyl Project (PBP)/Instrument Maintenance: The new electron capture detector installed on the Sigma 1 Gas Chromatograph turned out to be defective. Perkin-Elmer replaced it, but a great deal of time was used in installing the new detector and conditioning a new mixed phase packed column before maximum performance was achieved.

After numerous service calls, the Hewlett Packard Gas Chromatograph-Mass Spectrometer was returned to the company for repairs and will not be returned for several weeks.

PBP/Milford Laboratory Atlantic Mackerel Samples: Mackerel samples were collected from two separate cruises. A composite from each tow was made of the right fillets and kidneys, and the livers and ovaries were used separately. All were worked up and analyzed by a gas chromatograph equipped with an electron capture detector.

Polynuclear Aromatic Project (PAP)/Penobscot Bay Sediment Samples: Twenty-six samples were run by the method of Grimmer and Bohnke and chromatographed by high-performance liquid chromatography.

Fifty-six chromatograms were analyzed for polynuclear aromatic hydrocarbon.

PAP/Northeast Monitoring Program Workshop: A paper and slides to be presented at the upcoming workshop were prepared.

PAP/National Bureau of Standards Fly Ash Reference Material: Two one gram samples of fly ash were worked up and analyzed by a modified National Bureau of Standards method.

## Fisheries Technology and Engineering Investigation

### Product Standards and Specifications

The Washington Office is supporting a petition to the U.S. Department of Agriculture to allow the use of minced fish in their regulations governing the composition of meat products such as frankfurters and sausages. In support of this petition, we have drafted a U.S. Standards for Grades of Minced Fish Product and sent it to the Washington Office via a word processor.

A proposed U.S. Standard for Grades of Dressed Pacific Salmon has been reviewed and comments submitted for consideration.

A proposed draft U.S. Standards for Grades of Fresh or Frozen North American Freshwater Catfish and Product Therefrom was reviewed and comments submitted. A proposed sampling plan was prepared to test this draft. Instructions for using this draft were also prepared.

The preparation of a final rule-making document of the Proposed U.S. General Standards for Grades of Shrimp to be published in the *Federal Register* is underway. It will be transmitted by word processor to the Washington Office.

A proposed draft U.S. Standards for Grades of Fresh or Frozen Fish Steaks and a preamble for publication in the *Federal Register* are in the Washington Office.

A proposed draft U.S. Standards for Grades of Frozen Lobster and a preamble for publication in the *Federal Register* are in the Washington Office. With our help, the U.S. Army Natick Laboratory has issued a Purchase Description for spiny lobsters.

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

A revised proposed draft U.S. Standards for Grades of Frozen Fish Blocks has been sent to the Washington Office for review and comment by about 25 organizations. Instructions for using this draft and a sampling guide (covering species and country of origin) were also prepared.

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

Fred King's "Procedure for Cooking Seafood Products" has been adopted to official first action status by the Association of Official Analytical Chemists during its 96th Annual International Meeting.

## Processing and Preservation

Sorbate Preservation: The last of three storage experiments on the shelf life of fillets cut from five day old iced cod and dipped in potassium sorbate is completed.

This experiment completes a series of shelf life determinations for fillets dipped in potassium sorbate as well as whole dressed codfish stored for two days in chilled seawater containing potassium sorbate. The results are being statistically analyzed, and a preliminary report is being drafted.

An experimental protocol for the bacteriological analysis of potassium sorbate dipped fillets has been submitted to the program leader.

The results of a series of experiments on the pasteurization of blue crabmeat in flexible pouches are being compiled for publication.

Frozen Fish: The proposal to determine the frozen storage stability at 10°, 0°, -10°F of fish fillets cut from ripped and gutted fish after being held in ice for zero, five, and ten days has been accepted. This experiment will begin as soon as the storage freezers become available.

Bled Fish Quality: An experiment to determine the quality changes of bled cod vs. unbled cod was completed. The *Odin* out of New Bedford caught and bled the fish at sea. One batch of fish was ripped and gutted with the head on as is done traditionally; the second batch was ripped and gutted similarly to the first batch and the head was removed; the third batch of cod was bled for 20 minutes prior to being ripped and gutted; while the fourth batch of fish was bled for 20 minutes, ripped and gutted and the head cut off. Each batch of cod was held in plastic containers and kept well iced. The fish were examined at the laboratory. Every two to three days, fillets were cut from the iced fish and evaluated in the raw and cooked states.

The results from the raw and cooked fillet examinations show that all the iced cod, irrespective of processing variables, were acceptable on the 12th storage day and unacceptable on the 15th day. The largest decrease in quality was recorded in the texture, followed by the flavor in the cooked fish. The color and odor scores of the raw fish decreased slowly until the 12th day and fell off drastically. No color distinction was noted between the raw and cooked, bled and unbled fillets. Although these results are preliminary, it appears that boxing and icing well at sea is the major contributor to quality retention in cod. This experiment will be repeated to confirm the results.

Engineering: Nearly all of the equipment needed to construct a heat pump has been obtained. Installation should commence within the next month.

A freezer facility for freezing and storage of bait for lobster fishing in Maine is being designed using an existing building.

The prototype rotary head vacuum eviscerator was loaned to Safe Harbor Sea Foods, Ltd. of New Bedford where modifications will be engineered to attempt to make a commercially feasible machine out of it.

Water Damage: Room 28 (stockroom)--water damage to floor area has been taken care of. The floors were treated with a fungicide and waxed. Paper products that were damaged were purchased and paid for by the Reliance Insurance Companies.

Room 30 and 31 (Immunization and Microbiology)--these areas were cleaned by an outside contractor, Servpro Inc. New ceilings were installed by the Burke Corporation. All of this was paid for by the insurance company.

**Freezer Area:** The entire floor area in the vestibule, freezers #5 and #7, were torn up and replaced. Eight inches of new styrofoam insulation was installed with a three-inch concrete floor on top.

**Repairs:** Repairs were made to compressor #4 due to a broken oil return line. This compressor has 84,000+ hours running time. It should be replaced soon.

New block heaters were installed on compressors #7, #6, and #5. At this time, oil and filters were also changed.

A broken pipe (cracked due to vibration) was repaired on compressor #1.

Fan motors were replaced in the library and Burt Tinker's office.

#### NMFS/University of Rhode Island Cooperative Fisheries Engineering Unit

On February 22, Mr. Mark Ames from Lowrance Electronics demonstrated the use of their X-15 Computer Sonar in the University of Rhode Island Tow Tank to measure model trawl nets.

*Gloria Michelle* cruises during the period were:

Cruise No.	Title	Area
GM 83-01	Chromoscope Testing on Calibration Grounds	Block Island Sound
GM 83-02	MERL Diurnal Sampling	Narragansett Bay
GM 83-03	Experimental Scallop Dredge Testing	Narragansett Bay
GM 83-04	Sea Scallop Collection	Block Island Sound
GM 83-05	MERL Diurnal Sampling	Narragansett Bay

#### Publications

Krzymowek, J. and K. Wiggin. 1982. Generic identification of cooked and frozen crabmeat by thin layer polyacrylamide gel isoelectric focusing. *In: Proceedings: Blue Crab Colloquium*. 7:215.

Licciardello, J.J. Botulism and heat-processed seafoods. Accepted for publication in *Marine Fisheries Review*.

Licciardello, J.J. and L.J. Ronsivalli. 1982. Irradiation of seafoods. *In: Chemistry and Biochemistry of Marine Food Products*. R.E. Martin, G.J. Flick, C.E. Hebard and D.R. Ward, eds., pp. 305-322. AVI Publishing Company, Westport, Connecticut.

Lundstrom, R.C. and L.D. Racicot. 1983. Gas chromatographic determination of dimethylamine and trimethylamine in seafoods. Accepted for publication in the September 1983 issue of the *Journal of the Association of Official Analytical Chemists*.

Wiggin, K. and J. Krzymowek. 1983. Identification of frozen, cooked shellfish species by agarose isoelectric focusing. *Journal of the Association of Official Analytical Chemists*, 66(1):118.

#### Miscellaneous

##### Travel, Meetings, and Presentations

Judith Krzymowek addressed the Annual Meeting of the National Blue Crab Industry Association in New Orleans, Louisiana.

Eleanor Ravesi and Judith Krzynowek participated in two meetings held at the Essex Agricultural Institute (Hathorne, Massachusetts) and sponsored by the Northeast Chapter of Trout Unlimited in cooperation with the Massachusetts Water Resources Research Center in which the scope of the Essex County Acid Rain Monitoring Project was outlined. The Gloucester Laboratory is participating in this project by testing samples brought to us for pH and alkalinity on a monthly basis.

J. Perry Lane attended meetings of the New England Fisheries Management Council in Danvers, Massachusetts.

J. Perry Lane attended the Annual Meeting of the New England Fisheries Development Foundation.

J. Perry Lane participated in a meeting to establish a joint Center/Region committee on recreational fisheries at the Narragansett Lab.

A one-day workshop on "Selling Seafood to the Military" was held January 26, 1983, at this Laboratory. The workshop included representatives from the Defense Personnel Support Center, the U.S. Army Research and Development Command, and the US Department of Commerce Inspection Service, as well as the Gloucester Laboratory. It included talking on the qualifications for bidding on government contracts, military purchase documents and quality criteria, military packing requirements, origin inspection requirements, and US Department of Commerce grade standards and specifications.

Bob Learson attended the Mid-Atlantic Fishery Development Foundation Source Evaluation Committee Meeting in Annapolis, Maryland, January 11-13.

Bob Learson chaired the NMFS Quality Improvement Task Force meeting in Washington, D.C., January 18-19 and attended the NMFS-Food and Drug Administration Memorandum of Understanding meeting in Washington, D.C., January 20-21.

Bob Learson gave presentations at both the Long Island and Cape Cod Fishermen's Forum. At Long Island on February 4 he discussed, "Utilization Technology in the 80's," and at the Cape Cod Forum on February 13 he spoke on, "Handling Squid and Dogfish at Sea."

### University Affairs

Paul Geroux, a biology student at Colgate University, spent the month of January at the laboratory on a research assignment to satisfy a requirement in his course curriculum. He worked in the microbiology lab with Betty Tuhkunen and Dan D'Entremont on an experiment investigating the effect of gamma radiation dosage on the microflora of cod fillets during iced storage.

Fred King reviewed a Sea Grant proposal from the University of Rhode Island, Kingston, Rhode Island.

Fred King provided information on possible U.S. Sea Grant universities working in the area of seafood technology for a Finnish scientist.

Fred King provided information on U.S. universities for a Japanese scientist interested in a post-doctoral appointment in seafood myofibrillar protein research.

J. Perry Lane assisted Ken Gall, New York Sea Grant, in preparing a questionnaire on Seafood Technology Aspects and Needs in New England. Worked with Massachusetts Division of Marine Fisheries on a mailing list for the questionnaire.

J. Perry Lane provided Mr. David Kan, Massachusetts Maritime Academy, with resources for a Fishermen's Forum.

On February 10, Al Blott presented an introduction to NMFS Fisheries Engineering to a group of University of Rhode Island graduate students in ocean engineering during one of their weekly seminars.

### Public Affairs

Joe Licciardello made revisions for the 1983 Commodity Storage Manual on frozen fish for the Refrigeration Research Foundation.

Technical assistance was provided to the following:

Technique of performing a total aerobic plate count and discussion of the role of microbiology in assessing fish quality to Arthur Camuso of Turner Fisheries, Boston, Massachusetts.

Species identification by isoelectric focusing to Dr. John Kochanski of the Associated Foodstuffs Laboratories of Australia, Brisbane, Australia.

Seafood identification methods to Janet Evans, State of Virginia Consolidated Laboratories, Richmond, Virginia.

Identified two unknown fish samples as Pacific halibut (*Hippoglossus stenolepis*) by isoelectric focusing for the NMFS Seattle Laboratory.

Compared sarcoplasmic protein patterns of New Zealand abalone and Mexican giant squid using isoelectric focusing for Mr. Pratt, Seafood Marketing Institute, Boston, Massachusetts. Conducted sensory evaluation on above two species for same.

Information on seafood identification by isoelectric focusing to Dr. John Greene, U.S. Department of Agriculture, Beltsville, Maryland.

Attempted to identify, by isoelectric focusing, species of a minced, frozen, chemically-treated clam at request of NMFS Western Inspection Office, Bell, California.

Identified two samples of salt fish as cod (by isoelectric focusing) for Prof. J. Regenstein, Cornell University.

Identified three frozen fish fillets as widow rockfish by isoelectric focusing for NMFS Western Inspection Office, Bell, California.

Supplied information on red hake texture and enzymatic dimethylamine/formaldehyde production to Dr. Jens Jessen, Fisk. Dir. Inst. Nutrition, Nygardstangen, Norway.

Provided nutritional information to Massachusetts Nutrition Hotline and *Good Housekeeping Magazine*.

Provided Dr. Meech at Government Laboratory, London, England, with authentic crab samples for his species identification studies.

Assisted Cat Cove Marine Lab, Salem, Massachusetts, with computer literature-searching material.

Provided Brown & Company (Virginia) with information on crab processors.

Information on bacteriological standards for fresh fish to Massachusetts Food and Drug Administration.

Information on use of dips in the seafood industry to Church & Bennett Company, Boston, Massachusetts.

Discussed freezing and preservation with Arthur Murphy, Orr's Island, Maine.

J. Perry Lane helped prepared, setup, and staff the NMFS exhibit at the New York National Sportsmen's Expo at Uniondale, Long Island, New York.

Provided information in the following areas: minced fish and surimi blocks; military purchases, directory of fish processors and dealers; cartilage in shredded crab meat; thaw drip in five pound shrimp blocks; deboners and strainers; minced fish in meat products (two separate

inquiries); squid quality; parasites and minced fish in the fish fillet blocks; Association of Official Analytical Chemists methodology to determine drained weight of five pound shrimp blocks; softening bones in mackerel by pressure cooking; media for growth of microorganisms; Seafood Technology Group of the Institute of Food Technologists; packing fish blocks at sea (two separate inquiries); suppliers and consumption of rope and line in the fishing industry; irradiation of ocean perch fillets; conversion factor for Kjeldahl N to protein; polyphosphates to extend storage life of raw peeled shrimp; a pollock storage study; preparing minced fish from frames (backbones); directory of fisheries consultants; reformed fish blocks; sensory evaluation score sheets; labeling of portions as fillets; Codex Committee for Methods of Analysis and Sampling; The Griffin Report; determination of sodium bisulfite in raw shrimp; determination of polyphosphates in shrimp; information on ocean pout; reference on retailing fish and shellfish; methods of determining minced fish in mixed minced/fillet blocks; salting and drying of codfish for export; holding fresh fish in supermarkets; quality standards for fish; development of pinkish color in pickled fish; fish processing equipment; new products from underutilized fish species; hydraulic clam dredges; scallop dredges; and beam trawls.

#### Personnel

We welcome aboard Heather MacFarland who will be working in the protein chemistry lab under the supervision of Ron Lundstrom.

D.F. Gadbois was called to jury duty for the month of February.

Ron Lundstrom attended an intensive week-long workshop on, "Hybridoma/Monoclonal Antibody Production," sponsored by the Center for Advanced Training in Cell and Molecular Biology at Catholic University, Washington, D.C.

### ENVIRONMENTAL ASSESSMENT DIVISION

submitted by

Dr. John B. Pearce, Chief

#### SEPTEMBER-OCTOBER

##### Behavior of Marine Fishes and Invertebrates Investigation

As part of our ongoing effort to define critical life habits and ecological requirements of key marine species, we are examining the influence of seasonal changes in photoperiod and temperature on the prey consumption rate and feeding behavior of bluefish. Currently studies are being conducted on one school of adults and two school of juveniles. The results of these studies will provide an estimate on a yearly basis of the potential impacts of this predator on prey populations.

##### Coastal Ecosystems Investigation

###### Benthic Community Structure

We intensively sampled sediments and benthic macrofauna of the inner New York Bight aboard the *Delaware II* in September, in an attempt to detect

changes from prior monitoring and to separate influences of the Bight's various waste sources. Several stations on a possible PCB gradient from central Buzzards Bay to New Bedford were also sampled, as were 22 stations at 40-50 m depths around Massachusetts Bay.

An interdisciplinary report on our 1980 studies has been prepared for the Northeast Fisheries Center Technical Memorandum series, and is available as TM NMFS-F/NEC-16. Bob Reid presented a summary of findings from the Bight study concerning benthic biology at the Oceans '82 conference in Washington, D.C., in September. We also worked on characterizing the benthos in the potential area of influence of the Philadelphia dumpsite (as part of the Center's site characterization efforts) and on compiling information for our 1982 Northeast Monitoring Program (NEMP) annual report.

We conducted a pilot test of a sediment bioassay using amphipods. The test was developed by EPA in Oregon. Twenty individuals of a sensitive amphipod species (usually *Rhepoxayarius*) are held for 10 days on a small amount of control or test sediment in a one-liter beaker. Numerous replicates of sediments from the New York Bight sewage sludge deposition area are highly toxic, from the dredge spoil fringe moderately so, and there was complete survival in two different control sediments. The bioassays are being considered as an addition to our suite of Northeast Monitoring Program variables.

Clyde MacKenzie and Dave Radosh retrieved 48 sediment trays they had deployed in 10 m of water off Long Island, to determine settling seasonality and abundances for area invertebrates as affected by sediment type and contaminant concentration. Preliminary results are very promising. Surf clam abundances in clean mud or sand were approximately eight times densities found in mud with sewage sludge added or sand from the sludge dumpsite. Settling of other molluscs, as well as amphipods, also appeared inhibited by sludge, while polychaete densities were highest in the mud plus sludge trays.

Clyde also supplied water from selected areas in the New York Harbor and the inner Bight to Milford's Physiology-Biochemistry task, to determine water quality of these areas via effects on development of oyster larvae. Toxicities increased in the order Milford seawater less than Long Island coast, less than Bight acid dumpsite (where water was not collected immediately after a dump), less than dumpsite and Hudson-Raritan plume water.

Both the sediment tray and oyster larvae experiments represent important links between lab cause-effect studies and field monitoring, and plans are to expand both projects.

### Benthic Energetics

Dr. McNulty prepared a draft summary of our knowledge of the benthos at Deepwater Dumpsite 106 and adjacent continental shelf slope and rise areas that may be impacted by waste dumping at that site. He is currently developing a final draft of this summary.

Russ Terranova analyzed calorimetric samples collected during the August/September Ocean Pulse survey and began preparation for surveying the feeding habits of demersal fish and lobsters in the New York Bight apex. Our absence of knowledge about benthic invertebrates/finfish interacting in the New York Bight apex has hindered our assessment of the impacts of waste inputs to the area fishery resources.

The biomass for three benthic stations on Georges Bank, sampled as part of Ocean Pulse monitoring, were determined for four cruises to

estimate seasonal and annual variability. This information will be included in the final draft of a section of the "Georges Bank book" that deals with benthic production. An initial draft of this manuscript has been prepared by Frank Steimle and is being reviewed. Frank began working on another manuscript that will examine the standing stocks, estimated productivity and other functional ecology aspects of benthic macrofauna in the New York Bight apex relative to waste inputs. Biomass distribution patterns between 1973 and 1980 were compared and indicated very similar patterns, although magnitude varied in some areas.

Jan Ward initiated life history files for 35 additional species not previously in the file on the dominants at Middle Atlantic Bight Ocean Pulse stations. There are now a total of 93 species in the file. The species that dominate the benthic communities on Georges Bank and in the Gulf of Maine have been identified and life history profiles will be developed for them based on information available in the literature. She has received several requests for life history information to support the interpretations of other benthic studies. Jan and Dot Jeffress are continuing to analyze additional samples from the 65-mile alternate dumpsite and to computerize the resulting data as part of their efforts to develop a better site characterization of the benthos at that site.

An inventory of all the benthic or sediment data currently in the computer files at Sandy Hook was prepared for the Center automatic data processing coordinator. Aspects of this inventory were expanded to assist in developing improved techniques for using this data in computer analyses.

#### Ocean Pulse

The summer Ocean Pulse monitoring survey in which both Frank Steimle and Denise Hollomon participated, was completed. Given the very short duration of the cruise, we were fairly successful in meeting most basic sampling requirements. We are presently preparing for the fall/winter survey, which will address the needs of a variety of new researchers who are becoming involved in the Program; Frank will be Chief Scientist of Part I. The cooperative Ocean Pulse sampling effort in the fall groundfish survey went very well and initially appears to be a viable approach to well distributed, quantitative sampling to support some of the Ocean Pulse goals.

After final editing, the 1981 Northeast Monitoring Program annual report was returned to the New York Office of the NOAA Office of Marine Pollution Assessment for final typing. A modified protocol was developed for the individual submissions for the 1982 Northeast Monitoring Program annual report. The 1983 NEMP technical workshop has been scheduled for 22-24 February 1983 in Milford, Connecticut.

#### Environmental Chemistry Investigation

Several members of this investigation (J. O'Reilly, R. Waldhauer, A. Matte, A. Draxler) met with Drs. Ted Loder and Jim Love (University of New Hampshire) at Sandy Hook and discussed and reviewed plans for the extensive analyses of organic nitrogen and phosphorus in seawater which will be performed by Dr. Loder under a Northeast Monitoring Program contract. Work continued on reducing and computerizing extensive data dealing with measurements of inorganic nutrients made in 1980 during MARMAP and Ocean Pulse Surveys. Laboratory analyses of inorganic nutrients collected during the *Albatross* 82-09 and *Delaware* 82-06 surveys were also completed.

A. Draxler, R. Waldhauer, A. Matte, and J. O'Reilly completed a draft of a manuscript entitled, "Nutrient distributions on and around Georges Bank in 1979," for submission to the Fisheries SSRF series. The major conclusions in this paper have also been included in the Environmental Chemistry Investigation's Annual Northeast Monitoring Program Report.

Al Matte participated in a three-way intercalibration of seawater nutrient analyses with Brookhaven National Laboratory and NOAA Ocean Technology and Engineering Services aboard the R/V *Mt. Mitchell* in September. Samples for the intercalibration were collected throughout the water column in the New York Bight during the Northeast Monitoring Program water column monitoring survey.

Two reports characterizing nutrients and phytoplankton at the 106-mile and Philadelphia dumpsites were modified according to review comments provided by members of the EPA site characterization committee.

C. Murchant and C. Ingham participated in the warm core ring survey (*Delaware* 82-06). Chlorophyll data collected during this survey, and the five earlier warm core ring surveys, were proofed and entered into the automated data processing archive. Historical data on chlorophyll, collected in the Gulf of Maine and Georges Bank by Colten (NMFS) were keypunched, proofed and entered into the Automated Data Processing archiving so that we could begin making baseline comparisons between our recent (1977-present) data and the data Colten collected in 1965.

V. Zdanowicz and R. Bruno completed trace metal analyses on 149 ocean quahog and 65 surf clams collected during a survey on the *Delaware* in 1982.

R. Bruno and V. Zdanowicz, cooperating with Dusty Gould (Milford), completed eight weekly samplings of the scallop population off Asbury Park, New Jersey. This study is aimed at measuring several biochemical indices as well as heavy metal content of various tissues during peak spawning periods.

V. Zdanowicz participated in the *Delaware* 82-06 sediment survey and collected 973 benthic samples from 160 stations in the New York Bight and Massachusetts Bay.

## Physiological Effects of Pollutant Stress Investigation

### Physioecology

Tests with adult blue mussels exposed to silver at 0, 50, and 100  $\mu\text{g}/\ell$  for three months in a diluter system were terminated. All of the 100  $\mu\text{g}/\ell$  and about half of the 50  $\mu\text{g}/\ell$  exposed mussels died during the three month exposure. Control and the remainder of the 50  $\mu\text{g}/\ell$  exposed mussels were provided to Dr. Stephen Georges (Institute of Marine Biochemistry, Aberdeen, Scotland) who is performing studies on localization of metals in mussel tissue.

Tests with lobsters exposed to cadmium in a diluter system for 60 days were terminated. The lobsters were exposed for the Physiology Subtask.

An oyster embryo bioassay was conducted during this reporting period. Oyster embryos were challenged with seawater collected at specific sites in the New York Bight. The purpose of the bioassay was to determine the order of toxicity of different water sources on oyster embryos. This is a cooperative study between our group and Clyde L. MacKenzie, Jr. of the Sandy Hook Laboratory.

We participated in the second leg of the autumn bottom trawl survey, *Albatross* 82-11, from October 4-15.

### Physiology

A considerable amount of time was spent analyzing scallop hemolymph samples obtained on the summer scallop survey for sodium, potassium, calcium, and osmolality. This work is nearing completion.

We collected windowpane flounder from the New Haven dumpsite and from a clean station near Shoreham, Long Island, once each month in preparation for doing cooperative work with the EPA lab in Narragansett, Rhode Island. This study will concern the dredging of contaminated sediment from Black Rock Harbor (Bridgeport) and the dumping of this material at the central Long Island Sound dumpsite as an experimental dump. We hope to sample winter flounder as well as part of the cooperative study, but to date we have not obtained many winter flounder at the dumpsite. This next year we will also examine lobsters and mussels from this area. In addition, we have, as part of a continuing study, two other sites in Long Island Sound.

Physiology participated in the fall Ocean Pulse cruise *Albatross* 82-10. We obtained blood samples from yellowtail and windowpane founders and sea scallops. We have completed protein analyses on the yellowtail flounder plasma samples and are working on a suitable method for bilirubin analysis.

Physiology had fish blood samples collected on two legs of the autumn bottom trawl survey cruise. The plasma samples obtained are awaiting analysis.

We completed a second exposure of lobster to cadmium this month and sent a portion of this exposed group to the Beaufort, North Carolina, laboratory where they will be examined for the existence of metal-binding proteins which are important factors in metal detoxification. A third group of lobster has been collected and will be exposed to cadmium for studies of effects on heart and gill bailer activity.

### Biochemistry

During this bimonthly reporting period, seven consecutive weekly samplings were made of the sea scallop population off Asbury Park, New Jersey, during the 1982 spawning season. Besides the usual tissues taken for biochemical and chemical analysis, gonad specimens were preserved for Dr. Ray Thompson (Memorial University, St. John's, Newfoundland), who will examine them histochemically. This ongoing collaborative study (with Sandy Hook's Environmental Chemistry) has already provided us with the best part of a year's data, obtained on a monthly basis from March 1981 to February 1982. We plan to resume monthly sampling again in November for another year's data, adding a few biochemical parameters for gonad and photographing different development stages of gonad for each sex. This photographic record will be especially useful in staging scallop gonads at sea.

At the bench, biochemical analyses were completed for both kidney and adductor muscle sea scallop samples from the copper and cadmium exposure series; analyses continued on the New Jersey sea scallop tissue samples, and analysis was begun on scallop kidney samples from this summer's annual sea scallop survey cruise. These data are presently being calculated. Flounder kidney analyses were also completed for this summer's Northeast Monitoring Program cruise, *Albatross* 82-10.

Work has begun on transcribing biochemical data for samples obtained on the most recent Ocean Pulse cruises onto the newest automated data

processing format (some changes were made) and data for three cruises are ready for keypunching and computer entry.

Biochemistry personnel participated in the current autumn bottom trawl survey *Albatross* 82-11.

### Anaerobic Bacteriology

Major activities this reporting period included participation in Northeast Monitoring Program cruises *Albatross* 82-10 (1), 24 August-3 September and *Delaware* 82-08, 7-17 September. Monthly samplings were also made of our Long Island Sound stations which now also include the New Haven dumpsite. Sampling at this site is being done to obtain a bacteriological profile of the area prior to dredge spoil dumping as part of our input to the cooperative effort with EPA.

The *Delaware* 82-08 cruise was the third annual New York Bight benthic monitoring cruise in which we have participated. We took advantage of extensive bottom sampling to obtain additional sediments for bacteriological analysis. Some 109 sediment samples were obtained from the New York Bight and Massachusetts Bay. Bacteriological analyses have been completed but data compilation needs to be performed. Hopefully, the extensive sampling done will allow us to develop a more detailed outline of the impacted areas of the New York Bight (bacteriologically) than has been possible from previous Northeast Monitoring Program cruises.

Mussels (*Mytilus edulis*), which had been deployed at several stations in the New York Bight Apex for several months, were obtained from EPA personnel. They were examined for the presence of *Clostridia* and vibrios in addition to other bacterial pathogens being studied in the New York Bight benthic monitoring program. The presence of bacterial contaminants correlated well with the area of exposure of the mussels. The presence of fecal streptococci, however, seem to be more widespread. It would appear from this preliminary study that the presence of different bacterial groups in mussels could be used as a means for defining impacted areas.

### Chemistry

Sea scallops exposed to either copper or cadmium in experiments carried out during the spring of this year were analyzed for heavy metal body burdens this reporting period.

A high performance liquid chromatograph was purchased from Perkin-Elmer in August, Mr. Grieg spent three days in October attending a course on the operation of this equipment.

A Soxhlet extractor was also purchased and received this reporting period. This equipment is used primarily for extracting PCB's from sediment samples for subsequent gas chromatography analysis. One trial run with the equipment was conducted and, unfortunately, the results did not appear to be correct. Other procedures using this equipment will be tried in an attempt to find the most suitable methodology for sediment analysis.

### Biological Oceanography Investigation

The seabed metabolism subunit of Biological Oceanography participated in the sediment contaminants cruise (*Delaware* 82-06) in September during which seabed oxygen consumption measurements were made at most of the New York Bight Marine Ecosystems Analysis Program stations and at three stations in Buzzards Bay. These measurements have been analyzed and SYMAPed and will be compared to SYMAPs obtained in 1974 and 1975. This

information will be disseminated in the 1982 Northeast Monitoring Program report.

Pete Kube completed the statistical analysis of data concerning the effects of cadmium on seabed oxygen consumption and Bill Phoel completed a manuscript on diving in waters contaminated with hazardous materials which is to be presented at a workshop sponsored by the Undersea Medical Society, Bethesda, Maryland.

Bill and Pete assisted the Behavior Investigation by installing seawater well points by diving and using an underwater jetting hose.

An assay run was made of a total of 108 samples collected from 23 stations on a September 1980 cruise. The present batch was from six depths at five stations. For the 30 samples, the assay identified nitrogen mainly as the relatively scarcest micronutrient and phosphorous in secondarily critical supply. In six of the samples, nitrogen solely limited growth of the assay diatom *Thalassiosira pseudonana*. In five other samples, however, limitation of growth attributed to phosphorous supply rivaled or exceeded that of nitrogen. Silicon and vitamin B<sub>12</sub> abundances were not growth limiting.

In cooperation with Denise Hollomon, sampling was completed in September for a separate assay study to assess the growth potential of the New England red tide dinoflagellate, *Gonyaulax excavata*, in New York and New Jersey waters. This species has apparently spread southward over the last 10 years, causing red tide at least as far south as Rhode Island. Resting cysts of the species have been found in Connecticut and New York coastal locales. Intense blooms could be a possibility in nutrient superenriched New York Harbor if it finds these waters amenable. Some minimum indication of local water quality suitability is provided by the fact that we have achieved flourishing growth of *G. excavata* in water from a single sampling at one Lower Bay stations. The assay will broaden our information in this regard and also provide pertinent management agencies with some predictability as to the potential seriousness of the extension of this species into New York and New Jersey waters.

In September, Myra S. Cohn and Harold G. Marshall presented a paper, "Phytoplankton Populations and Distribution Patterns over the Northeastern Continental Shelf of the U.S.," at the Marine Technical Society, Oceans '82. The paper is published in the proceedings of that meeting. Mrs. Cohn and Dr. Marshall held a planning session at that time to design further research on geographic patterns of phytoplankton populations.

NOAA Technical Memorandum NMFS-F/NEC-15, "Seasonal phytoplankton assemblages in northeastern coastal waters of the United States," by Harold G. Marshall and Myra S. Cohn has been published and copies are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

Jim Thomas and Craig Robertson, in cooperation with the National Aeronautics and Space Administration/Goddard Space Flight Center, obtained thermal imagery of the sea surface for a Northeast Monitoring Program cruise in the Middle Atlantic Bight during September. Remotely sensed data for the cruise period were collected and stored on tape at Goddard. Following the cruise, these data were atmospherically corrected, enhanced and produced as a hard copy on a UPI Unifax Machine. A meeting is planned to review and intercompare the shipboard and the remotely sensed data. Plans are to monitor coastal waters via thermal imagery on a regular basis.

Jim Thomas and Helen Mustafa of the NEFC, along with Andy Tvirbutas, Tony McPherson, and Jack Suomala of the C.S. Draper Laboratory, Inc.,

completed a poster and paper, "Seasonal patterns of surface temperature and phytoplankton pigments in the Georges Bank region," which were presented at the 70th Statutory Meeting of the International Council for the Exploration of the Sea in Copenhagen, Denmark. The poster and paper were based on data from the Nimbus-7 Coastal Zone Color Scanner during the period from March to August 1979. Generally, from March to May, concentrations of phytoplankton pigments increased. Increasing concentrations spread southward along the coast of the western side of the Gulf of Maine from the Bay of Fundy to Cape Cod Bay, following the general circulation. Phytoplankton in slope water and in the Gulf of Maine bloomed in May. From June to August phytoplankton pigment concentrations decreased except for specific areas. The southwestern coast of Nova Scotia (Yarmouth Upwelling), Bay of Fundy, Georges Bank, and Nantucket Shoals were persistently high. The Scotian Shelf was persistently low except for the phytoplankton bloom in July. Based on visual examination of the imagery, the Gulf of Maine-Georges Bank region was divided into coherent subareas. Pigment concentration plotted against temperature for each of these subareas over time demonstrated the existence of three ecologically distinct regimes, (a) those subareas which are relatively cold in temperature and rich in pigment (Yarmouth Upwelling, Bay of Fundy, Georges Bank and Nantucket Shoals); (b) those subareas which are relatively cold and poor (Scotian Shelf and the Gulf of Maine); and (c) those subareas relatively warm and poor (slope). No relatively warm and rich subareas were in evidence. It is known that the colder waters, with the exception of the Scotian Shelf and Gulf of Maine, are subject to greater vertical turbulence (i.e., upwelling and/or tidal mixing) and nutrient replenishment. The persistently high pigment concentrations were associated with these turbulent waters which were less than 60 meters in depth. This series of coastal zone color scanner images enabled temporal-spatial comparisons and interrelationships to be made between temperature and pigment over a relatively large geographic region. From such comparisons it was possible to begin dissecting the overall region into functional ecological subunits for which future predictive models can be developed.

On the return trip from Copenhagen, Jack Suomala (Draper Lab) and Jim Thomas (NEFC) visited Dr. Peter Baylis of the Department of Electrical Engineering at the University of Dundee, Scotland, to observe firsthand the functioning of the satellite remote sensing receiving station in order to facilitate present planning within the Northeast Area Remote Sensing System for the collection and dissemination of real-time remotely sensed data.

### Publications

- Calabrese, A.; Gould, E.; Thurberg, F.P. Effects of toxic metals in marine animals of the New York Bight: some laboratory observations. Mayer, G.F., ed. Ecological Stress and the New York Bight.
- Calabrese, A.; MacInnes, J.R.; Nelson, D.A.; Greig, R.A.; Yevich, P.O. Effects of long-term exposure to silver or copper on growth, bioaccumulation, and histopathology in the blue mussel, *Mytilus edulis*. Mar. Biol. (S)
- Calabrese, A.; Nelson, D.A. Some observations on the life history of the slipper limpet, *Crepidula fornicata*. The Veliger. (S)
- Goldmintz, D.; Babinchak, J.A.; Richards, G.P.; Graikoski, J.T. Bacteriological evaluation of steam-pasteurized oysters, *Crassostrea virginica*. Developments. (S)

- Gould, E.; Greig, R.A. Short-term, low-salinity response in lead-exposed lobsters, *Homarus americanus*. J. Exp. Mar. Biol. Ecol. (S)
- Luczkovich, J.J.; Olla, B.L. Influence of prey availability on feeding and growth of pelagic juvenile red hake, *Urophycis chuss*. Can. J. Zool. (S)
- Olla, B.L.; Bejda, A.J.; Pearson, W.H. Effects of oiled sediment on burrowing behavior of the hard clam, *Mercenaria mercenaria*. Mar. Environ. Res. (A)
- Sindermann, C.J.; Esser, S.C., Gould, E.; McCain, B.B.; McHugh, J.L.; Morgan II, R.P.; Murchelano, R.A.; Sherwood, M.J.; Spitzer, P.R. Effects of pollutants on fishes. Mayer, G.F., ed. Ecological Stress and the New York Bight: Science and Management. Columbia, South Carolina: Estuarine Research Foundation; 1982:39-52. (P)
- Wolfe, D.A.; Boesch, D.F.; Calabrese, A.; Less, J.J.; Litchfield, C.D.; Livingston, R.J.; Michael, A.D.; O'Connor, J.M.; Pilson, M.; Sick, L.V. Effects of toxic substances on communities and ecosystems. Mayer, G.F., ed. Ecological Stress and the New York Bight: Science and Management. Columbia, South Carolina: Estuarine Research Foundation; 1982:67-86. (P)

## Miscellaneous

### Travel, Meetings, and Presentations

On Wednesday, 1 September, Dr. John Pearce participated in the interagency steering committee meeting in Boston, Massachusetts. Agencies involved included the EPA, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers. The meeting was one in a series of meetings to address problems concerned with dredged material disposal and ocean dumping of other solid wastes.

On Tuesday and Wednesday, 7-8 September, Dr. Pearce participated in a meeting of the ocean dumping steering committee involving personnel of the NOAA Office of Marine Pollution Assessment, EPA Environmental Laboratory (Naragansett), and the NEFC. The meeting was held to review progress in terms of developing site characterization studies for the 106-mile and Philadelphia dumpsites.

On 22-25 September, Dr. Pearce, Al Bejda, and Frank Steimle participated in the 112th Annual Meeting of the American Fisheries Society which was held at Hilton Head, South Carolina. Dr. Pearce presented a paper on the effects of ocean disposal and other pollution problems as they relate to marine and estuarine fisheries. The session at which Dr. Pearce presented his paper was concerned with multiple uses of the estuarine and marine waters and, in addition to the subject of ocean disposal, included presentations on industrialization, transportation, and the development of marine fisheries. Allen Bejda presented a paper entitled, "The behavioral response of red hake, *Urophycis chuss*, to decreasing levels of dissolved oxygen."

V. Zdanowicz attended the Oceans '82 symposium, 22-24 September.

Frank Steimle met with EPA personnel, Don Lear and Don Miller, on 6 October, to discuss preparation of Deepwater Dumpsite 106 and Philadelphia dumpsite characterizations.

During the period 7-19 October, Dr. Pearce participated in the International Council for the Exploration of the Sea Annual Statutory Meetings, Copenhagen, Denmark. He chaired the three sessions of the Marine Environmental Quality Committee, as well as the special sessions concerned

with plankton blooms and marine chemistry. In addition, he participated in the sessions of the Consultative Committee and the intersessional meetings of the Advisory Committee on Marine Pollution.

Bob Reid attended the Eighth Annual Meeting of the Coastal Society in Baltimore, Maryland, on 11 October.

Dr. J. Graikoski participated in the Interagency Botulism Research Coordinating Committee Meeting at Rockville, Maryland, 13-14 October. He also participated in the joint meeting of the Connecticut Valley, Northeastern and Eastern New York Branches of ASM, 15-17 October.

On Monday, 25 October, Dr. Pearce participated in the monthly session of the interagency steering committee concerned with site characterization updates.

Dr. Pearce, Dr. Sindermann, and Mr. Reid attended the Ocean Dumping Conference organized by the New Jersey Marine Sciences Consortium. This meeting, held at Stevens Institute in Hoboken, New Jersey, dealt with the three topics of ocean dumping: sources and fates of dumped materials, and the future of ocean dumping.

### Seminars

On 30 September-1 October, Dr. Pearce met with the Regional and Center Directors in regard to the development of the NMFS strategic plan.

On 4-5 October, Dr. Pearce chaired the Northeast Monitoring Program management team meetings held at Sandy Hook, New Jersey. The meeting was also attended by A. Calabrese, F. Steimle, and D. Hollomon.

A. Calabrese attended the Center Board of Director's Meeting, Woods Hole, Massachusetts, 25-27 October.

### University Affairs

Bori Olla visited Sandy Hook during the week of 25-29 October to discuss and draft a proposal for cooperative research on contaminant effects to be conducted with the Oceanography Department of Oregon State University.

### Public Affairs

Division of Environmental Assessment personnel actively participated in the Sandy Hook Laboratory Open House on 22 and 23 October.

### Personnel

On Friday, 10 September, Dr. Pearce completed the assignment as Acting Deputy Director, Northeast Fisheries Center. The assignment had been for the period June-September, 1982.

Bori Olla has been transferred to the Northwest and Alaska Fisheries Center and is currently on an IPA to Oregon State University.

Carol Roe is currently on maternity leave.

## NOVEMBER-DECEMBER

### Behavior of Marine Fishes and Invertebrates Investigation

As part of our continuing effort to assess the impact of anthropogenic stress on marine communities, we are currently analyzing data from a series of long-term experiments which examined the influence that weathering has on the sublethal effects of oil contaminated sediment on sand worms. In 10 experiments conducted this past summer and fall, measures of burrowing

impairment, emergence and recovery potential were made. Results from this study are being used to design further studies to examine the sublethal effects of sediments contaminated with a variety of pollutants.

Studies on seasonal changes of prey consumption in juvenile and adult bluefish are continuing.

### Biological Oceanography Investigation

On 8 November 1982, Craig Robertson attended a workshop at the NOAA Office of Ocean Technology and Engineering Services, in Rockville, Maryland, on the development of a miniature oxygen sensor. The sensor was being designed to operate from shipboard or helicopter, to be relatively insensitive to varying salinity or temperature changes, to be rapidly deployable or retrievable, possibly expendable, and to have a low purchase price (less than \$100). For the past two years the Office of Ocean Technology and Engineering Services had supported the funding of research on the sensor but was being forced to discontinue this support due to the lack of project funds. The meetings considered the progress on the sensor to date and whether other NOAA branches (National Ocean Survey, NMFS) could fund further research. Although the other NOAA branches expressed interest in the work continuing, no resolution was arrived at regarding additional funding.

On 1 December 1982, a wetlands field survey of the Barnegat National Wildlife Refuge was conducted by Craig Robertson for the NEFC/Coastal Habitat Assessment, Research, and Monitoring Program. The results of the survey were prepared on a U.S. Geological Survey topographic map and National Wetlands Inventory forms, and submitted to Dr. Jack Finn at the University of Massachusetts for use in Landsat satellite coastal wetlands computer mapping.

During 13-15 December 1982, Craig Robertson worked with Jack Finn at the University of Massachusetts on determining fixed points on Landsat scenes needed to geometrically correct the images. Approximately 30 points were located within the States of New York, New Jersey, and Delaware.

On 9-10 December 1982, Jim Thomas, Cathy Warsh (NOAA, National Ocean Survey) and Craig Robertson met at Sandy Hook to integrate in-situ temperature data imagery collected over a concurrent period. Examination of the satellite imagery showed detailed thermal structure of surface waters from Virginia to Cape Cod, Massachusetts, which agreed relatively well with hand-contoured in-situ data collected over a seven-day period.

Data from the three Superflux cruises and the Nantucket Shoals Experiment were keypunched onto computer cards and will be made part of the Northeast Monitoring Program data file in January by the Automated Data Processing Corporation. These data represent over 18,000 samples of biological, chemical, geological, physical, and meteorological variables collected on these cruises.

Sample bottles and instructions for the dinoflagellate resting cyst survey contract (P.I., Dr. Clarice Yentsch, Bigelow Laboratory) were placed aboard the November-December Northeast Monitoring Program/Ocean Pulse cruise. Over 50 samples were collected from Virginia to the Gulf of Maine and transferred to the Bigelow Laboratory for analysis for the presence or absence of *Gonyaulax excavata* resting cysts.

New York Bight Apex seabed oxygen consumption data analysis and interpretation was continued and will be presented in the 1982 Northeast Monitoring Program annual report.

Water samples for phytoplankton population evaluation were obtained from cruise *Delaware* 82-09 and are currently being processed by Mrs. Myra Cohn, Sandy Hook Laboratory, and Dr. Harold Marshall, Department of Biology, Old Dominion University, Norfolk, Virginia.

A joint effort to provide surveillance of New Jersey waters for cysts of *Gonyaulax excavata* continued. Paul Olsen and Eric Feerst (Water Resources Division, New Jersey Department of Environmental Protection) and Myra Cohn have examined 31 locations since December 1981 from Sandy Hook Bay to Absecon Bay (New Jersey), as well as sites along Delaware Bay and River during the time encystment is likely to have occurred (late fall and winter). No positively identified cysts of *Gonyaulax excavata* have been found to date.

Algal assay work concentrated on assessment of the growth potential of red tide dinoflagellate, *Gonyaulax excavata* in New York and New Jersey waters. Currently, the study deals with the growth of this species in Lower New York Bay waters. Pre-assay work included test of growth in various low-nutrient media to determine their suitability for assay inocula preparation. Also, electronic cell counts of cultures were compared with microscope counts. Our first assay run, of 14 samples, was set up. The samples collected from the same Lower Bay station from July through September, received 10 different supplements of essential micronutrients, singly or in combinations.

## Coastal Ecosystems Investigation

### Benthic Community Structure

Our winter sampling of sediments and benthic macrofauna of the Northeast Monitoring Program area was completed in November aboard *Albatross IV*. Dave Radosh was chief scientist for the northern leg of this cruise. Dave also worked on a manuscript concerning effects of anoxia on the benthos. Dave and Bob Reid edited a manuscript by Clyde MacKenzie on effects of sediment grain sizes and sewage sludge content on settlement of invertebrates in trays held on the ocean bottom off Long Island. Results indicated that settling molluscs (including the surf clam) and amphipods avoided, or were killed by, sediments with sludge, while polychaete densities were higher in sludge-containing sediments. This field experimental approach holds promise in determining what constituents of the New York Bight's contaminated sediment are responsible for observed effects on the macrobenthos. Future tray experiments will examine effects of sludges from different treatment plants, and of several heavy metals and other single constituents of the sludges.

We also worked on our annual report on the benthic ecology of the Northeast Monitoring Program area, and on the overall Northeast Monitoring Program "health of the oceans" report for 1982. Ann Frame and Steve Fromm continued to process macrofauna samples and data, concentrating on summer 1981 collections. We coordinated the analysis of sediments, lobsters and clams from the New Bedford area for PCB's. The benthos of the Philadelphia Dumpsite's potential area of influence was characterized to aid in management of that site by EPA. We reviewed a manuscript on the benthos of New York's Lower Bay.

### Benthic Energetics

Work continued on: (1) compiling life history information for dominant benthic macrofaunal species on Georges Bank and the Gulf of Maine,

(2) analyzing benthic data on the New York Bight Alternate Dumpsite to prepare site characterization reports for EPA, (3) finishing up calorimetry data base, (4) improving the draft manuscript on the secondary production of the benthic invertebrates of Georges Bank, (5) developing a paper on the standing stocks and estimated secondary production of the benthos in the New York Bight Apex with particular reference to impacts of dumping and relevancy to fisheries, and (6) developing an annual summary of 1982 efforts to support Northeast Monitoring Program monitoring.

We also contributed life history information to the Philadelphia site characterization report draft.

Frank Steimle worked with Denise Hollomon to plan and coordinate the November-December Northeast Monitoring Program monitoring cruise and was chief scientist of the first leg, 15-24 November. Frank also worked with John LeBaron, Automated Data Processing Unit, Sandy Hook, to review a proposal to retain the services of Robert Pikanowski to develop the NEFC benthic data file.

### Environmental Chemistry Investigation

Measurements of inorganic nutrients in seawater for 1980, including eight monitoring surveys (MARMAP and Ocean Pulse) were proofed and entered into our computer archive. This represents a major milestone, since we can now gain an understanding of annual variability of nutrients on the shelf by comparing 1979 (our first year of collection) with 1980 data. About 800 analyses of inorganic nutrient concentrations were completed for the algal assay studies being done by John Mahoney and Denise Hollomon (Sandy Hook). Salinities were measured, calculated, and submitted to the Automated Data Processing Unit for the Ocean Pulse cruise, *Albatross* 82-10.

C. Murchant, C. Ingham, and T. Finneran participated in the November-December MARMAP survey (*Delaware* 82-09). Chlorophyll was measured throughout the upper 100 meters at 161 stations and <sup>14</sup>C-primary production at 36 stations.

V. Zdanowicz participated in the Ocean Pulse survey, *Albatross* 82-12, collecting sediment samples from 87 stations for trace metal analyses, 40 sediment samples for hydrocarbon analyses (contract) and 337 sediment samples for grain size, organic C and N analyses.

Reports characterizing phytoplankton biomass and nutrients at the 106-mile deepwater dumpsite were finished and provided to Don Miller (EPA) and J. Pearce, both members of the Joint Agency Steering Committee on Ocean Disposal.

Considerable time was spent by all members of this investigation developing our annual report to the Northeast Monitoring Program. Our final report will be available in January.

### Environmental Statistics Investigation

As a part of our effort on synchronizing various Northeast Monitoring Program investigation data and other NEFC data files, we are creating a new data retrieval system through an automated data processing network. Our objective is to develop a system which allows easy access to those files and to retrieve and synthesize them in terms of spatial, temporal and other parameters of interest. We are starting with our autumn 1979 survey data files including benthos, phytoplankton, primary productivity, hydrography

and groundfish data. Works on zooplankton and ichthyoplankton data files are forthcoming in the near future.

Ongoing statistical consulting works are: examining the utilities of various diversity indices for the spatial and temporal discrimination of benthic communities in Long Island Sound, analyzing 1981 sediment metal data from the New York Bight Apex area to check the consistency of any recognizable grouping patterns of various metal distributions with respect to the 1980 data, and applying statistical techniques toward fish immunological studies and man-induced stresses on fish physiological response studies.

We completed a review of the monograph, "Ecological diversity in theory and practice," (edited by Grassle, Patil, Smith and Taellis) for the *Mathematical Review* published by the American Mathematical Society.

## Physiological Effects of Pollutant Stress Investigation

### Physioecology

Adult blue mussels were collected and are being conditioned for spawning. The mussels will be spawned and the embryos challenged by various heavy metals.

Adult oysters were obtained from a local oyster company and are being conditioned for spawning. Embryos of these oysters will be subjected to seawater collected at specific sites in the New York Bight, in a cooperative study with Clyde L. MacKenzie, Jr. of the Sandy Hook Laboratory.

*Fundulus heteroclitus* were collected and set up in a diluter system for Dr. Peddrick Weis of the New Jersey Medical School. The fish are being exposed to copper ( $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ ) and mercury ( $\text{HgCl}_2$ ) in combination. Copper concentrations are at 0, 5, 25, and 50  $\mu\text{g}/\ell$  and mercury concentrations are 0, 2, 10, and 20  $\mu\text{g}/\ell$ .

Six diluters were cleaned and calibrated for experiments for Biochemistry and Physiology. Four diluters are in use now, two for Biochemistry and two for Physiology. The Biochemistry diluters are exposing sea scallops to either copper ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) or cadmium ( $\text{CdCl}_2 \cdot 2-1/2\text{H}_2\text{O}$ ) at 0, 1, 5, and 10  $\mu\text{g}/\text{P}$  metal. The Physiology diluters are exposing lobsters to cadmium ( $\text{CdCl}_2 \cdot 2-1/2\text{H}_2\text{O}$ ) at 0, 1, 5, and 10  $\mu\text{g}/\ell$ .

We participated in both legs of the winter Northeast Monitoring Program Cruise (*Albatross* IV 82-12) from November 15-24 and November 29-December 10.

### Physiology

A major effort this reporting period was the participation in both legs of the November/December Northeast Monitoring Program cruise on the *Albatross*. We sent two people on each leg to sample blood from sea scallops and various flounder species. A major portion of our Northeast Monitoring Program data was entered in the NEFC data base and we are working on the entry of the remainder. A portion of this reporting period was also spent working on the annual Northeast Monitoring Program report.

In the laboratory, we have been working on scallops and lobsters exposed to metals in the diluter system. Sea scallops are being exposed to cadmium and to copper by the Biochemistry group and we are cooperating by sampling hemolymph and conducting gill tissue respiration measurements. The lobsters are also being exposed to cadmium, and are being removed at intervals for heart-rate and gill bailer-rate studies. In addition, we

have just completed a collection of windowpane and winter flounders for metal exposure later this winter, and we made a trip to Edenton, North Carolina, to pick up 500 small striped bass for future studies.

We are continuing our monthly sampling of flounder in Long Island Sound, and this winter we will have completed a two-year study of windowpane flounder hematology at polluted and clean sites in the Sound. We are also conducting initial flounder blood studies at the New Haven Dumpsite in preparation for cooperative studies with EPA at that site this spring and summer.

### Biochemistry

During this bimonthly reporting period (with four holidays), biochemical analysis was completed on sea scallop (*Placopecten magellanicus*) tissues from the weekly sampling of the New Jersey population through early October, in addition to sea scallop adductor muscle samples from RA/AL 82-06 (sea scallop survey, leg 1). Work is well underway on analysis of scallop tissues from RA/*Albatross* 82-08 (sea scallop survey, legs II and III) and Ocean Pulse *Albatross* 82-10 (August-September). Work is also in progress on flounder kidney specimens from Ocean Pulse *Albatross* 82-12 (November-December). Considerable time was spent in preparing the Northeast Monitoring Program annual report. Monthly collections from the New Jersey population were made in mid-November and December, and we participated in the November-December Ocean Pulse cruise, *Albatross* 82-12.

In mid-November, sufficient numbers of scallops were obtained from the Block Island East population, via the *Gloria Michelle*, for setting up two chronic exposures of this animal to heavy metals. In the first series the metal is 20 ppb cadmium as the chloride, and in the second, 20 ppb copper as the sulfate; both are nine-week exposures followed by one and five weeks of clearing. Kidney tissues will be fixed for EDAX examination by Dr. Bruce Fowler (National Institute of Environmental Health Science, Research Triangle Park, North Carolina), to localize sites of accumulation of each metal in kidney concretions and metallothioneins, and to gain some idea of their comparative rates and mechanisms of clearance by the scallop kidney. Replicate kidney samples, plus other tissue samples, will be analyzed for metals uptake by R.A. Greig of this investigation, for biosynthetic activity (in the kidney) and energy flux (in adductor muscle) by this subtask. Additional scallops from these exposure series will be supplied to Paul Yevich (EPA, Narragansett, Rhode Island) for histopathological examination.

An additional experimental exposure was set up and completed. Scallops were exposed for less than three days to 700 ppb cadmium as the chloride in aerated, filtered seawater held at 10°C, changed daily; the concentration was chosen to compare with results from a similar exposure of *Argopecten irradians* to cadmium (700 ppb) in flowing seawater for five days. Because our exposed sea scallops looked very poor at 67 hours, however, they were removed at that time. Kidney specimens were fixed for shipment to Bruce Fowler for EDAX work. Hemolymph specimens were supplied to Dr. R.A. Robohm (Molluscan Disease Investigation) to examine for the presence of opsonins; Physiology took gill tissue and hemolymph; Chemistry took digestive mass, kidney, gonad, and muscle; and Biochemistry took kidney, adductor muscle, and gonad, now archived at -80° to await biochemical analysis.

### Anaerobic Bacteriology

Activities for the bimonthly period included completion of analysis of the samples obtained from Northeast Monitoring Program cruises *Albatross* 82-10 and *Delaware* 82-08. Data from the numerous sediments collected during the New York Bight Benthic Monitoring cruise provided an outline of the distribution of *C. perfringens* in New York Bight and Massachusetts Bay sediments that was more detailed than results from previous collections. The pattern of distribution indicates a larger area of sewage pollution peripheral to the dumpsite in the Bight Apex than has been found previously, and some evidence of migration to the Upper Hudson Slope Valley. No trends were observed in Massachusetts Bay other than high levels of *C. perfringens* in the sediments.

Analysis of sediment cores demonstrated significant levels of *C. perfringens* in the sub-surface samples, although less (50%) than in surface layers. The decrease in count below the sediment surface reflects the die-off of vegetative cells of the bacterium. In contrast, the *Vibrio* group were confined almost exclusively to the top layer.

Sediments taken from 12 stations and fish taken from two areas were collected during Ocean Pulse cruise *Albatross* 82-12 to examine for our target group of bacteria and for procedural analysis.

A significant amount of time was spent in preparing the annual Northeast Monitoring report.

### Chemistry

Five new experiments were started this reporting period that required the chemistry group to monitor the seawater in the diluter exposure systems for ambient and contaminant levels of metals. These analyses took a good portion of analytical time. In particular, we did not have an existing set-up for analyses of seawater for mercury, which was one of the metals being tested. New equipment for mercury analyses (Laboratory Data Control mercury analyzer) was installed and made properly functional for analysis of seawater samples. Previous methodologies are being adapted for mercury analysis of tissue samples, as the present techniques are not compatible with this new equipment.

Metals analyses for cadmium, copper, and sometimes lead were performed on tissue samples from the following animals: oysters and surf clams collected from the New York Bight, windowpane and winter flounders exposed to cadmium and copper, and rock crabs collected during a spring Northeast Monitoring Program cruise as part of cooperative work with Tom Sawyer of the Oxford Lab.

### Publications

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- Draxler, A.F.J., R. Waldhauer, A. Matte, and J.B. Mahoney. Nutrients, hydrography and their relationship to phytoflagellates in the Hudson River estuary. Bull. N.J. Acad. Sci. (S)
- Evans-Zetlin, C., and J. O'Reilly. 1982. Characterizations of phytoplankton biomass and community size-composition near the Deepwater Dumpsite 106. 106-mile Dumpsite Characterization Update. NOAA Tech. Mem. NMFS-F/NEC. (S)

- Evans-Zetlin, C., and J. O'Reilly. 1982. Characterization of phytoplankton biomass and community size composition surrounding the Philadelphia Dumpsite. Philadelphia Dumpsite Characterization Update. NOAA Tech. Mem. NMFS-F/NEC. (S)
- Mahoney, J.B. 1982. The effects of trace metals on growth of a phytoflagellate, *Olisthodiscus luteus*, which blooms in Lower New York Bay. Bull. N.J. Acad. Sci. 27(2):53-57. (P)
- Marshall, H.G., and M.S. Cohn. 1982. Seasonal phytoplankton assemblages in northeastern coastal waters of the United States. NOAA Tech. Mem. NMFS/NEC-15. NTIS, Springfield, VA. (P)
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- Olla, B.L., A.J. Bejda, and W.H. Pearson. Effects of oiled sediment on burrowing behavior of the hard clam, *Mercenaria mercenaria*. Mar. Environ. Res. (S)
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- Reid, R. Benthic macrofauna. Philadelphia Dumpsite Characterization Report for EPA. (S)
- Reid, R. Recent and ongoing benthic macrofauna monitoring in U.S. marine and estuarine waters. International Council for the Exploration of the Sea. (S)
- Reid, R., J. O'Reilly, and V. Zdanowicz. 1982. Contaminants in New York Bight and Long Island Sound sediments and demersal species, and contaminant effects on benthos, summer 1980. NOAA Tech. Mem. NMFS-F/NEC-16. (P)
- Thomas, J.P., H. Mustafa, A.A. Tvirbutas, C.A. McPherson, and J.B. Suomala, Jr. 1982. Seasonal patterns of surface temperature and phytoplankton pigments in the Georges Bank region. ICES C.M. 1982/L:14.

## Miscellaneous

### Travel, Meetings, and Presentations

Bill Phoel presented a paper at the Undersea Medical Society's Workshop entitled, "Protection of Divers in Waterways Receiving Hazardous Chemical, Pathogenic and Radioactive Substance Discharges." The workshop was held in Bethesda, Maryland.

Bill assisted in the instruction of NOAA and U.S. Coast Guard personnel in recompression chamber therapy and attended the NOAA Diving Safety Committee's Annual Meeting.

Bill was also requested by the NOAA Diving Office to help advise the University of Puerto Rico Sea Grant Program on equipment and procedures for their recompression chamber and instructed doctors, nurses, technicians and affiliated students in its operation.

On 2-3 November, Jim Thomas visited the C.S. Draper Laboratory, Inc., Cambridge, Massachusetts, to join in discussions for planning the production of coastal zone color scanner imagery.

On 8-9 November, Jack Pearce participated in a major program review of NOAA funded activities being conducted at the Marine Science Center, State University of New York at Stony Brook. Programs ranged from studies ongoing with phytoplankton to major hydrographic features of western Long Island Sound as these relate to the East River and Hudson estuary. Most of the studies were of interest to fisheries ecology and oceanography and in many instances, the presence of a fisheries biologist enhanced discussions and decisions in regard to the project.

On Wednesday, 10 November, Jack Pearce participated in the Interagency Steering Committee meeting on ocean disposal. The meeting was held to review current progress in terms of the development of site characterization updates (regional assessments); these are of considerable importance to the Region and Center in the context of the Regional Action Plans, and they are also important to ongoing activities of the Advisory Committee on Marine Pollution, International Council for the Exploration of the Sea.

On Wednesday, 17 November, Jack Pearce gave a presentation to the Cape Cod Men's Professional Club. He discussed the matter of habitat quality as it relates to fishery production. Several members of the Club are commercial or avid recreational fishermen and the talk resulted in numerous questions from the floor.

On Monday, 22 November, Jack Pearce met with EPA Region II personnel in regard to projected ocean disposal of fly ash. In addition to the EPA personnel, individuals in attendance represented the Consolidated Edison Company, New York City, the Ocean Assessment Division of NOAA, and others. It has been projected that fly ash resulting from the use of coal in steam electric generating stations might be disposed of in shelf or off-shelf waters. Principal topics included the types of monitoring and research that should be conducted in advance of, and during, actual disposal operations. It was indicated that the Northeast Monitoring Program might be the acceptable monitoring format to be used. It has also been indicated that actual disposing of fly ash might be required to monitor the disposal operations. Types of sampling gear, temporal sequence of measurements, and chemical and biological effects were discussed.

On 1 December, Jack Pearce gave a lecture to the graduate course on pollution effects being offered at the University of Rhode Island. He discussed the results of site specific research and long-term monitoring that are conducted along the eastern seaboard and contrasted the findings with results that have come forward from studies being conducted in North Sea and Baltic Sea waters.

On 5-10 December, Ruth Waldhauer attended the American Society of Limnologists and Oceanographers/American Geophysical Union winter meeting held in San Francisco, California.

On Monday, 13 December, Jack Pearce participated in an ad hoc meeting of Center personnel concerned with coordination of Center environmental studies. It was decided that a task force would be established within the Center having the responsibility to develop data from various divisions for use in site characterization updates and regional assessments. Center personnel from the divisions represented were identified as participants in the task force which will report to Jack Pearce.

On 22 December Frank Steimle met with representatives of the New Jersey Marine Advisory Service to discuss artificial reef planning and development off southern New Jersey.

On Tuesday, 28 December, Jack Pearce met with University of Arizona personnel who are involved with environmental studies in the Gulf of California. He reviewed the ongoing research and monitoring activities that are being conducted in waters off the northeast coast. University personnel discussed a range of activities being conducted in marine waters off the Sonoran coast.

#### Seminars

A. Draxler presented a seminar entitled, "Genetic Variation in Phytoplankton (and its Relationship to Temperature Regimes)," to the staff of the Sandy Hook Laboratory on 17 December.

On 22 December, J. O'Reilly and J. Thomas met with R.L. Edwards, K. Sherman, H. Mustafa, A. Tvirbutas (Draper Laboratories), J. Goulet, and D. Busch at Narragansett, Rhode Island, to plan protocol for sea truthing coastal zone color scanner imagery.

On 29-30 November, Frank Steimle and Bob Reid met at Sandy Hook with other Northeast Monitoring Program personnel to discuss program management.

#### Visitors

Personnel from Camp, Dresser and McKee ecological consultants visited Bob Reid on 9 December to examine data on the benthos of Lower Bay, New York, to aid in determining impacts of changing levels of sewage treatment.

#### University Affairs

On 8 December, Anne Studholme presented a seminar entitled, "Behavioral measures of response to environmental stress," to the Graduate Colloquium on Physiology of Adaptation at the City College of New York.

On 28 December, Frank Steimle met with Stavoris Howe, University of Delaware, to discuss problems in preparing the final report on the secondary production of select benthic invertebrates at the mouth of Delaware Bay.

### JANUARY-FEBRUARY

#### Behavior of Marine Fishes and Invertebrates Investigation

As part of our continuing effort to assess the impact of anthropogenic stress on marine communities, a series of collaborative studies with Bori Olla of Oregon State University and Dr. R. Swartz of the EPA have been initiated. The aim of these studies is to examine the feasibility of extending the techniques that we developed with oil-contaminated sediments to other potential sediment pollutants. In the first phase of these studies, we are examining the effects that sediments contaminated with sewage and associated contaminants have on the burrowing behavior of the sand worm, *Neanthes virens*.

#### Biological Oceanography Investigation

A report on algal assay studies was prepared for the annual Northeast Monitoring Program/Ocean Pulse meeting. Data from over 300 samples assayed affirms that nitrogen is most frequently the nutrient limiting phytoplankton growth in northeast coastal and shelf waters. However, other nutrients, especially phosphorus, also have major importance. In addition,

growth inhibiting substances may be critical at times since complete growth inhibition was found in 12 of 109 samples from one cruise set.

Work continued on assessment of growth potential of the toxic dinoflagellate *Gonyaulax excavata* in New York and New Jersey waters. This work is considered necessary and timely because of the apparent southward spread of this species. Dr. Edward Carpenter of the State University of New York has suggested in a letter that because of the widespread distribution of *G. excavata* in Long Island waters it will likely be found soon in New Jersey waters. Paralytic shellfish poisoning caused by this dinoflagellate has not been found in Long Island, but is regarded as a potential problem. Water samples collected last summer from surface and bottom at seven stations in Raritan, Lower, and Sandy Hook Bays are being assayed station-by-station. Assay of the first station was completed. Of the various nutrient supplements tested, trace metals mix chelated with ethylenediaminetetraacetate was the most stimulating to growth. A second set of 14 samples was set up and is presently incubating.

A joint effort with Paul Olsen and Eric Feerst, New Jersey Department of Environmental Protection to provide surveillance for cysts of *Gonyaulax excavata*, responsible for paralytic shellfish poisoning in New England has examined thirty-one estuarine locations in New Jersey. No cysts of *G. excavata* have been identified to date from these samples.

Water samples for phytoplankton community structure were obtained from two legs of the cruise *Delaware* 83-01 (the third leg was cancelled) and are currently being processed by Myra S. Cohn, Sandy Hook Laboratory, and Harold G. Marshall, Department of Biology, Old Dominion University, Norfolk, Virginia.

A paper, "Phytoplankton in Northeastern U.S. Shelf Waters: Spatial and Temporal Trends," was delivered by Dr. Marshall and Mrs. Cohn at the second annual Northeast Monitoring Program workshop held in Milford, Connecticut, 22-24 February. While Mrs. Cohn and Dr. Marshall were in Milford, plans were made for joint studies on three shelf regions defined by recurrent patterns on phytoplankton populations.

During the period 31 January until 3 February, Jim Thomas and Craig Robertson visited the NOAA/Goddard Space Flight Center in Greenbelt, Maryland, to process NOAA-7 satellite thermal imagery to be utilized in the study of estuarine plume dynamics and continental shelf surface water circulation. Scenes from October 1982 were enhanced and facsimile hard copies produced.

On 22 February, Craig Robertson in conjunction with Cathy Warsh (NOAA National Ocean Survey) and Terry Whitlege (Brookhaven National Laboratory) presented a report on the Northeast Monitoring Program water column monitoring cruises for 1982 at the Northeast Monitoring Program annual meeting in Milford, Connecticut. Craig reported on the comparison of NOAA-7 thermal imagery with in-situ sea-truth temperature data collected on the September 1982 cruise. The comparison showed a close agreement between satellite and shipboard measurements with the remotely sensed data exhibiting greater detail. Sea-truth data were also used to calibrate the satellite imagery to yield temperature values for the gray-scale contours. This experiment will be continued throughout 1983.

Craig Robertson was invited to speak at the Keansburg High School, Keansburg, New Jersey, for their Career Day. Approximately 50 students were addressed on the topic of, "Marine Science as a Career."

Jim Thomas visited and spoke with students at the Mater Dei School in Middletown, New Jersey, as part of their Career Day.

The analyses and interpretations of seabed oxygen consumption data from the New York Bight Apex for the summers of 1974, 1975, and 1982 were completed and submitted in our 1982 annual Northeast Monitoring Program report. These data were also presented at the Northeast Monitoring Program meeting in Milford, Connecticut, during February.

In January, Bill Phoel attended a symposium entitled, "Hyperbaric Oxygen in Emergency Medical Care," at the Bronx Municipal Hospital Center, Albert Einstein College of Medicine, to keep the Sandy Hook Laboratory Diving Unit abreast of emergency diving accident procedures in the New York/New Jersey areas.

Jim Thomas participated in a meeting at the C.S. Draper Laboratory, Inc., Cambridge, Massachusetts, to discuss remote sensing of phytoplankton pigments and suspended sediments. At the meeting, Niels Højerslev, of the Danish Institute of Physical Oceanography, discussed possibilities for the development of suitable algorithms for converting ocean color into total phytoplankton pigment concentration.

Jim Thomas presented an invited talk, "Remote Sensing - A New Tool in Oceanographic Research," to the American Chemical Society on 17 February.

At the Northeast Monitoring Program meeting in Milford, Connecticut, Jim Thomas talked about the potential for remote sensing to help in the definition of water management units.

## Coastal Ecosystems Investigation

### Community Structure

We completed our annual report on benthic community studies for the Northeast Monitoring Program. Major findings in the past year were:

(1) Moderate decreases in numbers of species (a variable usually inversely related to environmental stress) at 21 of 25 regional stations from winter 1979 through summer 1980 to winter 1980. At most stations, species numbers returned to typical values by summer 1981; also, numbers of amphipods (also thought sensitive to pollution stress) were consistent over this period. It is therefore felt that the decreases in species richness were not indicative of continued environmental degradation, but instead represented greater natural variability than had been seen in the data previously.

(2) Declines in species numbers did continue through July 1981 at four of the six standard New York Bight stations. At the Hudson Shelf Valley site, numbers of the amphipod, *Ampelisca agassizii*, dropped by 80% between summer 1980 and 1981. Preliminary data indicate that another sensitive amphipod, *Rhepoxynius epistomus*, has become scarcer off the Long Island coast since the early 1970's, and more recently (summer and fall 1982) at our midshelf station off Delaware Bay. These trends could signal increasing degradation of the mid-Atlantic shelf. To ascertain this, it must be determined whether the trends persist in macrofauna samples presently being analyzed, and whether similar trends are found in other Northeast Monitoring Program studies. Our results were presented at the Northeast Monitoring Program workshop in Milford in February.

Ann Frame and Steve Fromm continued working on Northeast Monitoring Program benthic samples, Dave Radosh on a manuscript concerning anoxia effects on benthos, and Clyde MacKenzie on plans for field experiments on effects of different sediment types and contaminant levels on settling of larval surf clams and other species. Bob Reid participated in the first meeting of the Ocean Dumping Working Group, a pilot effort under the Regional Action Plan. A position paper on dumping and recommended

monitoring at Deepwater Dumpsite 106 was developed. Bob also provided data to Metcalf and Eddy, Inc., and EG&G environmental consultants, on Northeast Monitoring Program monitoring data and on variability of the benthos at Deepwater Dumpsite 106, respectively.

### Benthic Energetics

Frank Steimle worked on several manuscripts including: (1) the benthic productivity section of the Georges Bank book, (2) a paper on impacts of dumping on benthic invertebrate biomass and production in the New York Bight Apex -- Bight and fisheries implications, (3) a paper summarizing the results of our calorimetric analysis of continental shelf organisms, (4) a paper on the secondary production of the benthos at the mouth of Delaware Bay, and (5) a report on the benthos at Deepwater Dumpsite 106.

Work continued on analyzing the final set of samples in preparation for a report on the benthic population at risk from waste dumping at the alternate dumpsite south of eastern Long Island, and analyzing miscellaneous samples from the Deepwater Dumpsite 106 area and stations off eastern Long Island to include these data in our files on these areas. Jan Ward continued working on the life history data file for benthic species of Georges Bank.

Russ Terranova completed calorimetric analyses of liver samples from blue shark collected in 1981 as part of a cooperative study of seasonal variations of stored energy reserves relative to spawning and migrations. Russ also ran analyses on the effect of long-term freezer storage on caloric and moisture content of shark liver tissue; preliminary results indicate no significant change with time. He continued to work on developing our caloric inventory file which currently contains data on 324 aquatic species from 99 literature sources.

Russ participated in two one-day cruises on the *Kyma* to collect samples in the New York Bight Apex for study of the productivity of selected benthic invertebrate species relative to pollution gradients, and to collect data on the feeding habits of fish and lobster found in and around the contaminated Christiaensen Base of the Apex.

Frank Steimle worked on editing the 1981 Northeast Monitoring Program report, preparing a subtask section to the 1982 investigation annual report, and prepared material to support Superfund planning in NMFS, Washington, D.C.

### Physiological Effects of Pollutant Stress Investigation

#### Physioecology

An experiment challenging oyster embryos with seawater collected at specific sites in the New York Bight was conducted this reporting period. Varying degrees of inhibited development of larval growth have been observed in water from several sites, but it is much too early in the experiment to notice any trends. This is a cooperative study with Clyde L. Mackenzie, Jr. of the Sandy Hook Laboratory.

Adult oysters were spawned and the embryos stressed with water collected at specific sites from the Central Long Island Sound Dumpsite. This is the initial phase of a study to monitor the water quality of the dumpsite. Dumping is to begin in mid-April. The spoils are from Black Rock Harbor and Ash Creek in Bridgeport, Connecticut. Surface and bottom water samples will be collected at 14 sites. The sites will be monitored

monthly prior to dumping, weekly during dumping, and biweekly after dumping for a short period, later changing to monthly sampling.

Dr. P. Weis, New Jersey Medical School, has removed his killfish from a diluter where they had been exposed to copper and mercury in combination for 30 days.

Three diluters were calibrated for Physiology. One diluter is exposing windowpane flounder to copper ( $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ ) at 0, 10, and 20  $\mu\text{g}/\text{l}$ . The other two diluters contain striped bass that are being exposed to mercury ( $\text{HgCl}_2$ ) at 0, 5, and 10  $\mu\text{g}/\text{l}$ .

### Physiology

In the laboratory we have been working on sea scallops exposed to copper and to cadmium in the diluter system. We have completed gill-tissue respiration measurements on these animals after seven weeks of exposure to 20  $\mu\text{g}/\text{l}$  of each metal. Copper depressed respiration significantly even after two weeks of recovery in clean seawater. Cadmium had a mild stimulatory effect, with elevated respiration rates even after four weeks of recovery.

We have also been studying the effects of copper, cadmium, and zinc on the gill bailer and heart activity of lobsters. We have worked out the techniques for monitoring and recording these activities and are now gathering data on metal effects.

We began exposures of windowpane flounder to 10 and 20  $\mu\text{g}/\text{l}$  copper and of striped bass to 1, 5, and 10  $\mu\text{g}/\text{l}$  mercury. Hematological measurements will be made on both groups of fish during March. Half of the striped bass will be held for a 60-day recovery period. Striped bass liver and kidney from the exposed animals will be provided to Dr. P. Weis, New Jersey Medical School.

In the field we are preparing for a major monitoring effort at the Central Long Island Sound Dumpsite. We will be studying long-term effects of contaminated dredge spoils from Black Rock Harbor in Bridgeport on flounder, lobster, and blue mussels. Much of this effort will be coordinated with studies conducted by EPA, Narragansett, at this site.

The Long Island Sound study continued during this reporting period. Blood from both winter and windowpane flounder was sampled once each month at stations 9, 90, and the Central Long Island Sound Dumpsite. Windowpane flounder only were sampled at Station 54.

Considerable time and effort were spent graphing and interpreting the Long Island Sound data to determine whether more data are necessary for publication. The decision was made to complete the monthly sampling for March and April, finish the copper exposure (windowpane flounder) that is in progress now, and expose a group of the same species to cadmium prior to publication of the data.

### Biochemistry

During this reporting period biochemical analyses were completed for all adductor muscle samples from last summer's annual sea scallop survey cruise, *Albatross* 82-06 and *Albatross* 82-08 (I, II) and from Northeast Monitoring Program cruise *Albatross* 82-10. Also completed were scallop kidney analyses from Northeast Monitoring Program cruises *Albatross* 82-12 and flounder kidney analyses from *Albatross* 82-12.

Work continued on tissues from the monthly sampling of the single scallop population off Asbury Park, New Jersey. Beginning with last November's collection, we have added gonad analysis to our testing

schedule. Optimal protocols have been established for gonadal G6PDH, PK, MDH, GDH, and malic enzyme.

Two experimental exposures of sea scallops to 20  $\mu\text{g}/\ell$  copper (as sulfate) and 20  $\mu\text{g}/\ell$  cadmium (as chloride), respectively, were completed, as were the subsequent holding period in seawater to which no metal was added. This multidisciplinary study was designed to examine the mechanisms and rates of uptake, detoxification, and clearance of these two toxic heavy metals, one of which (copper) is also a physiologically essential trace element. The experimental exposures took place while the scallop reproductive cycle was at low ebb, during post-spawning resorption of gametes and the first stages of gametogenesis. Gross observation during animal dissection showed that roughly 20% of the controls had discernibly differentiated gonads; in the copper-exposed scallops, gametogenesis was inhibited (only 5% differentiated), whereas the reverse was true for the cadmium-exposed scallops (30% differentiated). First results from gonad analysis corroborate these gross observations, with greater biosynthetic activity (G6PDH) in the cadmium-exposed animals. High mortalities in the copper-exposed scallops necessitated shortening the exposure period to seven weeks (from a planned nine weeks), but we lost no cadmium-exposed scallops at all. We plan to repeat the exposure series during a different phase of the reproductive cycle, with the takedowns scheduled for after glycogen reserves have been built up in the adductor muscle and transfer of those reserves to the gonad is beginning.

Considerable time was spent on manuscript revision, jury duty, and participating in the annual Northeast Monitoring Program workshop.

#### Anaerobic Bacteriology

A major activity for the bimonthly reporting period was the preparation for the Second Annual Northeast Monitoring Program Workshop held at Milford, February 22-24, 1983. Two presentations were made, "The distribution of *C. perfringens* and *Vibrio* spp. in the top sediments and waters of the Western Atlantic," the Northeast Monitoring Program study area, and, "The distribution of *C. perfringens*, *Vibrio* spp. and bacterial fecal indicators in animals." A summary of this year's results and those of previous years show that the presence and distribution pattern of *Clostridium perfringens* in the top layer of sediments can show the patterns of sewage contamination in impacted areas. Distribution of the pathogenic *Vibrio* spp. is concentrated at estuarine mouths, suggesting that lower salinity is a factor in their distribution (temperature and nutrients being equal). An exception is *V. vulnificus* (a member of the lactose-positive halophilic group) whose presence in many offshore areas reflects a greater salt tolerance for this species. In several animal species (crabs, lobsters, mussels, scallops) from the New York Bight Apex the presence of several bacterial pathogens correlated well with coliform indices, although some exceptions are to be found. *C. perfringens* was often present in relatively high numbers when coliform indices were low, indicating a more persistent type of fecal pollution. *Vibrio* spp. were also found in apparently non-impacted sewage areas, that is, with no coliforms present.

Recent field work has been directed at obtaining background information (bacterial indices) for the Central Long Island Sound Dumpsite, in anticipation of the dredging operation at Black Rock Harbor that will begin in April. Sampling includes sediments and waters from Black Rock Harbor, New Haven Harbor, and Bridgeport Harbor, since material from the latter two will also be dumped at the site. The purpose of this study is

to follow the effects of dredging and disposal operations using several bacterial indices, and to relate those effects to those observed at other areas in Long Island Sound.

### Publications

- Dawson, M. 1982. Effects of long-term mercury exposure on hematology of striped bass, *Morone saxatilis*. Fish. Bull. 80(2):389-392. (P)
- MacKenzie, C., D. Radosh, and R. Reid. Field experiments on effects of sewage sludge on settlement of marine invertebrates. Coastal Ocean Pollution Assessment News (COPAS). (A)
- Olla, B.L., A.J. Bejda, and W.H. Pearson. 1983. Effects of oiled sediment on burrowing behavior of the hard clam, *Mercenaria mercenaria*. Mar. Environ. Res. 9. (A)
- Pearce, J.B. 1983. The Ocean Pulse and Northeast Monitoring Program (OP/NEMP); new approaches to monitoring the quality of fisheries habitats. Pages 39-61 In: L. Ciaccio and A.C. Cristini, eds. Proceedings of a Water Conference, Ramapo College, May 1-2, 1980. Ramapo College, Mahwah, New Jersey. (P)
- Pearson, W.H., D.L. Woodruff, P.C. Sugarman, and B.L. Olla. The burrowing behavior of the sand lance, *Ammodytes hexapterus*: effects of oil-contaminated sediment. Mar. Environ. Res. (A)
- Roesijadi, G., A. Calabrese, and D.A. Nelson. 1982. Mercury-binding proteins of *Mytilus edulis*. Pages 75-87 In: W.B. Vernberg, A. Calabrese, F.P. Thurberg, and F.J. Vernberg, eds. Physiological Mechanisms of Marine Pollutant Toxicity. Academic Press, New York. (P)
- Steimle, F.W. Benthic productivity (meio-, macro-, and megafauna). Chapter 9.2 In: R.H. Backus, ed. Georges Bank. MIT Press. (S)
- Thomas, J.P., H. Mustafa, A.A. Tvirbutas, C.A. McPherson, and J.B. Suomala. Seasonal patterns of surface temperature and phytoplankton pigments in the Gulf of Maine - Georges Bank region. J. Geophysical Res. (S)
- Vernberg, W.B., A. Calabrese, F.P. Thurberg, and F.J. Vernberg, eds. 1982. Physiological Mechanisms of Marine Pollutant Toxicity. Academic Press, New York. 564 p. (P)

### Reports

- Boehm, P.D. 1983. Organic pollutant levels in the ocean quahog (*Arctica islandica*) from the northeastern United States. Report prepared under contract NA-81-FA-C-0013. 14 p. (S)
- McNulty, J.K. 1983. Benthic fauna at Deepwater Dumpsite 106. (Section of NEFC Dumpsite Characterization Report to EPA.) (S)
- Staff. Benthic Ecology. Northeast Monitoring Program Annual Report, October 1981 through September 1982.

### Miscellaneous

#### Travel, Meetings, and Presentations

On 13 January Frank Steimle participated in a Northeast Monitoring Program management meeting at Rockville, Maryland.

On Monday, 17 January, Dr. Pearce met with New Jersey Department of Environmental Protection personnel and NMFS Regional Office personnel in relation to problems of PCB contamination of estuarine and coastal fish.

Frank Steimle presented a talk on the use of used tires as artificial reef material at a meeting of the New Jersey County Recycling Coordinators held in Toms River, New Jersey, on 20 January.

During the period 29 January through 4 February Dr. Pearce participated in the International Council for the Exploration of the Sea Working Group on Marine Pollution Baseline and Monitoring Studies which was held at Council headquarters, Copenhagen. The Working Group was especially concerned about the matter of biological effects monitoring, resource assessment, and intercalibration involving a range of contaminants.

Fred Thurberg attended a meeting of the International Council for the Exploration of the Sea Working Group on Marine Pollution Baseline and Monitoring Studies in Copenhagen, 31 January to 4 February.

Richard Greig attended a meeting of the International Council for the Exploration of the Sea Working Group on Marine Chemistry in Copenhagen, 7-10 February.

Frank Steimle attended a training session for supervisors in New York City, 7-11 February.

Tony Calabrese and Fred Thurberg participated in an EPA-sponsored workshop, "Dump Site Designation," in West Greenwich, Rhode Island, 14-17 February.

On Saturday, 26 February, Mr. Stu Wilk and Dr. John Pearce participated in the recreational fishing forum which was sponsored in part by NMFS/NOAA and held at the Farmingdale, Long Island, campus of the State University of New York.

Margaret Dawson participated in a panel on Water Quality and Marine Resources at the 1983 Environmental Leaders Conference sponsored by the Long Island Sound Task Force of the Oceanic Society.

### Seminars

Dr. Joanne Stolen, Drew University, presented a seminar on her behavior research being done as part of the Ocean Pulse Program. The seminar was given in the Nelson Benedict Room on Friday, 7 January.

Frank Steimle met with Center personnel in Narragansett, Rhode Island, on 13 January to discuss 1984 vessel scheduling options for Ocean Pulse.

On Tuesday and Wednesday, 25-26 January, Dr. Pearce chaired the bimonthly meeting of the Northeast Monitoring Program management team. The team considered the agenda and format for the Northeast Monitoring Program workshop which was held 22-24 February in Milford, Connecticut.

On Wednesday, 9 February, Dr. Joel O'Connor, Stony Brook office, Office of Marine Pollution Assessment, gave a seminar to the Sandy Hook Laboratory staff. His seminar was concerned with criteria for establishing unreasonable degradation due to ocean dumping and other forms of pollution.

On Monday and Tuesday, 14-15 February, Dr. Pearce, Dr. Sindermann, and other Center personnel participated in the NEFC Board of Directors meeting held at the Woods Hole Laboratory.

Most Division personnel participated in the Northeast Monitoring Program Workshop, 22-24 February. Dr. Pearce served as overall chairman of the workshop. This was the second annual workshop for the program.

On Tuesday, 24 February, Dr. Pearce met with the Advisory Council for the American Littoral Society. The Council discussed new programs for the Society for the coming year and also provided guidance to the Director of

the Society in regard to comments on various proposed ocean dumping activities.

On Tuesday and Wednesday, 11-12 January, Sandy Hook Laboratory hosted meetings of the Regional Action Plan planning group, and the EPA/NEC/Office of Marine Pollution Assessment interagency steering committee for ocean waste disposal. The meetings led to finalization of the planning document and considered the site characterization updates for the 106-mile and Philadelphia dumpsites.

On Monday, 24 January, Dr. Pearce gave a lecture to the New England Fisheries Management Council environmental forum. He talked about the various problems associated with ocean dumping of contaminated dredged materials and sewer sludge.

### Visitors

On 12 January Jack Pearce, Bob Reid and others participated with NOAA Office of Marine Pollution Assessment and EPA personnel in a meeting of the steering committee for site characterization studies at Sandy Hook.

On 9 February Bob Reid provided Dr. Joel O'Connor (NOAA Office of Marine Pollution Assessment) with data on benthos of the inner New York Bight and other physically similar ("control") areas for testing of an Index of Benthic Degradation which Dr. O'Connor is developing.

Norman Rubenstein, EPA, Gulf Breeze, Florida, visited Sandy Hook on 11 February to inspect our aquarium systems and discuss collaboration on laboratory studies of effects of different sediment types on settling and development of benthic communities. The work will tentively be done at Sandy Hook this summer. It is sponsored by the Corps of Engineers and is designed to help determine what types of sediments are most appropriate for capping dredged materials.

### University Affairs

The Physiological Effects of Pollutant Stress Investigation exposed killfish to mercury and copper in combination for 30 days for Dr. Peddrick Weis, Rutgers University, Newark, New Jersey. This investigation also provided gravid winter flounder to Dr. Judy Weis, Rutgers University.

Tony Calabrese reviewed a Ph.D. thesis for the University of South Florida, Tampa.

Bob Reid provided information for a Monmouth College seminar on New York Bight pollution, a Rutgers University analysis of effects of oil/gas pipelines on ecology of the New Jersey shelf, and a Kings Point, New York, Merchant Marine Academy study of historical trends in Long Island Sound dissolved oxygen.

Frank Steimle provided Dr. Allen Poole, Marine Biological Laboratory, Woods Hole, Massachusetts, with caloric information on flounder to support his development of an energy budget for osprey.

On Thursday, 13 January, Dr. Pearce participated in a graduate course on marine pollution at the University of Rhode Island. He gave lectures concerned with pollution in the North and Baltic Seas and contrasted these areas with the situation in the Middle Atlantic Bight.

On Friday and Saturday, 21-22 January, Dr. Pearce participated in the Marine Biological Laboratory course on pathology of marine organisms. He gave lectures on the effects of pollution on living marine resources and on the effects of symbiotic relationships involving pinnotherid crabs and bivalve mollusks.

On 10 February Allen Bejda met with graduate students enrolled in the Behavioral Ecology of Fishes course, Rutgers University, to discuss problems, methodology, and experimental designs in behavioral research.

### Public Affairs

Bob Reid spoke to the eighth grade class of Manasquan Elementary School on problems and studies in the New York Bight on 9 February.

Dr. Pearce spoke to the Rumson-Fair Haven Garden Club. His talk was concerned about habitat quality in relation to recreational and commercial fisheries in the Middle Atlantic Bight.

### EEO Activities

Frank Stiemle provided volunteer services to the Sandy Hook Day Care Center.

Tony Calabrese attended a Milford EEO Committee on 12 January and a NEFC EEO Committee meeting on 16 January.

## AQUACULTURE DIVISION

submitted by

Dr. James E. Hanks, Chief

### SEPTEMBER-OCTOBER

## Aspects of Nutritional Requirements of Mollusks Investigation

### Oyster Feeding

An experiment was completed in our experimental molluscan rearing chamber system in which juvenile oysters, *Crassostrea virginica*, were fed *Dunaliella euchlora*, *Pyramimonas grossi*, or diatom strain D-828 cultured in enriched seawater medium without vitamins (ENV). Growth of oysters on these diets was compared with that of oysters fed the same algal species cultured in the standard enriched seawater medium (E). Consistent differences in the growth of oysters fed algae cultures in E or ENV medium were observed, but conclusions based upon these data await completion of ancillary work on morphology and protein content of cells grown in these media.

We have also conducted experiments with larval oysters to determine the relative food values of single species diets of *Isochrysis galbana*, *I. galbana* Tahitian strain, *Dicrateria inornata*, *Pavlova gyrans*, and diatom strain D-828. Of these, *I. galbana* Tahitian strain produced the best larval growth with veligers increasing to 195.0  $\mu\text{m}$  after nine days of feeding. Mean larval sizes after nine days of feeding other algal species are as follows: *D. inornata*, 161.0  $\mu\text{m}$ ; *I. galbana*, 156.5  $\mu\text{m}$ ; diatom strain D-828, 150.0  $\mu\text{m}$ ; and *P. gyrans*, 128.5  $\mu\text{m}$ . The relatively poor food value of *P. gyrans* observed in this study is surprising considering that another species of the genus *Pavlova* (*P. lutheri*) has been shown previously to be a good food for larval oysters. These species offer a promising research opportunity for investigation of what constitutes a "good food" for oyster veligers.

## Semicontinuous Mass Algal Cultures

Algal cultures were harvested from carboys to yield volumes of 2,136 liters and 2,024 liters for larval and juvenile molluscan foods, respectively. These algal suspensions were distributed to the various investigations as follows: Spawning and Rearing of Molluscs, 2,975 liters; Aquacultural Genetics, 1,469 liters; and Physioecology, 812 liters.

Several carboy cultures have been replaced recently to accommodate seasonal changes in the needs of the laboratory for larval and juvenile foods.

### Miscellaneous

Starter cultures of axenic algal strains were provided upon request to Ms. Marine Priesnitz, Wheaton College, and the Shinnecock Tribal Oyster Project, Long Island. We have also provided detailed information and consultation concerning the design, construction, and operation of a practical algal culture system to a new hatchery beginning operation in Connecticut--Mulberry Farm Bivalve Aquaculture, Inc.

## Spawning and Rearing of Mollusks Investigation

In cooperative experimentation with the South Carolina Wildlife and Marine Resources Department, 10,000 juvenile surf clams, *Spisula solidissima*, spawned in Milford are being reared in a land-based, upwelling seawater system near Charleston. Last year, the rapid growth of this species through the fall and winter was documented at this latitude. Currently, an experiment is underway to investigate strategies for the grow-out of the surf clam to a potentially marketable 50 mm size. The possibility of northern and southern crops of surf clams in opposite season greatly enhances the feasibility of aquaculture for this animal.

This experiment has been designed to investigate production potential by determining the biomass of animals that can be supported at a particular flow rate. Similar systems will be evaluated in Milford to compare the two locations. Methodology to monitor phytoplankton availability and consumption has been standardized to compare growth efficiency. In addition, in the Milford experiment physiological "scope for growth" will be measured to define nutritional stress resulting from overcrowding.

To maximize the yield of bay scallop, *Argopecten irradians*, adductor muscle in a single-season growth system, we have been investigating the relative growth rates of hatchery-reared population in various locations in Massachusetts and Connecticut. Growth rates about 20% faster than that achieved in Long Island Sound off Milford would result in 50% to 100% increases in adductor muscle weight. It appears that these results will be obtained in at least two areas under consideration. A detailed study of the biological and physical influences on growth and muscle yields will be made next year.

We have initiated a series of experiments to investigate overwintering survival of hatchery-produced bay scallops. Results from past winters have been variable, and generally unacceptable mortalities for an aquaculture industry have occurred. Some of the variables under study in these overwintering tests include scallop size, degree of protection from winter storm turbulence and salinity.

## Aquacultural Genetics Investigation

### Aquaculture Genetics of Shellfish

Spat produced by a second generation of American oysters, *Crassostrea virginica*, selected for high- and low-growth rate have been transported to the South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina, for grow-out and conditioning for spawning. There are about 15,000 16-month-old oysters in this phase of the several-generation selection experiment.

Preparations are being made to analyze dry meat weights in oysters selected one generation for high and low dry weight of the meat. Also being made are preparations to employ gynogenetic techniques in an effort at obtaining hybrids of the American and Japanese oysters, *C. gigas*.

A. Longwell attended the Annual Statutory Meeting of the International Council for the Exploration of the Sea this past October, and served as Rapporteur of the Mariculture Committee, and its joint session with the Andromous-Catadromous Committee. The Mariculture Committee and its Genetics Working Group (as also its other Working Groups) now have various interactions with other International Council for the Exploration of the Sea committees which will necessitate additional work (of a joint nature), and additional reports on national literature and programs. U.S. research and activities in genetic identification of stock are to be reviewed, and also new procedures in molecular biology and chromosome techniques as they might be applied to genetic differentiation of natural or artificially-bred stocks of fish and shellfish.

### Cytologic and Cytogenetic Tests of Mutagenicity in Fish

#### Mutation Frequencies in the Somatic and Germ Tissues of Adult and

Larval Fish: Considerable effort has been expended this reporting period on the collection of new field samples of adult fish, and in attempts at collecting adequate samples of young-of-the-year and very early-stage larval fish.

Additional samples of cod are being taken so that mutation incidences can be examined with respect to age, sex, gonad condition and size, as well as site of the capture. An agreement has been made with Professor F. Anscombe, Statistics Department, Yale University, to have statistical examinations made of the association of these parameters with mutation frequency, along with sample location for both cod and Atlantic mackerel. The study will serve as a technical work project with the idea that interesting development of the project would lead to an appropriate doctoral thesis.

Now that the windowpane flounder study is completed, additional field sampling for examination of any correlation between site of capture and pollution will concentrate on the less migratory winter flounder. *Ammodytes*, the sand lance, also relatively non-migratory, will be sampled for estimates of germ-line mutation from ripe sperm and gametogenic tissue. Modifications of the sperm abnormality test will be used in the former case, and a further modification of the micronucleus test for secondary spermatocytes in the latter case. Oysters artificially conditioned during January will be used to ascertain the suitability of applying the micronucleus test to secondary spermatocytes in shellfish. Such an application would make practical large-scale monitoring of natural shellfish beds in polluted areas as in the New York Bight, provided samples can be taken when the animals are in gametogenesis.

Mutation studies in field samples of fish have not reached the point where data must be considered in context of the populations. For this reason, all future samples of gonad, sperm, or blood-forming kidney tissues will be accompanied by otolith samples, and information on gonad state, sex, length, and weight of the fish.

Mutation frequencies have now been calculated in roughly 170 red hake larvae from plankton samples collected in 1981 and 1982. Mutation was calculated in the larval blood with the micronuclei test after microdissection of the blood-filled heart. Early observations showed larvae with high outlying frequencies of mutation and low blood count all to occur in the New York Bight Apex or close along the coast. However, it seems essential that data be adjusted for differences in size-age of the larvae. The new samples may make it possible to do this, or it may be necessary to obtain additional red hake larvae from MARMAP, or by additional sampling.

### Publications

- Lee, R., A.C. Longwell, F.C. Malone, L.S. Murphy, D.R. Nimmo, H.B. O'Connors, Jr., L.S. Peters, and K.D. Wyman. 1982. Effects of pollutants on plankton and neuston, p. 39-52. In section on "Reports of science panels." *In: Ecological Stress and the New York Bight: Science and Management.* G.F. Mayer, ed.
- Longwell, A. Crosby, and J.B. Hughes. 1982. Cytologic, cytogenetic, and embryologic state of Atlantic mackerel eggs from surface waters of the New York Bight in relation to pollution, p. 381-388. In section on "Contributed papers on the effects of pollutants on plankton and neuston." *In: Ecological Stress and the New York Bight: Science and Management.* G.F. Mayer, ed.

### Miscellaneous

#### Travel, Meetings, and Presentations

September 21-23 - E. Rhodes, R. Goldberg and J. Widman discussed cooperative shellfish work with personnel from the South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina.

October 14-16 - E. Rhodes and R. Goldberg attended the New England Estuarine Research Society meeting in Boston.

October 29 - E. Rhodes participated in a lipid staining and shellfish workshop sponsored by Woods Hole Oceanographic Institution, Woods Hole.

#### Visitors

October 6 - Diane Brousseau, Fairfield University, Connecticut.

October 7 - Ken Bondi and Tom Robinson, Groton, Connecticut, general aquaculture interest.

October 12 - Bill Cuthbert and Jim Pepper, Mulberry Farm Bivalve Aquaculture, Inc., Guilford, Connecticut.

#### University Affairs

Considerable time and effort were spent reviewing and writing critiques of Sea Grant proposals submitted by university researchers.

Aquacultural Genetics Investigation

Oyster Breeding

Oysters, *Crassostrea virginica*, are being prepared for conditioning for continuation of inbreeding by sib-crossing; also, for a two-directional selection program which, on the basis of some line breeding, seems advisable. The third generation of oysters in the two-way selection experiment for growth, as measured linearly, will remain in South Carolina for further grow-out before conditioning for spawning.

The high pressure chamber to be used in manipulating ploidy of the chromosomes in fertilization and early cleavage of the oysters has been set up. It will be used as oysters intended for wide hybridization and parthenogenesis can be spawned.

A survey is being made of aquaculture projects and publications that can be included in the annual administrative report to the International Council for the Exploration of the Sea and accompanying bibliography or aquaculture in the U.S. Also being prepared is a description of U.S. research and publications concerning genetic differences between populations of aquatics, particularly marine, for the International Council for the Exploration of the Sea Working group on Genetics. Particular attention is to be paid to new molecular and cytogenetic procedures for measuring genetic differences.

Mutation and the Environment

Atlantic Mackerel: The 1981 joint U.S.-Poland fishing survey expedition for Atlantic mackerel provided an opportunity to sample this species intensely over time for any increase in mutation frequency during its annual spawning migration coastward from offshore overwintering waters. Hematopoietic kidney tissue and blood smears were collected in three offshore station groups over a period of several weeks, and then again some weeks later in Hempstead Bay, Long Island.

In a prior bimonthly report trends were reported on mutation incidences as seen in 80 out of the 400 fish analyzed at that point. Mutation frequencies have now been calculated for the mature erythrocytes of an additional 93 fish. There may be a trend in both mature and immature erythrocytes for frequencies to be higher in the more northerly of the three sample groups. It is anticipated that the mutation frequencies in the mature erythrocytes of all fish will be determined in about three weeks. However, calculations of frequencies in the immature erythrocytes of the remaining 300 fish for which this must be done will take about three months.

Data available to date are being examined statistically to ascertain the significance of these seeming variations. Also, mutation frequencies are being examined, as in the case of cod, for variations with age by otolith readings, length, sex, and reproductive state. Additional samples are to be scored, and further statistical analyses then conducted.

Winter Flounder: Because they are an easily sampled fish inshore and offshore, one of the least migratory species, and also a resource species, it was decided to use winter flounder to continue the study of variation in mutation frequencies by site which was begun on windowpane flounder. As earlier with the windowpane flounder, the micronucleus test is being used to calculate incidences of chromosome mutation in mature and immature

erythrocytes. An effort will further be made to apply the same test to the secondary spermatocytes to obtain mutation incidences for the germ line whenever fish are sampled in their seasonal gametogenesis. All age-size classes of fish, including juvenile and young-of-the-year, are to be sampled and analyzed. Age, as well as reproductive state, is to be considered in the interpretation of data relative to variation in mutation frequency at particular sites and Northeast Monitoring Program Water Management Units.

To date, immature erythrocytes have been scored for only about 40 fish sampled at eight stations. Mature erythrocytes have been scored in all 192 fish from all 27 stations. These stations are from the coastal Mid-Atlantic, the Mid-Atlantic, Georges Bank, the Gulf of Maine, the coastal Gulf of Maine, and the Scotian Shelf (Water Management Units for Northeast Regional Action Plan). There is certainly considerable fish-to-fish variation with many values higher than encountered in windowpane flounder. There appears to be significant station variation, all stations with high values occurring in coastal or near coastal impacted areas (being examined statistically). Again, fish sampled in Hempstead Bay have the highest mutation incidences. Fish from different sample sites thus far studied tend to fall in the same age-size category and maturation state, so this alone cannot explain the seeming site variation of maturation frequency.

#### Spawning and Rearing of Mollusks Investigation

We have begun construction of several experimental systems to evaluate the growth efficiency of surf clams, *Spisula solidissima*, and bay scallops, *Argopecten irradians*, reared in flowing natural seawater. Raceways, active up-flow columns and passive up-flow columns are being built on a uniform scale. Up-flow systems allow considered vertical packing of small shellfish seed and, therefore, offer considerable space savings in hatcheries. Consequently, they are being adopted worldwide even though minimal data on biological and economic efficiency are available. By monitoring available nutrition, growth, waterflow, and the physiological state of animals in our experimental systems, we hope to learn more about these different approaches to the nursery culture of juvenile bivalves.

To meet experimental requirements for small shellfish seed in the spring we have begun to condition and spawn clams and scallops. A major effort to demonstrate the feasibility of bay scallop growth to market size in a single season will be made in 1983; this project will require about 100,000 three-mm seed in April. Experiments are continuing to evaluate constant, low concentration algal feeding strategies and standard once-a-day feeding for larval bivalves. Some preliminary results indicate clam and scallop larvae feed efficiently at low algal concentrations and, using this strategy, may substantially reduce algal requirements and improve growth rate and survival.

#### Aspects of Nutritional Requirements of Mollusks Investigation

##### Oyster Feeding

A study conducted in our experimental molluscan rearing chamber system has been completed in which the food values of five strains of unicellular algae were compared for juvenile oysters, *Crassostrea virginica*. At the onset of the experiment, each chamber contained a group of 50 oysters with a mean live weight of 0.150 g. After 12 weeks of feeding, oysters reared

on *Tetraselmis maculata* had increased to a mean live weight of 0.557 g. Feeding the chlorophytes *Carteria chunii* or unidentified strain NOR-5-466G to oysters produced growth to 0.523 and 0.462 g/oyster, respectively. Oysters fed the chrysophytes *Pavlova gyraus* or *Dicrateria inornata* achieved final mean live weights of 0.543 g and 0.304 g, respectively. The relatively poor food value of *D. inornata* for juvenile oysters is contrary to results obtained feeding this alga to larval oysters in previous experiments. Larvae grow very well when reared on a unialgal diet of *D. inornata*. In contrast, *Pavlova gyraus*, which produced very rapid growth of oyster spat in the present study was shown to be a poor food for larval oysters in our previous experiments. Differences in the food values of these and other chrysophytes (e.g., *Isochrysis galbana* and *Pavlova lutheri*) for larval and juvenile oysters indicate a potentially fruitful research area for studying the utilization of specific strains of algae by various stage of the oyster and other molluscs.

### Publications

Longwell, A. December 1982. Remarks from the genetic perspective as to what should ideally be known to make assessment of waste disposal options of land, sea, or air (through incineration), p. 143-148. In: Background Papers for the National Research Council Workshop on Land, Sea, and Air Options for the Disposal of Industrial and Domestic Wastes, January 16-21, 1983, Napa, CA. 335 p.

### Reports

Longwell, A. December 1982. Annual Report. NEMP Program - Mutation and the Environment. 27 p., 2 tables, 6 data maps, appendices, and approximately 70 references.

### Miscellaneous

#### Travel, Meetings, and Presentations

On November 15 J. Widman attended the Atlantic Fisheries Biologists meeting in Newport, Rhode Island.

#### Visitors

November 15, Chris Smith, Marine Advisory Service, Stony Brook, New York.

December 1, Tom Lally, New London, Connecticut; Tom Robinson, Waterford, Connecticut.

December 7, Ernest Ferguson, Albertin Albert, Gaetan Dugas, and Paul Cormier, Department of Fisheries, Caraquet, N.B., Canada.

December 16, Peter Haas, Higganum, Connecticut.

December 27, Joy Goodsell and Rich Lutz, Rutgers University.

#### University Affairs

November 17, Ed Rhodes attended the doctoral committee meeting for Stephen Tettelbach, University of Connecticut.

December 25-27, we provided space and assisted in maintaining some bivalve larvae for Rich Lutz, Rutgers University.

### Public Affairs

November 4, R. Goldberg spoke to students at the Booth Hills Elementary School, Trumbull, Connecticut, about careers in marine science.

Dr. Ukeles was invited to review a manuscript submitted for publication in the Biological Bulletin.

### Personnel

Mr. Robert Lewis, who was in charge of our mass culture activities, completed his tour of duty on December 30. Renee Coulombe, a NOAA Junior Fellow who worked in our laboratory this past summer, has returned for a short tour of duty during college break.

## JANUARY-FEBRUARY

### Aquacultural Genetics Investigation

#### Oyster Breeding

Fourth generation animals in a two-way selection experiment for fast and slow growth in American oysters will be bred selectively in the next several weeks. These experimental oysters were over-wintered and ripened for spawning at South Carolina Wildlife and Marine Resources Laboratory in Charleston. Also being bred are fourth-generation, full-sib inbred oysters.

The high pressure chamber intended for manipulations of the chromosome groups in meiotic, fertilized oyster eggs has been set up and is functional. Changes in ploidy level of the oysters are expected to be of value in obtaining species hybrids presumed desirable, but not obtainable by more ordinary procedures.

Plans are being made for the forthcoming meeting in the United Kingdom of the Genetics Working Group of the Mariculture Committee, International Council for the Exploration of the Sea. There will be a one-day workshop on gynogenesis in fish breeding. This will be followed by a two-day summarization of ongoing activities in the several Council-member countries directed at genetic identification of resource stocks. Also there will be an update of mariculture genetic activities in the several countries. In this regard, and also to review current literature on spontaneous mutation rates (see below), a valuable literature review has been nearly completed.

#### Mutation and the Environment

An initial statistical study has been completed of the chromosome mutation frequencies calculated on the immature erythrocytes of 80 Atlantic mackerel and on the mature erythrocytes of 400 mackerel (done using a modified micronucleus test). These were sampled near the edge of the Continental Shelf, February-April 1982, and in Hempstead Bay, Long Island, in June 1982. Counts on the immature erythrocytes of the remainder of the fish will not be completed for several weeks, at which time a final data analysis will be conducted. Of the three offshore groups sampled, the most northerly had, like Hempstead Bay mackerel, significantly higher mutation frequencies in the mature cell counts. The lower number of immature counts available to date showed only borderline significance among groups, with the much higher values for Hempstead Bay fish being largely responsible for the significance in analysis of variance. The most northerly of the three offshore groups was the only one of these to demonstrate significant station or tow variability in mutation frequency of fish sampled. Also

interesting was the failure of maturation to correlate significantly with mutation frequencies in the more southerly of the sample groups, although it correlated significantly in all others. Mutation frequencies as calculated on the immature erythrocytes provided better multiple regression models than did mature cell frequencies. This is as expected since immature cell counts must reflect the more immediate condition and environment of the fish than do mature counts which, in contrast, must integrate frequency changes over months (because of the kinetics of erythropoiesis). Final interpretation of these data is best left then until counts are completed on the immature erythrocytes. Because of the sample locations (dependent on the migratory pattern of last year's mackerel), it seems these data will be more useful in discerning natural variables contributing to variations in mutation frequencies than they will in discerning likely pollution-influenced changes. (Additional samples of mackerel to be taken from the New York Bight Apex and coastal New Jersey this April could, though, change this impression.) Even so, it is noteworthy that mackerel taken in Hempstead Bay, Long Island, like winter flounder and windowpane flounder (see earlier reports) sampled there, have among the highest mutation frequencies noted for their respective species samples.

October 1982 cruises provided samples of blood and hematopoietic tissue from about 250 winter flounder over the several Northeast Monitoring Program Water Management Units. Mutation frequencies as calculated in the same test on the mature erythrocytes of this non-migratory species easily revealed variations in mutation frequencies highly significant, at least in the statistical sense. This was irrespective of how data were broken down for treatment and using conservative tests of significance. Fish samples in the New York Bight Apex and in Long Island Sound had clearly higher incidences. Overall, fish from the Coastal Mid-Atlantic water management unit had frequencies double those from the Mid-Atlantic, from Georges Bank, and from the Gulf of Maine. Of the winter flounder sampled, 5% were identified statistically as having outlier frequencies of mutation, and all of these were from either the New York Bight Apex or Long Island Sound. Most frequencies ranged from 0-3/1000 cells, not far from the range observed in all of the several species checked in the process of developing the methodology now being applied in the field.

It is widely recognized that numerous--but not all--environmental pollutants are mutagens, and certainly the areas of high frequencies of chromosome mutation in the winter flounder study are more contaminated in a general sense than are the other areas sampled. However, other natural factors can influence mutation rates, particularly in the presence of a mutagen, chemical or physical. The literature on spontaneous mutation rates in mammals is not large, and even less is known concerning fish. Spontaneous mutation is receiving renewed interest in the field of genetics. (It is expected that state of knowledge will rapidly change in this regard, and that fish may even be regarded as models for some fundamental studies apart from environmental work.) It seems imperative to examine any influence of age, sexual maturation (season), life-cycle stage, racial differences, temperature, and salinity on mutation frequencies as measured on the marine fish sampled in the field or used in laboratory assays. This is being done. However, consideration--statistical and otherwise--of the several natural variables measured already in the field samples of winter flounder analyzed thus far make it seem that such factors could account simply for but a small portion of the much higher overall

frequencies of mutation in coastal Mid-Atlantic fish. Most likely body burdens of certain contaminants, stress and natural variables are interacting in a complex way to produce the differences measured between the several water masses sampled. This will be known with certainty only with additional work.

Consequences of any increased rates of chromosome mutation are expected to be higher incidence of fish with tumors and, when the higher rates extend to germ-line tissues, a decrease of reproductive efficiency as mutations which are dominant lethals for egg and larvae occur more frequently. Over generations of fish, natural selection could act to reduce any detrimental effect of persistent harmful influences, natural or pollutional on either mutation rates or on the numerous sub-lethal physiological responses measured in environmental studies.

#### Reviews and Professional Contacts

A. Longwell reviewed pertinent sections of the Effects Section of the National Academy update on Petroleum in the Marine Environment prior to its submission to the Academy for final formal review.

Grant requests and manuscripts were also reviewed on outside requests.

Requests for information on methodologies and procedures from sources in U.S. and abroad were filled.

#### Aspects of Nutritional Requirements of Mollusks

##### Semicontinuous Algal Cultures

Algal cultures were harvested from carboys to yield net volumes of 1,380 liters and 2,408 liters for larval and juvenile molluscan foods, respectively. These algal food suspensions were distributed to the Laboratory Investigations as follows: Spawning and Rearing of Molluscs, 1,319 liters; Aquacultural Genetics, 135 liters; Physioecology, 2,134 liters. In response to an increase in laboratory needs for larval foods in the mass culture system. Considerable effort has been put into rebuilding carboy culture containers carefully with new components to insure a food source of uniform high quality.

Efforts to culture *Dunaliella euchlora* in culture carboys with large volumes of artificial seawater ASP<sub>2</sub> containing a high CuCl<sub>2</sub> concentration have met with limited success although, in smaller culture volumes, growth is satisfactory. Feeding studies using the CuCl<sub>2</sub> adapted algae will proceed when a dense population of the CuCl<sub>2</sub> adapted strain in large volumes of media is obtained.

##### Algal Culture Studies

Investigation of the responses of algae to reduced nutrients in growth media has continued with experiments in which major nutrients were varied. Media were prepared using 16 variable combinations of the nitrate and phosphate components and were tested as nutrients for the growth of *Dunaliella euchlora*. Daily measurements of growth densities were taken and growth curves plotted. No significant differences in populations were observed in any of the 167 variable media formulations. Protein analyses were made of the populations in each of these variables and these data are currently being subjected to analysis of variance. Cells from experimental media were also stored for later analysis of total carbohydrates. For this purpose, a reliable carbohydrate assay is being developed incorporating reagents and procedures from a number of published reports.

Subcultures of stock strains of algae have been brought up to date, and dense, axenic cell suspensions have been available to fill a large number of requests for starter cultures from academic and commercial laboratories.

### Oyster Feeding

Although no oyster feeding experiments were in progress during the period covered during this report, considerable time and effort have been expended preparing for pending studies. Molluscan rearing chambers and the seawater filtering/heating system have been completely disassembled, cleaned and reassembled; any components, such as tubing, clamps, and screens have been replaced. We have been rearing a large number of post-set oysters in static basins of seawater that is changed daily. Of these, 900 healthy, rapidly growing oyster spat have been culled; from this group, oysters will be selected for an anticipated feeding study. For studies to be conducted later in the year, another large group of oysters has been reared from fertilized eggs through setting and is being grown in clean seawater on a mixed-algal species diet.

Starter cultures were requested by and provided to the Shinnecock Tribal Oyster Project, South Hampton, New York; Mr. Douglas Moffat, University of Connecticut Graduate School; Mr. Steven Wright, Peck Environmental, Kennebunk, Maine; Ms. Nora Fernandez, Castro, Central Nacional Patagonica, Argentina; and Mr. Michael Caffrey, Fairleigh Dickenson University, New Jersey.

### Spawning and Rearing of Mollusks Investigation

We have completed the first phase of our cooperative experiment with the State of South Carolina to study the growth of hatchery reared surf clams during the fall and winter months. Clams were maintained at different densities and constant flow rates in a land based pumped seawater upflow system. Growth was most rapid during October but continued steadily through February. Clams held at low densities that were initially 13.3 mm attained a size of 25.7 mm. Relationships among growth, nutrition, temperature and water use have been defined. The second phase of the experiment will continue through May and will investigate the feasibility of producing potentially marketable small clams in less than one year.

We have begun our 1983 spawning program for bay scallops and hard clams in order to produce seed stock for field trials later in the spring, and to evaluate a number of systems designed for the intermediate culture of these shellfish. Clam larvae and early juveniles have also been used in experiments to determine size specific food consumption rates for this species. This information is critical to our ongoing efforts to suggest optimum feeding strategies for larval and early juvenile culture of shellfish in hatcheries.

Good progress has been made in the construction of experimental systems that will be used to determine the biological efficiency and best use of water in units with either horizontal flow or vertical flow. These systems will be ready for use in the next few weeks and we expect to begin tests with surf clams and hard clams shortly thereafter.

## Publications

Hughes, J.B. 1982. Variability of chromosome number in the lobsters, *Homarus americanus* and *Homarus gammarus*. *Caryologia* 35: 279-289.

## Travel, Meetings, and Presentations

February 3, 4 - Ron Goldberg and Ed Rhodes presented lectures at the Long Island Fishermen's Forum on current aquaculture research. They also visited the Bluepoints Company, West Sayville, New York, and the Shinnecock Tribal Oyster Project at Southampton, New York, to discuss shellfish hatchery production methods.

February 15-17 - Ed Rhodes and Ron Goldberg visited the Marine Resources Department, Charleston, South Carolina, to discuss co-operative efforts for surf clams, hard clams, and bay scallops.

## Visitors

January 4, Al Stauble, Bellview, Inc., Hollis, New Hampshire.

January 18, Joan Miyazaki, Queens College, New York.

January 31, Paul and Kim Hanna, Hanna Productions, Framingham, Massachusetts.

## University Affairs

January 18, we provided *Mercenaria mercenaria* pediveligers to Joan Miyazaki, Queens College, New York, for her work on shell structure.

February 2, Ed Rhodes provided information to Nancy Helm, State University of New York, on bay scallop growth and shell check marks.

February 16, Ed Rhodes advised Earl Sanders, College of Charleston, Charleston, South Carolina, on his graduate work with clam larval feeding.

## Public Affairs

February 8, Ron Goldberg served as a judge for the Science Fair at St. Mary's School, Milford, Connecticut.

February 22, Ron Goldberg met with representatives of the New Haven Water Co., to discuss measurements of primary productivity.

## PATHOBIOLOGY DIVISION

submitted by

Dr. Aaron Rosenfield, Chief

## SEPTEMBER-OCTOBER

### Fish Pathology Investigation

As part of the activities conducted on behalf of the Northeast Monitoring Program, Fish Pathology Investigation staff participated in two legs (Middle Atlantic, 4-15 October, and Georges Bank, 18-29 October) of the fall bottom fish survey. John Ziskowski and Sharon MacLean examined and obtained tissues from a large number of fishes from the two areas surveyed. Linda Despres-Patanjo and staff of the Resource Survey Unit continued to make observations on the prevalence of integumental lesions and pigmentation and skeletal anomalies. The log sheets prepared for

recording observations made at sea have been very useful and permit direct transcription of data for computer storage and analysis (system 1022).

John Ziskowski participated in a stock assessment cruise on the Spanish Galician coast from 13-22 September. His participation was the result of a recently drafted Treaty of Friendship with the Spanish government. Although the primary purpose of the cruise was to numerically evaluate the status of commercially important fishes (especially hake) on the Galician coast, Mr. Ziskowski's participation broadened the scope of the cruise to include observations on fish health. Tissue samples were excised from 49 fishes, fixed in formalin, and returned to the Oxford Laboratory. All tissues have been sectioned and stained and soon will be examined for histopathology.

Analysis of skeletal anomalies of *Ammodytes* is being updated for the current Northeast Monitoring Program annual report. Statistical examination of the effect of differing sample sizes on confidence in the values obtained has indicated some potential problems. A sample of 30 fish appears adequate for identifying areas of very high or very low prevalences of anomalies, but the samples having intermediate prevalences of anomalies have rather wide confidence limits. Some thought is being given to increasing sample size or perhaps pooling samples. Attempts are being made to obtain data on sediment chemistry (heavy metals, organics) to correlate with skeletal anomaly data.

Reagents have been prepared to perform an enzyme-linked immunoassay technique on fish which are known carriers of infectious pancreatic necrosis virus. If the technique is successful in demonstrating virus in histologic sections, it will be used to diagnose suspected viral disease of marine fishes. This will be a useful and less time-consuming adjunct to cell culture techniques which have not always proved successful in the past. The primary antibodies necessary to use in this technique are being prepared by Dr. McAllister of the Fish Health Research Center in Leetown, West Virginia.

Young-of-the-year mackerel collected at the end of August from Orient Point, Long Island, New York, were examined for early blood infections by *Baematractidium scombrini*. None of 48 fish ranging in size from 17.5 cm to 20 cm has *H. scombrini* infections, thereby confirming earlier observations that young-of-the-year mackerel are not infected with this hemoparasite. Gross examinations of young-of-the-year fish revealed no ectoparasites which could serve as vectors of this parasite, further suggesting that transmission of the disease takes place after the mackerel migrate offshore.

Preliminary results of examinations for ectoparasites and gill parasites of adult mackerel sampled offshore in late winter show the monogenetic trematode *Kuhnia scombrini* to be the most common gill parasite of these fish (no copepods or leeches were observed during the sampling period). Although monogenetic trematodes are not known to be blood-sucking parasites, they may play a role in transmission of this disease.

Monogeneans from adult mackerel and tissues from young-of-the-year mackerel are being processed for histologic examination to obtain further information about *H. scombrini* infections of mackerel.

A preliminary examination of *Ammodytes* larvae exposed to 100 and 300 ppb copper (Cu++) for 48 hours revealed damage to the cornea and olfactory organ at the highest concentrations. Only the olfactory tissues were affected in those fish exposed to 100 ppb. Lesions in the cornea were similar to those observed previously for striped bass larvae; cells were

necrotic and sloughing from the corneal membrane. The lesions in olfactory tissues were severe at the highest concentration and were characterized by a marked loss of cells in the lumen of the olfactory organ, vesiculated intermediate and basal cells, and numerous pyknotic nuclei. The principal changes observed in the olfactory tissues of fish exposed to 100 ppb Cu++ were limited to vesiculated basal and intermediate cells accompanied by occasional condensed or pyknotic nuclei.

### Comparative Invertebrate Pathology Investigation

Mr. Farley participated in a regional workshop on oyster diseases and current research. Participants were concerned with the reasons for differential setting of oysters in nearby areas and on the effects of heavy metal contaminants on oysters. Mr. Farley presented data on the histopathology of oysters contaminated by copper.

In support of the Northeast Monitoring Program, collections of 50 mussels each were made from Sandy Hook and Great Bay, New Jersey; Cape Henlopen and Bethany Beach, Delaware; Ocean City, Maryland; Wachapreague, Virginia; and from new sites in Boston Harbor and Provincetown, Massachusetts.

An automated data processing program was developed which can selectively print out time and space information, individual specimen data on physiology, pathology and parasitology, and several statistical parameters on individual samples and groups of samples.

High prevalence of gill pathology characterized by acute inflammatory infiltration and adenohyperplasia was seen in a March mussel sample from Raritan Bay. This pathology may be indicative of contaminant related stress. Similar pathology has not been seen in mussels from other location sampled.

The processing of the 1,053 clams collected on recent resource assessment cruises continues. The majority of the clams were ocean quahogs (922) and surf clams (107); the remainder were southern quahogs (*Mercenaria campechiensis*). Station, strata, and tow data are being converted to Northeast Monitoring Program formats. Information collected on earlier scallop cruises (bridge log, gross pathology, size data) has also been prepared for entry into the Northeast Monitoring Program data base.

Considerable time was spent preparing documents for a Workshop on Shellfish Transport and Disease Control to be held at Williamsburg, Virginia, later next month. This will be the second such meeting with the Mid- and South Atlantic States to promote better understanding of the problems associated with shellfish transports. Efforts in this regard have been very successful with the New England and Pacific coast state.

Amphipods from three of the Ocean Pulse benthic reference stations, collected courtesy of Sandy Hook personnel, have been received, identified, and prepared for histological processing. A total of 341 amphipods was included.

Tissues of 19 blue crabs experimentally exposed to *Paramoeba* by injection of infected hemolymph or by feeding of infected tissues, and four naturally exposed crabs, have been examined histologically. *Paramoeba* were demonstrable in tissues, the hemocoel, and blood vessels of two groups of two and three crabs, respectively. The first group had been fed infected tissues 48 days previously; the second group had been injected with infected hemolymph 44 days previously. Amoebae were detected in hemolymph withdrawn from the heart immediately before dissection in all by one 44-day

animal. Amoebae were not detected in tissues of 14 crabs dissected 9-36 days after exposure, making comparison with progress of naturally acquired infections impossible. Naturally infected crabs have a "prepatent" infection of unknown duration during which amoebae are present in variable numbers in the hemocoel and tissues, but not in the heart and blood vessels. Thus, amoebae are not demonstrable by examination of withdrawn hemolymph. Two and possibly more viruses were present in the series, including both non-infected and infected crabs. To compare possible differences in infection according to host species, 15 *Carcinus maenas* exposed to *Paramoeba* by feeding or injection 9-85 days previously have been dissected and tissues are being processed for histological examination.

Tissues of 30 blue king crabs collected from the Pribilof Islands were received from the NMFS Kodiak facility and have been prepared for histological processing. The Pribilof population follows the expected reproductive pattern more closely than does the Olga Bay, Kodiak Island, population. The latter population is extensively infected with a rhizocephalan parasite that causes "parasitic castration."

Shrimp, *Penaeus japonicus*, were received from Pedro F. Costa, Brazil, through Dr. R. Wolke, University of Rhode Island. These specimens were from groups undergoing mortalities due to unknown causes. They were from groups being reared by the Brazilian government, as part of a project to determine the feasibility of rearing *P. japonicus* commercially in Brazil. Mr. Costa remarked in his accompanying letter that, at the present time, disease is the most important factor in their rearing efforts. The preserved shrimp have been dissected and prepared for histological processing.

Dr. Johnson attended the Society for Invertebrate Pathology Annual Meeting and International Colloquium on Invertebrate Pathology at the University of Sussex, Brighton, England, 5-10 September. During the meeting the accustomed duties of the Society president were performed and a paper was presented on parasites of benthic amphipods. Some post-meeting time has been spent gathering together documents and other materials for the incoming Society President.

During the reprint period the histology laboratory received 1,703 fixed tissues of marine fishes, crustaceans, and mollusks to prepare for light microscopic examination; 2,037 tissues were blocked, 2,363 sections were cut, and 2,618 slides were stained.

#### Microbial Ecology and Parasitology Investigation

Monitoring studies on the health of rock crabs, *Cancer imbricatus*, have shown that several conditions affecting gill condition and color serve as excellent indicators of the accumulation of black, highly organic muds on the seabottom. Two conditions, gill blackening and black discoloration of the suture line separating the dorsal and ventral carapace, result from the direct contact of crabs with altered seabottom sediments. Visual observations have shown that 15-30% of the specimens collected in the Hudson Shelf Valley show moderate to severe gill blackening. Microscopic examination of stained gill tissue has shown that a diverse group of external fouling microorganisms become attached to gill epicuticle or occupy the spaces between adjacent gill filaments. The fouling organisms are of interest because of their presence on gills of crabs from both control and contaminated sampling stations, and differences in their relative abundance at diverse study sites. Reproducible results from

control and contaminated sites cannot be achieved, however, unless seasonal molting periods are taken into account. Monitoring activities to date have shown several striking differences in the fouling community growing on gills of intermolt crabs from the New York Bight Apex and from the Sheepscott River, Maine. Three collections from Maine covering the years 1976-1982 provided remarkably comparable data:

Date	No. Crabs	Fouling Bacteria	Diatoms	Sessile Ciliates	Amoebae	Copepods	Necrotic Lamellae
10/76	20	75%	25%	35%	30%	65%	15%
7/77	51	88%	32%	26%	12%	88%	16%
7/82	25	84%	24%	36%	20%	60%	8%

Comments: (1) Fouling bacteria--the incidence of bacteria is approximately 75-85% on gills of intermolt crabs regardless of their source. Further studies are needed, however, to determine whether or not they are the same species. (2) Diatoms--unidentified naviculoid diatoms that occlude spaces between adjacent gill filaments have been found in approximately the same number of crabs from New Jersey bays and the Bight Apex. (3) Sessile ciliates--the incidence of sessile ciliates is approximately the same in New Jersey bays, exclusive of molting periods, but is considerably less (0-10%) in crabs from ocean stations. (4) Amoebae --the incidence of amoebae is approximately the same in ocean and bay crabs. (5) Copepods--the incidence of copepods is two to three times greater in Maine crabs than in those from New Jersey bays and the Bight Apex. Furthermore the number of copepods in each stained section ranged up to 95 in Maine crabs, and rarely over five in bay and Bight Apex crabs. (6) Necrotic lamellae--incidence about the same regardless of source of crabs.

The large amount of data on "black gill disease" and microbial fouling that have been accumulated have shown that further monitoring activities in New Jersey and New York Bight Apex waters may be limited to only three to four collections each year. Additional data, however, are needed on crabs from Georges Bank, Gulf of Maine, and from waters off of Virginia and North Carolina.

#### Diseases of Larval Mollusks Investigation

The fall cruise to sample Long Island Sound oyster shell associated bacteria was completed 13 October. To date 127 isolates have been selected from the New Haven and Stratford sites. Stratford provided more *Vibrio* shell than New Haven. However, in challenge tests of the 127 isolates, six isolates from New Haven and four from Stratford were pathogenic to oyster larvae. Challenge studies using oyster embryos will be postponed until January 1983 when laboratory spawning is resumed. In the meantime, biochemical identification of the isolates is in process.

Data on the seasonal changes of the microbial flora of laboratory sea water have been collected and analysis is almost complete. The data support the findings of Weiner, Hassong, and Colwell (Can. J. Microbiol. 26:1366; 1980); average total viable counts were higher on estuarine agar

plates than on seawater agar plates. Although generic diversity appeared to be greater on estuarine agar plates, this was apparent only during the months of April and August. Seawater agar plates yielded more agar digesters than estuarine agar plates.

Research was initiated to determine the nutritional requirements of a pathogenic *Vibrio* sp. and two *Pseudomonas* sp. Preliminary data suggest that the *Vibrio* sp. is more fastidious than either of the two pigmented pseudomonads.

An attempt to isolate bacteria from moribund eels from Oyster Bay and Great South Bay, Long Island, failed to produce a pathogen. Absence of bacteria was expected since the eels were caught after the peak of the mortality had passed. Two *Vibrio*-like isolates from Great South Bay water were obtained from the Nassau County Division of Laboratories and are being compared biochemically with molluscan pathogens isolated at Milford. Mortalities of clam larvae in the bay this summer may be related to the presence of pathogenic vibrios. The eel mortalities may also have been caused by *Vibrio anguillarum*.

Additional data were collected to compare the accuracy of our lytic fluorometric method of counting oyster cells with that of an electronic cell counting method. The new technique has been used for counting cells in monolayers. Since the electronic technique can be used only on cells in suspensions, it was necessary to develop protocols for retrieval, holding, and counting of phagocytic cells in suspensions using both methods.

Continuing work during the past two months included development of diagnostic tests for opsonins in scallop sera and antibodies to pathogenic bacteria in fish sera. Sea scallop sera and fish sera (primarily summer flounder, winter flounder, and yellowtail flounder) routinely collected on resource survey cruises are being held for further testing when the diagnostic systems are fully developed. Additional sera from local sampling in Long Island Sound (collected on the *Shang Wheeler*) and New Jersey coastal areas (collected by J. Stolen at Sandy Hook) are also being held for testing. Rabbit blood cells were injected into summer flounder to induce flounder immunoglobulin. This will be purified by adsorption onto rabbit blood cells and then used to produce a rabbit anti-flounder immunoglobulin. The latter is a necessary reagent in the enzyme-linked antibody assay. Similar antibodies have been produced against striped bass immunoglobulins. However, as a back-up for the latter reagent, striped bass serum was provided to J. Stolen at Sandy Hook for immunoglobulin extraction and subsequent antibody production in rabbits at the National Fish Health Research Laboratory at Leetown, West Virginia.

### Publications

- Blogoslawski, W.J. Depuration and public health. (Abstract). Proc. World Maricult. Soc. (A)
- Blogoslawski, W.J.; Ampola, V.; Lundstrom, R.; Ravesi, E.; Tuhkanen, B.; Van Twuyer, R. Effect of ozonized ice on preservation of squid (*Loligo pealei*). (Abstract). Int. Ozone Assoc. (A)
- Brown, C.; Roland, G. Characterization of exotoxin produced by shellfish-pathogenic *Vibrio* sp. J. Fish Dis. (S)
- Cariker, M.R.; Anderson, J.W.; Davis, W.P.; Franz, D.R.; Mayer, G.F.; Pearce, J.B.; Sawyer, T.K.; Tietjen, J.H.; Timoney, J.F.; Young, D.R. Effects of pollutants on benthos. In: Ecological Stress and

- the New York Bight: Science and Management, G.F. Mayer, ed. Estuarine Research Federation, Columbia, S.C.; 1982, pp. 3-21. (P)
- Daggett, P.-M.; Sawyer, T.K.; Nerad, T.A. Distribution and possible interrelationships of pathogenic and nonpathogenic *Acanthamoeba* from aquatic environments. *Microb. Ecol.* (A)
- Johnson, P.T. Patterns of parasitism in species of benthic amphipods. *In: Invertebrate Pathology and Microbial Control. Prog. Abstr. IIIrd Int. Colloq. Invertebr. Pathol., XVth Annu. Meet. Soc. Invertebr. Pathol.; 1982 September 6-10, Brighton, U.K.; 1982, p. 50. (Abstract).* (P)
- Murchelano, R.A. Some pollution-associated diseases and abnormalities of marine fishes and shellfishes: a perspective for the New York Bight. *In: Ecological Stress and the New York Bight: Science and Management, G.F. Mayer, ed. Estuarine Research Federation, Columbia, S.C.; 1982, pp. 327-346.* (P)
- Robohm, R.A. *In vitro* handling of molluscan hemocytes: control of cell loss from centrifugation effects. *In: Invertebrate Pathology and Microbial Control. Prog. Abstr. IIIrd Int. Colloq. Invertebr. Pathol., XVth Annu. Meet. Soc. Invertebr. Pathol.; 1982 September 6-10, Brighton, U.K.; 1982, p. 53. (Abstract).* (P)
- Sawyer, T.K. Distribution and seasonal incidence of "black gill" in the rock crab, *Cancer irroratus*. *In: Ecological Stress and the New York Bight: Science and Management, G.F. Mayer, ed. Estuarine Research Federation, Columbia, S.C.; 1982, pp. 199-211.* (P)
- Sawyer, T.K.; Adams, W.N.; Gaines, J.; Lear, D.W.; O'Malley, M.L. Potentially pathogenic protozoa in sediments at the Philadelphia-Camden disposal site. Contract Rep. FY 82 (PL 92-532, Sect. 101) to Off. Mar. Pollut. Assess., Rockville, Md. Submitted October 1982.
- Sawyer, T.K.; Daggett, P.-M.; Nerad, T.A. Potentially pathogenic protozoa in sediments from ocean sewage disposal sites. (Abstract). *Proc. Fourth Int. Ocean Disposal Symp.* (S)
- Sawyer, T.K.; Griffin, J.L. Plankton marine amoebae -- taxonomic considerations. (Abstract). *NATO Advan. Worksh. Plank. Mar. Protozoa.* (Abstract). (A)
- Sindermann, C.J.; Esser, S.C.; Gould, E.; McCain, B.B.; McHugh, J.L.; Morgan II, R.P.; Murchelano, R.A.; Sherwood, M.J.; Spitzer, P.R. Effects of pollutants on fishes. *In: Ecological Stress and the New York Bight: Science and Management, G.F. Mayer, ed. Estuarine Research Federation, Columbia, S.C.; 1982, pp 23-38.* (P)
- Tettlebach, S.T.; Petti, L.M.; Blogoslawski, W.J. Survey of *Vibrio* associated with a New Haven Harbor shellfish bed, emphasizing recovery of larval oyster pathogens. *Proc. Conf. Vibrios Environ.* (A)
- Visvesvara, G.S.; Baxter, P.J.; Brandt, F.H.; Sawyer, T.K. Isolation of *Rosculus* sp. from a human nose and demonstration of anti-*Rosculus* antibody in human sera. (Abstract). *J. Protozool.* 29:290; 1982. (P)

### Miscellaneous

#### Travel, Meetings, and Presentations

On 1 September Dr. Blogoslawski (Milford) attended the NESSA/ISSC review at the Milford Laboratory.

Dr. Johnson presented a paper and attended the IIIrd International Colloquium on Invertebrate Pathology at the University of Sussex, Brighton, England, 5-10 September.

Dr. Robohm (Milford) presented a paper and attended sessions of the IIIrd International Colloquium on Invertebrate Pathology at the University of Sussex, Brighton, England, 5-10 September, and visited marine laboratories at Plymouth and Weymouth, England, 13-14 September.

Dr. Blogoslowski (Milford) visited with Santo Furfari in Rhode Island on 21-22 September and discussed a joint project concerning depuration and public health.

Dr. Murchelano visited the Narragansett Laboratory and Dr. Richard Wolke at the University of Rhode Island on 30 September.

Mr. Newman attended the Northeast Monitoring Program meeting at Sandy Hook, New Jersey, 1-6 October.

Dr. Murchelano attended an NEFC Factor IV Committee meeting at Narragansett, Rhode Island, on 4 October.

Dr. Robohm (Milford) attended the Northeast Monitoring Program meeting at Sandy Hook, New Jersey, 4-5 October.

Mr. Farley and Dr. Sawyer attended the Northeast Monitoring Program meeting at Sandy Hook, New Jersey, 5-6 October.

Mr. Newman attended the Atlantic States Marine Fisheries Commission meeting in Baltimore, Maryland, 11-12 October.

Dr. Bodammer participated in a Sea Grant site review at the University of Maryland, College Park, 12-14 October.

Dr. Murchelano attended the University of Maryland Sea Grant site visit at College Park on 13 October.

Ms. MacLean participated in a groundfish survey aboard the R/V *Albatross IV* from 17-30 October.

Dr. Blogoslowski (Milford) presented a paper on, "Inactivation of red tide toxin," at the 17th Annual Joint Meeting of the American Society for Microbiology in Windsor Locks, Connecticut, on 17 October.

Dr. Murchelano attended the 11th Annual UJNR Aquaculture Panel meeting in Tokyo, Japan, 18-29 October.

On 25 October Mr. Farley and Mr. Kern attended the Oyster Research/Management Workshop at the Chesapeake Biological Laboratory in Solomons, Maryland. Mr. Kern presented a paper on, "The national and international aspects of disease control."

Dr. Brown (Milford) attended the PMAC meeting at Woods Hole, Massachusetts, on 27-28 October.

### Visitors

Visitors to the Oxford Laboratory during the reporting period were Ola B. Watford and Jeannie Garvin, NOAA, Rockville, Maryland; Chuck and James Donaldson and Charlotte Weeks, Portsmouth, Ohio; Tim Cole, Center for Environmental and Estuarine Studies, Cambridge, Maryland; Russel Black, German, Hersloff and Swanson, Easton, Maryland; Paul Marvel, Lancaster, Pennsylvania; and Sara Otto, Department of Natural Resources, Annapolis, Maryland. On 25 September the Oxford Laboratory held its annual picnic and approximately 80 guests attended.

### University Affairs

Cooperative work continues between the Milford Laboratory and Fairfield University.

### Public Affairs

On 16 September Dr. Blogoslowski (Milford) presented a talk on, "Red tides and elimination of red tide toxins," to the Sigma Xi Scientific Research Society, Quinnipiac College.

The Talbot County Board of Education held its annual picnic on 21 September at the Oxford facility.

### Personnel

Dr. Blogoslowski (Milford) completed a 10-week statistics course given at Milford by U.S. Nuclear Regulatory Commission consultants.

Maureen Riley, a Gallaudet College volunteer student, began a three-month appointment at Oxford on 15 September.

Kelley Clark, Biological Laboratory Technician, began a temporary appointment at Milford on 4 October.

### EEO Activities

Dr. Brown (Milford), Dr. Murchelano, Ms. MacLean, and Ms. McNelis attended the EEO Training Workshop for EEO Committees on 28-29 September at the Milford Laboratory.

Dr. Brown chaired the NEFC Federal Women's Program Managers' meeting held at the Milford Laboratory on 20 October; Ms. Swann attended the meeting.

### Fish Pathology Investigation

Tissues excised from fishes examined by John Ziskowski on a recent cruise on the Spanish Galician coast have been examined. Mr. Ziskowski excised tissues from 38 fishes with gross lesions (*Scomber scombrus*, 11; *Lophius piscatorius*, 7; *Micromesistius putassou*, 7; *Merluccius merluccius*, 6; *Trachurus trachurus*, 3; and one each of *Lepidorhombus boscai*, *Lophius budegassa*, *Sardina pilchardus*, and *Trisopterus luscus*. Most of the lesions of mackerel were focal granulomata in either gill, heart, liver, or spleen (6/11). Three of the lesions were caused by *Ichthyophonus hoferi*. Several of the mackerel also had concurrent hepatic coccidian infections. All lesions in *Lophius* were caused by microsporidians in central nervous system tissues. It is well-known that the anglerfish is parasitized by microsporidians.

The *Micromesistius* examined had nodular gill lesions (6/7). Microscopic examination disclosed that the probable cause of the nodules is a parasite now classified as a protozoan (*Perkinsus*), but previously known as a fungus (*Dermocystidium*). Recent studies by Mr. Jerry Otis, a graduate student of Dr. Richard Wolke at the University of Rhode Island, implicate this parasite as responsible for nodular gill lesions in red and silver hake from the western North Atlantic. Furthermore, the parasite appears to cause systemic disease in these species.

With the exception of an epitheliocystis-like lesion in the gill of *Merluccius*, none of the other lesions noted were particularly interesting histologically or threatening physiologically.

The microscopic examination of approximately 300 tissues from fishes sampled on bottom fish survey cruises is complete. Data summaries and photomicrographs are being prepared for a manuscript describing histologic lesions in commercially important fishes from the western North Atlantic.

Further experiments have been performed using the Avidin-Biotin-Complex technique for detecting infectious pancreatic necrosis virus in

fixed fish tissues. These experiments were conducted to determine whether or not the standard technique could be shortened somewhat. It was possible to reduce the incubation time in several reagents by 25-50%. It was learned, however, that the initial step of floating the tissue sections with normal serum of the species in which the secondary antibody is prepared (goat serum in this instance) could not be omitted. Omission resulted in abundant nonspecific staining. Apparently there are many tissue components of fish with binding sites for goat serum proteins.

The data base for skeletal anomalies of *Ammodytes* has been brought up to date and several hundred additional samples from fall bottom trawl surveys have been processed. An annual report has been prepared for the Northeast Monitoring Program. Arrangements were made with Sandy Hook personnel to obtain sediment samples and samples of sand lance for chemical analysis from areas which have a very high prevalence of skeletal anomalies.

The current study of *Haematraetidum scombri* in mackerel blood has resulted in the examination of over 680 blood smears of mackerel collected between February and August 1982 at various geographic locations along the east coast of the United States. *H. scombri* was found most commonly in low-level infections (parasitemias < 1%) and with a prevalence of 0% to 30% within the groups of fish sampled. Previous studies indicate that prevalence of infection within a group is dependent upon the sizes of the fish samples. It is most appropriate then to compare prevalences of infection between similar size classes of fish sampled from different locations. Examination of blood smears from 47 fish collected off Orient Point, Long Island, and 33 fish collected off Boothbay Harbor, Maine, showed 0% and 21.2% prevalence of *H. scombri* infections, respectively. Previous examination of small mackerel from Long Island also revealed 0% infection. Due to the timing of their appearance along the shore, it was thought that the Long Island mackerel were young-of-the-year fish. It was assumed that infection by *H. scombri* occurs offshore. However, otoliths of these fish (and those from Maine) aged by the Age and Growth Unit at the Woods Hole Laboratory indicated that both groups of fish were age 1+ tinkers. This raises a new question as to why age 1 mackerel in Maine are infected by *H. scombri* and those in Long Island appear to be uninfected. This was the first collection of tinker mackerel from Maine and the observed infection rate in this size class of fish along with the following information suggest a need for closer examination of age 1+ mackerel caught between Long Island and Maine.

*Haematraetidum* occurred in the Maine-caught mackerel primarily as what appeared to be a ring form rather than as the more typically observed elongate form. Small (approximately 2 microns), dense, ring-like forms were also quite common and resembled early infective stages of other known intraerythrocytic parasites. One mackerel from the Maine sample showed a remarkably high parasitemia (14%) of apparent divisional stages. As many as five separate organisms were observed in one red blood cell; dividing parasites also were seen. Erythrocyte destruction was not characteristic of the observed parasite multiplication as was reported by Henry in his original observations of *H. scombri*. During the present study, dividing parasites were not seen in over 170 infected mackerel sampled over several years. What was observed could be multiplication of another parasite, however, no other intraerythrocytic parasite was observed during the course of the study.

In order to determine the life cycle of this parasite and identify its significance to mackerel populations, plans are being made to fill the gaps in sampling fish from the Gulf of St. Lawrence and along the U.S. coast between Long Island and Maine, and young-of-the-year mackerel.

In conjunction with Sharon MacLean, a short manuscript by Joel Bodammer on the ultrastructure of *Haematractidium scomberi* in the blood cells of the Atlantic mackerel has been completed for submission to the *Journal of Fish Diseases*. The manuscript features a description of the organism's cytology and a discussion on possible modes of feeding and multiplication. Regrettably, only the "trophozoite" stage of the parasite's life cycle within the red blood cell was present in the samples examined. Additional studies will be required before the intraerythrocytic cycle of this parasite is understood.

Until now, reports on the effects of copper on the cornea of larval striped bass have been based only on light and scanning electron microcopic examination. Recent examination of normal and Cu<sup>++</sup> treated larval fish with transmission electron microscopy has provided additional information on the effects of Cu<sup>++</sup>. The earliest observed changes appear to be the dissolution of desmosome and hemidesmosome junctions between the stratified epithelial cells on the corneal surface. After loss of these junctions the cells commence to "roundup" and slough. Cytoplasmic changes include vesiculation, mitochondrial degeneration, and the appearance of dense bodies in some of the cells. In severely affected tissues the cells are ruptured and all cellular integrity is lost.

All maturity-pathology observations collected during bottom survey cruises in 1982 have been entered into the 1022 computer data base. The work accelerated with the assistance of Robin Friend (temporary employee) who helped with the preparation of data log sheets for the year 1982 and historical observations of fish pathology beginning on groundfish cruises in 1979.

### Comparative Invertebrate Pathology Investigation

At the request of the Maryland Department of Natural Resources, Fred Kern and Austin Farley participated in a joint sampling cruise to several oyster growing areas of Chesapeake Bay. Local watermen had been reporting an abnormally high number of dead and "weak" oysters from the mid-bay area (Eastern Bay). Sampling techniques developed at the Oxford Laboratory were used to determine recent and accumulative mortality. These samples indicated that an accumulative mortality of at least 30% had occurred in several locations. Histological examination of these samples by both the Oxford Laboratory and the Department of Natural Resources confirmed the presence of the oyster pathogen *Minchinia nelsoni*. During the late 1950's and 1960's this parasite caused tremendous losses to the oyster industries of the mid-Atlantic area. Maryland Department of Natural Resources biologist Sara Otto has been monitoring oysters from the Maryland section of the bay on an annual basis for parasites and diseases. She has previously reported the presence of *M. nelsoni*, at very low prevalence levels, from the newly affected area. We have continued to work closely with various agencies in Maryland and Virginia to develop strategies to manage this potentially disastrous disease. Consequently, a meeting was called in December by the Department of Natural Resources to assess mortality findings and discuss etiology and course of action. The meeting was attended by Austin Farley and representatives of the Maryland

Department of Natural Resources, Virginia Institute of Marine Science, Sea Grant, University of Maryland, and the Maryland Department of Health. It was determined that (1) mortalities of significant levels had occurred this fall and that a more accurate assessment throughout the bay was needed; (2) *M. nelsoni* disease was clearly implicated in the Eastern Bay mortality and additional studies were needed in other areas to confirm etiology there; (3) other factors, such as pollution, could be implicated; (4) salinity assessments were needed to determine if the *M. nelsoni* epizootic was due to increased salinity in the upper bay or if the disease organisms had adapted to lower salinity requirements. Our assessment is that the preliminary evidence suggests the possibility of new, severely devastating mortalities in areas which previously were not affected by this disease. A cooperative study was planned involving the Oxford Laboratory and other Maryland agencies.

Diagnostic services were provided to the Virginia Institute of Marine Science at Wachapreague, Virginia. Hatchery reared clams, *Mercenaria mercenaria*, were examined to determine the possible cause of a regularly occurring fall mortality. No pathogens were detected by histological examination. The pathology observed is consistent with gas bubble disease; steps are being taken to eliminate this possible cause from the hatchery system.

A delegation of oyster biologists led by Ernest Ferguson from the Division of Fisheries Research, New Brunswick, Canada, visited the Oxford Laboratory in December.

The histology laboratory processed approximately 1,000 individual specimens and prepared over 2,000 stained sections for examination by laboratory fish and shellfish pathologists.

#### Microbial Ecology and Parasitology Investigation

Rock crabs, *Cancer irroratus*, were collected for our ocean dumping site characterization studies from the "Mudhole" in the Hudson Shelf Valley in November 1982. The collection was made to coincide with minimal molting activity (inermolt period) when large numbers of specimens with black gills could be expected. Among 80 crabs only 35% had clean gills (28/80), while 30% showed the blackened gills (24/80); the remaining 28 had discolored gills. Accumulations of black sludge around the suture line between the dorsal and ventral carapace were found in 63 specimens (79%). The collection clearly demonstrated that maximal gill blackening in *C. irroratus* may be found at the "Mudhole" station. Other reliable indicators of sludge contamination at the site include the presence of human viruses in the sediments and in the digestive glands of the rock crab. Dr. Sagar Goyal, University of Minnesota, (personal communication) is preparing a publication to report the presence of several enteric viruses in digestive glands from *C. irroratus*. Histological slides are being prepared from 30 of the specimens to document microbial fouling of the gills and pathological conditions in the gill tissue. An attempt was made to collect "control" crabs from Georges Bank during an Ocean Pulse cruise also made in November. Only 36 crabs were caught during the cruise and 30 of them were females. The very low ratio of males to females (1:5) suggested that males may have migrated shoreward to molt. The size range for both males and females was similar, 6.5-9.0 for females and 7.5-9.0 for males, and two females were sponged. Among the six males one had all legs missing, one had a jet black intestine, and one had extremely muddy gills. The

generally poor condition of the males suggested that they were in a poor state of health and did not participate in migrating activity. Very little is known about the seasonal behavior or status of health in *C. imoratus* from offshore stations.

Mr. Jay Lewis and Mr. Mark Galasso participated in the November Ocean Pulse cruise to collect winter and yellowtail flounder in addition to rock crabs. They assisted Dr. Ann Cali, Rutgers University, in examining fish for microsporidans and at the same time made visual estimates of nematode and cestode infestations in the body cavity and digestive tract. Among 96 yellowtail 21% had nematodes, 59% had cestodes, and 11% had microsporidan xenomas. Among winter flounder 19% had nematodes, 81% had cestodes, and 30% had microsporidans. Thus, cestodes were responsible for the highest incidence of parasitism in the two fish species. Analyses of winter flounder data from Ocean Pulse Station #13 showed an incidence of 48% for microsporidans vs. 30% for fish away from the station, and an incidence of 32% for nematodes compared to 19% away from the station. Gills from all fish caught at Station #13 were fixed for histological examination. Further studies are planned to compare evidence for disease in yellowtail and winter flounder at Station #13 with disease, type, and prevalence at other locations.

#### Diseases of Larval Mollusks Investigation

Lisa Tettlebach participated in the 14 November Ocean Pulse cruise to quantify bacterial colonies associated with deepwater scallops, *Placopecten magellanicus*. Samples were collected from the ocean shelf off Shinnecock, New York, to Delaware. Microbiological data are given in Table 1.

Table 1. Countable Bacteria Colonies Using Differential Media from Ocean Pulse Cruise, November 15, 1982.

	REFERENCE STATION	OZR	TCBS
<i>P. magellanicus</i>			
gill tissue	48	$4.8 \times 10^5$	$5.3 \times 10^3$
	49	$4.8 \times 10^5$	$5.5 \times 10^3$
	51	$7.5 \times 10^4$	$1.8 \times 10^3$
	57	$1.7 \times 10^5$	$3.7 \times 10^3$
	63	$3.1 \times 10^4$	$3.5 \times 10^1$
whole animal	51	$7.3 \times 10^2$	---
Sediment			
	35	$2.5 \times 10^3$	$5.5 \times 10^2$
	61	$8.3 \times 10^1$	$2.0 \times 10^1$
<i>Spisula solidissima</i>			
gill tissue	63	$1.2 \times 10^5$	$9.3 \times 10^4$
whole animal	63	$2.1 \times 10^5$	$1.2 \times 10^4$

Generally, bacterial counts decreased on sampling from north to south. Sediment samples were plated and results showed less countable colonies in the open ocean than comparable samples from estuarine sediment in Long Island Sound. A similar relationship was observed for sediment from the southern leg vs. the northern leg of the cruise. These results are not considered unusual.

In a comparison of total plate counts, surf clam gills (one sample) and scallop gills showed similar numbers of colonies. Whole animals had lower counts than gill in scallops only. Since scallops strain particulates through gill tissue, concentration of countable bacteria was expected, although the counts were higher than anticipated. Eighty-four microbial isolates have now been taken from this cruise and are being identified for report in a future narrative. In addition to the bacteriological data, scallop sera were collected from this cruise.

Glycoproteins participating in defense against pathogens have been identified in the sera of a variety of molluscan species. These molecules may non-specifically cause agglutination of clumping of foreign particles which enter the mollusk. They may also act as opsonins which coat the foreign particle and make it more susceptible to uptake and digestion by phagocytic cells. Because it is possible that agglutinin and/or opsonin levels may vary in proportion to nutritional status or environmental stress, we are examining sera of sea scallops for the presence of these molecules. Scallop sera were found to agglutinate *Bacillus cereus*, E-15 (a *Vibrio* species pathogenic for oyster larvae), and rabbit red blood cells at dilution endpoints of 1:16 to 1:32. Since activity of glycoproteins can often be inhibited by specific carbohydrate molecules, a series of sugars was included in the reaction mixtures. Agglutination was not significantly prevented by galactose, cellobiose, mannose, dextrose, raffinose, stachyose,  $\alpha$ -D (+) melibiose,  $\alpha$ -D (+) fucose, D (+) galactosamine, D (+) glucosamine, N-acetyl-D-galactosamine, and N-acetyl-D-glucosamine. Further, no agglutinin could be absorbed out of the serum by multiple treatments with the agglutinating cells. Therefore, whatever was causing agglutination was not an absorbable glycoprotein molecule, but had some other chemical cause (such as enzymatic alteration of the cell surface). This in itself could function as a defense mechanism. However, since opsonins can also function without agglutination, an experiment to test for opsonins is in progress. *In vitro* uptake of serum-coated *Bacillus cereus* and *Vibrio* sp. by scallop phagocytes was determined in scallop blood cells held in cell culture medium. These results are currently being tabulated.

In our toxicological studies, contamination in tubes prepared for nutritional requirement study of specific toxin-producing bacteria has necessitated the retesting of the *Vibrio* strain reported in the last narrative. Fresh media were prepared and a one-week waiting period between preparation and inoculation of media was initiated to safeguard against future misinterpretation of the tube readings. Two defined media were found to support growth of the pathogenic *Vibrio*. The media have been further reduced to determine the minimal requirements for growth. Once these requirements have been established a study will be conducted to determine whether the toxin is still being produced under these conditions. If the toxin is not being produced, the medium will be supplemented to determine the nutritional requirements for toxin production.

A bacteriological study is underway to provide support to preliminary data which showed that bacterial counts were further reduced when seawater was subjected to activated carbon prior to being ultraviolet-irradiated. Thus far, the data collected show that bacterial counts are lower and the predominant bacterial colony is yellow when seawater is exposed to activated carbon prior to ultraviolet irradiation. Conversely, the counts are higher and the colonies are predominantly non-pigmented when carbon is not used.

Water samples collected on 20 October from Palmer Cove, Connecticut, were analyzed. Dinoflagellates were observed at Station A (one-half mile from the mouth of the cove) with none observed at Station B (three-fourths of a mile from the mouth of the cove). Sediment collected from both stations showed the presence of *Gonyaulax* sp. cysts, but all were damaged or empty. Cyst counts are higher at Station B than at Station A, which agreed with counts made from samples taken from the same stations on 28 June 1982.

Additional work during this reporting period included calibration of an electronic cell counter to produce accurate counts of oyster phagocytes, immunization of fish and rabbits to produce enzyme-linked antibody reagents, collection and storage of flounder sera from Long Island Sound, and preservation of fish and scallop sera from Resource Survey and Ocean Pulse Cruises.

### Publications

- Blogoslawski, W.J.; Monasterio, P.O. Bacterial depuration of the Mexican scallop, *Argopecten circularis*. *Ozone Sci. Engin.* (A)
- Blogoslawski, W.J.; Stewart, M.E. Depuration and public health. *Proc. World Maricult. Soc.* (S)
- Sawyer, T.K.; Lewis, E.J.; Galasso, M.E.; Ziskowski, J.J. Microbial fouling and parasitism of gills of the rock crab, *Cancer irroratus* Say. (Abstract). *Sec. Int. Symp. Repon. Mar. Organ.* (S)
- Sawyer, T.K.; Lewis, E.J.; Galasso, M.E.; Ziskowski, J.J.; Pacheco, A.L.; Gorski, S.W. Gill condition in the rock crab, *Cancer irroratus*, as an indicator of ocean health. *Proc. Third Int. Ocean Dispos. Symp.* (S)

### Miscellaneous

#### Travel, Meetings, and Presentations

Mr. Farley and Ms. Tettelbach participated in the Northeast Monitoring Program cruise aboard R/V *Albatross* from 14-24 November.

Mr. Kern attended a meeting with Food and Drug Administration personnel concerning introduction of shellfish from foreign countries in Boston, Massachusetts, on 22 November.

Mr. Lewis participated in the second leg of the Northeast Monitoring Program cruise aboard R/V *Albatross* from 28 November to 11 December.

Ms. Hines attended the 1982 Federal Interagency Field Librarians Workshop in Washington, D.C., on 30 November.

Dr. Rosenfield and Mr. Farley participated in the Shellfish Transport Conference in Yorktown, Virginia, on 29 November-2 December and conferred with Washington Office officials on national and international fishery disease problems in Washington, D.C., on 3 December.

Mr. Newman performed laboratory studies on viral staining at the National Fish Health Research Laboratory in Leetown, West Virginia, on 1 December.

Dr. Murchelano attended the Northeast Monitoring Program meeting at Sandy Hook, New Jersey, on 30 November-1 December.

### Visitors

Dr. George Ridgway, NEFC, Woods Hole, Massachusetts; Brian Gorman and Roland Paine, NOAA, Washington, D.C.; Tom Sleeter, Bermuda Biological Station; Ted Suman, Anne Arundel Community College, Arnold, Maryland; Nagahisa Uki, Tohoku Regional Fisheries Research Laboratory, Miyagi, Japan; Ellis Bolton, College of Marine Studies, Lewes, Delaware; Mr. and Mrs. Stanley Ballard, Easton, Maryland; Helen Lang, Easton, Maryland; Ernest Ferguson, Paul Cormier, and Gaitan Dugas, Department of Fisheries, New Brunswick, Canada; Kathryn Ashton, Old Salt Seafood Co., Easton, Maryland; Robert Palmatier, Carl Zeiss, Inc., Greenbelt, Maryland; and Dr. D. Minard, Royal Oak, Maryland.

### University Affairs

Work continues with Dr. Julius Kuck, Fairfield University, on the arginine procedure for paralytic shellfish poison identification. Mouse bioassays were used to test recently received control extracts containing paralytic shellfish poison.

Fish pathogenic bacteria, winter flounder sera, and summer flounder blood were prepared and forwarded to Dr. J. Stolen, contractor with Drew University. Also, yellowtail flounder and winter flounder sera collected on Resource Survey cruises were preserved with sodium azide and aliquots sent to Dr. Stolen for cooperative immunology studies.

Drs. Ann Cali and P. Takvorian, under a contract to Rutgers University, continued their field and laboratory studies to quantify the effects of parasitism on fish health and survival.

### Public Affairs

On 22 November, Dr. Carolyn Brown discussed careers in marine biology with a Roger Ludlowe High School student, David Schroeder, and his parents.

### Personnel

Dr. Rosenfield returned to full-time duty as Laboratory Director and Chief of the Pathobiology Division on 17 December after having spent the past two and one-half months on temporary duty in Woods Hole as Acting Deputy Center Director.

Ms. Renee Mercaldo, a Junior Fellow, returned to the Pathobiology group at Milford during her winter break.

Ms. McNelis and Ms. Wheatley attended the Personnel Training Workshop at Gloucester, Massachusetts, on 3-5 November.

Ms. Latina Cornish, temporary clerk-stenographer, entered on duty at Oxford on 27 December.

Ms. Robin Friend, temporary coding clerk, entered on duty at Oxford on 27 December.

### EEO Activities

On 16-18 November, Dr. Carolyn Brown attended the Conference on Employment Issues Affecting Minority Women held in Washington, D.C.

Ms. MacLean attended the NOAA Women's Day Training Seminar in Bethesda, Maryland, on 10 December.

## JANUARY-FEBRUARY

### Comparative Invertebrate Pathology Investigation

Histopathologic data from *Mytilus edulis* samples collected from coastal sites were analyzed and presented at the Northeast Monitoring Program conference in Milford, Connecticut, 22-25 February. Tables were prepared for the report and all of the significant lesions and parasites were photographed for evaluation. Forty-six types of lesions and 15 types of parasites have been seen to date, comprising over 2,000 disease conditions from 700 animals examined. Gill lesions including ciliates, inflammation, and adenohyperplasia were seen in 88% of Raritan Bay mussels opposed to 14% in all other samples, indicating a probable association with contaminant effects.

A pre-introduction diagnostic examination of oysters, *Crassostrea gigas*, from Bicheno, Tasmania, was performed prior to their introduction into Humboldt Bay, California. There was no indication of serious pathology or pathogens. Two types of ciliates were detected in the gills and digestive tract of many of these oysters, but these organisms are not considered harmful to the oysters. A second sample will be examined in March prior to their relocation into the State of Washington.

A preliminary study of the influence *Minchinia nelsoni* (MSX) has on the physiology and energy partitioning of oysters was conducted with Dr. Roger Newell at the University of Maryland's Center for Environmental and Estuarine Studies, Cambridge, Maryland. The comparison of physiological parameters to the histologically determined disease intensity showed that feeding rates were depressed and meat yields were significantly reduced in the infected animals.

Benthic amphipods collected on Ocean Pulse cruise *Albatross* 82-10 have been examined histologically. A total of 165 specimens was involved. Amphipod species and parasites were the same as those found on earlier cruises (see previous bimonthly reports). A total of 735 amphipods from four stations were collected on cruise *Albatross* 82-12, and 197 of them are now ready for histological examination.

As part of a cooperative project on the histology of experimental paramoebiasis with Mr. David Campbell, Johns Hopkins University, tissues of 24 *Carcinus maenas* injected or fed *Paramoeba* 9-85 days previously have been examined histologically. *Paramoeba* were present in tissues of all crabs in two groups of five each injected with *Paramoeba* 7 and 25 days before dissection. *Paramoeba* were not seen in crabs fed amoeba-infected tissues 7, 25 and 85 days before dissection. Seven-day infected crabs had small-form amoebae, while in 25-day crabs mainly large-form amoebae were present. Host reaction to the amoebae was present in all the crabs, but was more pronounced in the seven-day group. Infections were much heavier in the 25-day crabs, and occasionally free amoebae were seen in blood vessels.

Histological examination of specimens of Brazilian aquacultured shrimp, *Penaeus japonicus*, from groups undergoing mortalities (received from Dr. P.F. Costa, see November report) showed that in all, the epithelium of the midgut was necrotic or absent, and the hepatopancreas was variably and sometimes massively necrotic. Microorganisms and parasites

were not consistently present. Cause of the mortality was presumably a chemical or biotic toxin.

Tissues of 30 blue king crabs collected by personnel of the NMFS Kodiak facility in the vicinity of the Pribilof Islands, and 10 crabs from the St. Lawrence Island area have been examined histologically. Rhizocephalan parasites were not found in any of these crabs, and gonads of the females appeared to be normal. This is in contrast to females of the Olga Bay, Kodiak Island, population where gonadal anomalies and rhizocephalan parasites were present in 50% of the females examined.

The histological services unit prepared over 1,700 sections of tissues representing samples of materials derived from experiments and from field collections as furnished by Center, divisional, and cooperating investigators from universities, state, and other federal agencies. These tissues, to be examined by resident pathologists, consisted of several species of fish, American and Japanese oysters, rock crabs, green crabs, blue king crabs, mahogany quahogs, hard clams, surf clams, scallops, and mouse olfactory and brain tissues.

### Fish Pathology Investigation

Since 1979 the Fish Pathology Investigation has been acquiring data on the prevalence of integumental lesions and pigmentation/skeletal anomalies of commercially important bottom fishes from the western North Atlantic. This activity has involved several individuals from several laboratories, all of whom have contributed substantially to the success of this ambitious undertaking. Ms. Linda Despres-Patanjo and other staff members of the Survey Unit of the Resource Assessment Division at the Woods Hole Laboratory have been the cornerstone of the program. Without their continued cooperation, the activities undertaken would have been very difficult to accomplish. Mr. Ziskowski of the Pathobiology Division at the Sandy Hook Laboratory has participated in many cruises, particularly in the Middle Atlantic region, and has been instrumental in the design and preparation of the logs used to record data at sea. Mr. John LeBaron and Mr. Dan Ralph, also of the Sandy Hook Laboratory (Automated Data Processing Unit), have assisted immeasurably in the preparation of logs suitable for immediate and convenient computerization. John and Dan also have provided programs for data collation and analysis which will greatly facilitate evaluation of the large amount of numeric information acquired. Over 150,000 fish have been examined since 1979 from inshore and offshore strata from Cape Hatteras to Nova Scotia. Although data analysis is incomplete, overall disease prevalence, fortunately, is very low. This is in marked contrast to findings in the eastern North Atlantic. Distributional trends (which may be associated with anthropogenic activity) yet are inapparent, but may be evident subsequent to computer analysis of the data on file.

Determination of the distribution of vertebral anomalies of *Ammodytes* continues. Several hundred specimens from recent surveys have been frozen and yet must be examined. Fish reared in the laboratory under different temperature regimes (Narragansett) will be examined to determine the effects, if any, of temperature on prevalence of vertebral anomalies. The examination of these larval fish will require the use of techniques other than x-ray.

Immunochemical studies of virus infections in fish are proceeding slowly. Progress has been made in eliminating background staining and

false-positive reactions. More experiments with known viruses in cell culture are planned for the next several months.

Mr. Newman spent two weeks on an inshore herring and mackerel survey. Large collections of young-of-the-year clupeids (shad, alewife, and blueback) were made for pathological examination. Almost nothing is known about the health of clupeid pre-recruits. Both fixed and frozen material now is available for study.

A follow-up on the intensive sampling in 1982 of mackerel for the study of the hemoprotozoan *Haematractidium scomberi* and its possible vector has begun this year through utilization of the joint US-Polish research cruises. Blood and gill parasites were obtained from 78 mackerel samples by John Ziskowski on the second leg of the *Wieczno* cruise; sampling will continue throughout the three-month *Admiral Arciszewski* cruise. Some samples will be forwarded to the Pathobiology Division at the ZSIDP lab in Szczecin, Poland. It is hoped that these two years of sampling will reveal trends of parasitic infections, particularly of *H. scomberi* and the monogen, *Kuhnia scomberi*, in the mackerel population.

In order to obtain more information on hosts of *Haematractidium*, scombrids other than *Scomber scombrus* were examined. Spanish mackerel (174), cero mackerel (12), king mackerel (2), and bonita (3) from Florida were sampled by making blood smears and identifying ectoparasites of the gills and integument. One bonita was infested with three parasitic copepods, but the remaining fish had no ectoparasites or gill monogenes. cursory examination of blood smears of these fish showed no infections by hematozoa. Further detailed examinations will determine the presence or absence of *H. scomberi* in these scombrids.

Blood smear preparations from yellowtail flounder captured on Northeast Monitoring Program cruises (fall 1981 and spring 1982) have been carefully examined to select specimens to be selected for electron microscopic examination. Thus far, it has not been possible to identify a biologic agency in relation to the piscine erythrocytic necrosis (viral erythrocytic necrosis)-like inclusions observed in previously studied slides.

Studies of the effects on starvation upon the structure of the retina in striped bass larvae have progressed. An additional 60 specimens have been sectioned for light microscopic examination and photomicrography. This additional material will be used to select specimens for further electron microscopy examination and to quantify the degenerative changes observed.

Discussions with staff of the Maryland Department of Natural Resources and with investigators from the University of Maryland and Johns Hopkins University regarding cooperative striped bass research have been initiated. Toxicant experiments with cultured striped bass larvae and collections of wild larvae from the Choptank River will take place this spring. In addition, electron microscopy studies of phagocytic leukocytes from juvenile striped bass are being planned in conjunction with University of Maryland researchers who have developed a chemiluminescent assay for determining rates of bacterial ingestion in cells derived from kidney (pronephros).

#### Diseases of Larval Mollusks Investigation

Phagocytosis experiments to detect the presence of opsonins in sea scallop sera were performed using sea scallop hemocytes in monolayers under

cell culture fluid. Bacteria, incubated 30 minutes in the presence of (1) scallop serum, (2) scallop serum absorbed with bacteria, and (3) seawater, were washed and then exposed to cell monolayers. Differences in bacterial uptake by the phagocytes were scored microscopically. Phagocytosis of serum-treated *Bacillus cereus* was not significantly different from that of bacteria receiving no serum treatment; thus, there appeared to be no opsonins for *Bacillus* in sea scallop serum. On the other hand, phagocytosis of serum-treated *Vibrio* sp. was increased to a highly significant degree compared with uptake of untreated bacteria. Uptake of *Vibrio* which had been treated with absorbed serum was significantly less than that of serum-treated *Vibrio*. Therefore, an opsonin was found for *Vibrio* sp. but not for *Bacillus*. Since the *Vibrio* sp. is an oyster larval pathogen while the *Bacillus* is a terrestrial organism, the experiments suggest selective evolution of a protective mechanisms (against marine bacteria) in sea scallops.

Additional experiments were run using cells and sera from scallops which had been exposed for seven weeks to 20 ppb copper or cadmium. Although the experiments will need to be repeated to obtain reliable statistical values, the initial results demonstrate a marked increase in bacterial uptake by cells from animals exposed to the heavy metals. Uptake by cells from copper-exposed animals was particularly enhanced.

To obtain pure suspensions of oyster phagocytic cells for measurement of various elements affecting disease resistance it is necessary to separate phagocytes from other blood cells in the hemolymph. We have found that this can be effectively done by first allowing phagocytes to attach to cell culture plates and then removing unattached cells by gentle washing, followed by detachment of phagocytes by overnight incubation at 4°C in the presence of 0.02 M chloral hydrate in a membrane filtered seawater overlay. This procedure allows recovery of 63% of the oyster phagocytes. The cells appear to be unharmed by the procedure since most will re-attach to cell culture plates.

A study is underway to determine the nutritional requirements for toxin production by several bacteria pathogenic to oyster larvae. A minimal broth medium was derived which provided visible growth of a specific toxin-producing *Vibrio* sp. within 24 hours. The medium consists of an energy source, asparagine, hypoxanthine, and various salts dissolved in distilled water. Data collected thus far suggest that the pathogen does not produce the toxin after it has been transferred at least twice in the minimal broth medium. There is some indication that hypoxanthine hinders toxin production; however, further testing is required before a definitive statement can be made.

Daily Milford Laboratory seawater sampling data are being analyzed microbiologically. Analyzed data collected during the months of December and January suggest that the average bacterial load in seawater is reduced as it leaves Milford Harbor and flows to one of the individual labs in the Milford Laboratory. Using estuarine agar plates, bacterial counts of seawater taken from Milford Harbor averaged  $4.4 \times 10^4$  colony-forming units/ml, while seawater collected in one of the individual labs averaged  $2.0 \times 10^4$  colony-forming units/ml.

A bacteriological study was completed which showed that bacterial counts are lower when seawater is exposed to activated carbon prior to ultraviolet irradiation. The counts continued to be lower even after the activated carbon column had been in use for a month. The bacterial flora did not appear to change with the age of the column.

On 10 February, several experiments were conducted as part of a demonstration for the Shellfish Hatchery Disease Workshop. The first involved heat inactivation of bacteria. At four different temperatures (25°, 35°, 45°, 55°), three pathogenic isolates were heated for one hour and directly plated on TCBS, but preliminary work showed low counts on OZR. Heavy growth was observed at 25° and 35°C on TCBS and OZR. It can be suggested from this work that 55°C can significantly affect the growth of these particular pathogens, and such information is useful, as a 55°C freshwater rinse in hatchery piping could reduce disease incidence.

On 3 January, the Larval Molluscan Disease Investigation completed its collection of bacterial isolates from Stratford and New Haven shellfish beds. Isolate totals were 261 collected at Stratford and 249 at New Haven. Additional laboratory challenge studies are necessary to confirm a 3% recovery of suspect shellfish pathogens associated with wild shell stocks from these sites. Of the total isolates collected, approximately 66% have been characterized to genus with emphasis on identification of the suspect oyster larval pathogens. Laboratory work on this project is expected to continue until June.

After observing an unexplained mortality to local hard clam populations (*Mercenaria mercenaria*), Connecticut State Aquaculture Division Chief, John Volk, requested Milford personnel of the Pathobiology Division to determine if bacteria were responsible for the loss. Since we had recorded the "kill" during May of the previous two years while on other sampling missions, it was relatively simple to develop a sampling protocol to assist on this problem. Adult (quahog) and young (cherrystone) clams, sediment, and water samples were collected and plated for total countable numbers, coliform, and *Vibrio* presence on cruise to Bayview, Milford, Connecticut, on 25 January and 17 February. Both the January and February samples showed significant difference in the appearance of body tissues. The quahog's mantle had a darker color with feathery, vein-like lines throughout. The cherrystones had pink tissues with no obvious water buildup. Written reports were sent to the state. Further work will be conducted to confirm results.

#### Microbial Ecology and Parasitology Investigation

In our ocean monitoring study, all data on the incidence of "black gill" disease in *Cancer irroratus* collected at the New York Bight "Mudhole" since May 1981 were analyzed for comparison with previous data collected near Sandy Hook and the New York sewage disposal site. The "Mudhole," located in the Hudson Valley shelf approximately eight miles east of Monmouth Beach, New Jersey, and eight miles south of the sewage disposal site, was selected because of its high levels of organic carbon, coprostanol, and black sludge in the bottom sediments. The overall incidence of gill blackening from six collections was 14%, in contrast to 2% previously recorded from New Jersey bays and the disposal site. On a seasonal basis, blackening was noted in less than 1% of the crabs collected in March, August, and September, and in up to 33% of the crabs collected in May and November. In contrast to the 33% incidence observed at the "Mudhole," New Jersey and disposal site stations showed a peak incidence of only 10%. The range of less than 1% to 33% gill blackening was influenced by molting activity. For example, recently 90 crabs were caught and 78 (87%) were late papershells; all were males, and only one specimen had blackened gills. In August and September 1981, 16/147 specimens (11%) were

in the pre- or postmolt condition, 10 females and six males. Thus, there were two seasonal periods of molting activity at the "Mudhole" stations-- winter and late summer. Histological sections of gill tissue showed minimal microbial fouling in newly or recently molted crabs, and heavy fouling in intermolt specimens. Microbial fouling served as an excellent indicator for molting activity. Black discoloration of the suture between the dorsal and ventral carapace also served as a useful indicator of molting activity. Crabs collected in November 1982, showed an incidence of gill blackening of 30%, and an incidence of suture blackening of 79%. In February 1983, when less than 1% of the gills were blackened, the blackened suture was noted in only 2% of the specimens. Studies completed to date have shown that blackened gills, blackened suture lines, and microbial fouling all serve as valuable indicators of molting activity and sludge contamination of bottom sediments.

Cooperative studies with Richard Greig, Milford Laboratory, have provided very valuable data on heavy metals in the same specimens of *C. irroratus* examined for evidence of microbial fouling and disease. Preliminary data suggest that copper levels in gills of newly molted soft crabs seldom exceed 14 ppm, while in intermolt specimens it may reach slightly over 100 ppm; in the digestive gland, copper may reach 400 ppm in intermolt specimens, and 116.7 in new molts. The higher levels in the digestive gland may be due to enzyme-protein complex that binds copper in this organ but not in the gills. Heavy metal data that are now being analyzed are as follows:

Location	No.	Date	Cu in gill	Cu in digestive glands	Cd in gill	Cd in digestive glands
Sandy Hook Bay†	30	2/82	3.0- 14.2	2.3-116.7	0.30-1.5	0.22- 4.1
Sandy Hook Bay	50*	5/80	0.9-113.4	10.3-404.0	0.08-2.7	0.40-12.8
Mudhole	30	5/82	5.0- 42.7	5.3-154.0	0.28-4.4	0.20- 4.5
Willa. Dumpsite	53	5/81	1.1- 49.2	7.2-120.0	0.33-2.4	0.47-54.2
Willa. Dumpsite	45	6/82	0.9- 33.3	0.7-319.0	0.19-2.2	0.30-18.5
Georges Bank	30	11/82	6.7- 85.4	9.9-108.5	0.20-2.9	0.20-18.8

All soft crabs.

50 gills, 15 digestive glands.

Data summarized above show that copper may range from 0.9 to 113.4 ppm in the gills, and from 0.7 to 404.0 ppm in the digestive glands. The very wide range in copper concentration suggests that *C. irroratus* would be a useful model for physiological studies. Cadmium concentrations having a narrow range in the gills (0.08-4.40) and a wide range in the digestive glands (0.2-54.2) would be worthy of study in a similar model. Physiological studies are needed to test our hypothesis that low copper values are characteristic in gills of newly molted *C. irroratus*. Further analyses are in progress to compare metal data obtained during periods of molting and during intermolt periods.

## Publications

- Blogoslawski, W.J.; Monasterio, P.O. Bacterial depuration of the Mexican scallop, *Argopecten circularis*. *Ozone Sci. Engin.* 4:121-130; 1983. (P)
- Braun, P.C.; Combs, T.C.; Blogoslawski, W.J. Inhibition of thymidine uptake by larvae of *Crassostrea virginica* when challenged by *Candida albicans* and *Candida tropicalis*. *Amer. Sci. Microbiol., Abstr.* 83rd Annu. Meet., New Orleans, La. p. 26 (P)
- Brown, C. The role of carbon filtration in culturing the American oyster, *Crassostrea virginica*. *J. Shellfish Res.* (S)
- Brown, C.; Roland, G. Characterization of exotoxin produced by a shellfish-pathogenic *Vibrio* sp. *J. Fish Dis.* (A)
- Farley, A. Viral gametocytic hypertrophy. *Int. Counc. Explor. Sea, Fiches d'ident. malad. poiss. coquilles.* (A)
- Kern, F.G. *Perkinsus marinus* (Mackin, Owen, and Collier, 1950) Levine, 1978, a sporozoan disease of oysters. *Int. Counc. Explor. Sea, Fishes d'ident. malad. poiss. coquilles.* (S,A)
- Newman, M. Viral erythrocytic necrosis. *Int. Counc. Explor. Sea, Fiches d'ident. malad. poiss. coquilles.* (A)
- Sawyer, T.K.; Bodammer, S.M. Marine amoebae (Protozoa:Sarcodina) as indicators of healthy or impacted sediments in the New York Bight apex, pp. 337-352. *In: Wastes in the Ocean, V. 1: Industrial and Sewage Wastes in the Ocean*, Duedall, Ketchum, Park, and Kester, eds. John Wiley and Sons, Inc., New York; 1983. (P)
- Sawyer, T.K.; Griffin, J.L. Planktonic marine amoebae: taxonomic considerations. *Ann. Inst. Oceanogr., Paris*, 58:169-172; 1982. (P)

## Reports

- Bodammer, J.E. Light and electron microscopic studies of anomalies in fish tissues. *Northeast Monitoring Program Annu. Rep.* 6 pp.
- Farley, C.A. Coastal molluscan pathology. *Northeast Monitoring Program Annu. Rep.* 4 pp.
- Johnson, P.T. Parasites and pathologies in benthic amphipods. *Northeast Monitoring Program Annu. Rep.* 7 pp.
- Kern, F.G. A parasite and pathology survey of three species of ocean molluscs. *Northeast Monitoring Program Annu. Rep.* 5 pp.
- Murchelano, R.A. Prevalence and distribution of fish diseases in the western North Atlantic. *Northeast Monitoring Program Annu. Rep.* 7 pp.
- Newman, M.W. Vertebral anomalies of *Ammodytes* sp. from the Northwest Atlantic. *Northeast Monitoring Program Annu. Rep.* 12 pp.
- Robohm, R.A. The use of immune responses against pathogenic bacteria to monitor environmental effects on fish and sea scallops: development of assays. *Northeast Monitoring Program Annu. Rep.*
- Sawyer, T.K. Distribution of pathogenic and nonpathogenic protozoa in sediments at the Philadelphia-Camden disposal site. *Northeast Monitoring Program Annu. Rep.* 6 pp.
- Sawyer, T.K.; Lear, D.W.; O'Malley, M.L. Black gill disease and gill pathology in the rock crab, *Cancer irroratus* Say. *Northeast Monitoring Program Annu. Rep.* 10 pp.

## Miscellaneous

### Travel, Meetings, and Presentations

Mr. Farley was a participating faculty member of the Comparative pathology course given at the Marine Biological Laboratory in Woods Hole, Massachusetts, during January.

Dr. Blogoslowski (Milford) attended the 1983 World Mariculture Society/National Shellfisheries Association meeting from 10-13 January in Washington, D.C. His presentation was entitled, "Depuration and Public Health."

Dr. Rosenfield attended the meeting of the National Shellfisheries Association Executive Board in Washington, D.C., on 12 January.

On 13 January, Dr. Rosenfield met with Washington Office personnel in Washington, D.C., regarding the US/France Cooperative Agreement on exotic species transport.

Dr. Murchelano attended a meeting on striped bass culture and management in Annapolis, Maryland, on 14 January.

Dr. C. Brown (Milford) participated in a Sea Grant site review at Rutgers University on 24-26 January at New Brunswick, New Jersey.

Mr. Newman performed experiments in the use of immunological techniques for staining of fish viruses at the National Fish Health Research Laboratory in Leetown, West Virginia, on 26 January.

Dr. Rosenfield met with Washington Office personnel in Washington, D.C., on 2 February regarding state-federal relationships on shellfish transports.

Dr. Blogoslowski attended the Long Island Fisherman's Forum, Speonk, New York, on 3-4 February and gave a paper on, "Shellfish Hatchery Disinfection." He also visited the Bluepoint Clam Hatchery, West Sayville, New York, and the Shinnecock Tribal Oyster Project at Southampton, New York.

Ms. MacLean collected specimens from several species of scombroid fishes for blood parasite studies on 3-6 February in Melbourne, Florida.

On 4 February, Dr. Rosenfield and Mr. Kern visited the US Department of Agriculture Plant and Animal Health Inspection Office in Hyattsville, Maryland, to discuss shellfish disease control programs.

Dr. Murchelano, Ms. Despres-Patanjo, and Dr. Francisco Ruaneo visited colleagues at the National Fish Health Research Laboratory in Leetown, West Virginia, on 8 February.

Dr. Rosenfield attended the Center Board of Directors meeting at Woods Hole on 14-16 February.

From 14-18 February, Dr. Blogoslowski traveled to St. Andrews, New Brunswick, Canada, to collaborate with Dr. Allen White on an experiment using ozonized seawater to detoxify *Mya arenaria* containing paralytic shellfish poison.

Mr. Newman participated in the herring assessment cruise aboard the *Delaware II* from 15-25 February.

Dr. Murchelano and Dr. Francisco Ruaneo attended a seminar at the Johns Hopkins University Medical School on 18 February.

Drs. Rosenfield, Sawyer, and Ms. Shawn Bodammer attended the 18 February meeting of the Helminthological Society at the Navy Medical Research Center, Bethesda, Maryland. Ms. Bodammer presented a paper entitled, "Ultrastructural and Taxonomic Aspects of Acanthamoebas from Marine Sediments."

Dr. Sawyer, Mr. Lewis, and Mr. Galasso attended an informal "brainstorming" session on the Chesapeake Bay with representatives from other bay organizations on 18 February at Popes Creek, Maryland.

Drs. Rosenfield, Murchelano, Sawyer, Bodammer, Robohm (Milford), and Messrs. Farley and Kern attended the Northeast Monitoring Program annual workshop in Milford, Connecticut, during 22-25 February.

#### Seminars

On 14 January Dr. Blogoslowski (Milford) presented a seminar on, "Larval Oyster Disease and Water Quality," at the Virginia Institute of Marine Science, Gloucester Point, Virginia.

Dr. Harold Rosenthal, Biologische Anstalt Helgoland, Hamburg, presented a seminar to the Oxford staff on 18 January on, "Environmental and Water Quality Control in Fish Culture Systems."

#### Visitors

On 5 January Mr. Woodman Harris and Ms. Judith Hill of the Seafood Management Corp., Cos Cob, Connecticut, visited and discussed ozone disinfection with Dr. Blogoslowski at Milford.

Dr. Francisco Ruaneo, a veterinarian from Lisbon, Portugal, began a six-month assignment in January at the Oxford Laboratory to study diseases of mollusks.

Visitors to the Oxford Laboratory during the reporting period were Ms. Sara Otto and Mr. Howard King, Maryland Department of Natural Resources, Annapolis, Maryland; Mr. Robert Palmatier, Carl Zeiss, Inc., Greenbelt, Maryland; Dr. George Krantz, Center for Environmental and Estuarine Studies, Cambridge, Maryland; Dr. Joel O'Connor, NOAA, Stony Brook, New York; and Dr. Harold Rosenthal, Biologische Anstalt Helgoland, Hamburg, Republic of West Germany.

#### University Affairs

On 27 January Dr. Murchelano discussed cooperative research with Dr. Richard Wolke at the University of Rhode Island.

On 7 February Dr. Rosenfield attended a special seminar and reception at the University of Maryland as part of the ceremonies dedicating the University of Maryland as a Sea Grant college.

On 24 February Mr. Phillip Platcow, a student from Quinnipiac College, visited with Dr. Blogoslowski at Milford to discuss cooperative research.

Dr. Blogoslowski completed research on a cooperative project with Drs. Brown and Coombs at the Fairfield University Biology Department, the results of which will be presented at a poster session at the annual meeting of the American Society for Microbiology in March.

Dr. Arthur Repac, Quinnipiac College, Hamden, Connecticut, asked Dr. Blogoslowski to sponsor Mr. Phillip Platcow's research project as part of the course requirements for biology.

#### Public Affairs

On 10 February the Milford Pathobiology staff sponsored the 3rd Annual Shellfish Hatchery Disease Workshop for the northeast shellfish hatchery facilities. Representatives from the following private hatcheries attended: Bluepoints Co., F.M. Flowers, Mulberry Farm, Shinnecock Tribal Oyster Project, Long Island Lighting Co., and Jackson Shellfish.

Information on vaccination procedures, water purification, and fish nutrition was sent to Mark Fauci of Lilco, Northport, Long Island, New York.

Seventeen specific reprint requests for Milford pathobiology publications were received and filled during January and February.

Dr. Blogoslawski reviewed three proposals for the National Science Foundation.

### Personnel

Ms. Renee Mercaldo, a Junior Fellow, completed her winter break assignment with the pathobiology group at Milford (29 November-21 January).

Dr. Rosenfield was presented a 25-year length of service award and pin in a brief ceremony at the Oxford Laboratory.

Mr. Sol James, maintenance man, resigned on 28 February because of health reasons. Sol had been with the Oxford Laboratory since February 1971.

### EEO Activities

On 5 January a National Institute of Health educational film on herpes simplex II was shown to the Oxford staff.

A film exploring sexism in advertisements entitled, "Killing Me Softly," was shown at the Oxford Laboratory on 20 January.

Dr. Murchelano and Ms. MacLean attended the Center EEO meeting in Narragansett, Rhode Island, on 26-27 January.

Ms. McNelis attended the Society of government Meeting Planners in Columbia, Maryland, on 26-27 February.

## NATIONAL SYSTEMATICS LABORATORY

submitted by

Dr. Bruce B. Collette, Director

### SEPTEMBER-OCTOBER

#### Systematics of Fishes

Began revising manuscript on Spanish mackerels based on comments received from five reviewers. Revised sections of scombrid host-parasite manuscript prior to the manuscript being sent to press. Corrected page proof of a paper on needlefishes of the genus *Potamorhaphis*.

#### Systematics of Crustaceans

Continued preparation of a monograph on the genus *Sicyonia*, "rock shrimps," occurring in the American Pacific.

Continued to assemble photographs of spiny lobster tails in US trade that will be used in illustrating a key for their identification.

Revised manuscript joint authored with Mark Millikan, Charleston Laboratory, Southeast Fisheries Center, on synopsis of biological data on the blue crab, *Callinectes sapidus*, prior to submittal for publication.

Finished draft of manuscript describing a new species of *Munidopsis* from submarine thermal vents of the East Pacific Rise at 21°N (Anomura:

Galatheidae), joint authored with Cindy Van Dover, University of California at Los Angeles.

Corrected edited manuscript of, "Shrimps, lobsters and crabs of the Atlantic Coast of the United States, Maine to Florida," for Smithsonian Press. Manuscript was composed on floppy discs with a word processor and will be the pilot model used by Smithsonian Institution Press for setting type directly from author's discs.

### Scientific Services

Identifications: Xanthid crab from loggerhead turtle for C. Potter, US National Museum, Vertebrate Zoology; Miocene clam fragment for J. Hall, NMFS; figures of blue crab from the Torner collection of illustrations made during Spanish Explorations of the New World in 1700's for J.J. White, Hunt Institute for Botanical Determination, Carnegie-Mellon University, Pittsburg; specimens of caridean shrimp for L. Barker and D. Allen, University of South Carolina; penaeoid shrimps from Haiti for F. Vilsant, Institut de Developpment Agricole et Industriel, Port-au-Prince; a collection of 644 shrimps from the Arabian Gulf for Saudi Arabian Tetra Tech, Ltd. and ARAMCO; and shrimps from the Caribbean and the Florida keys for the Department of Crustaceans, National Museum of Natural History.

Information provided: On correct name of shrimp species from Brazil for B. Drucker, NMFS; on distribution of Chilean hard shell clams for J. Begley, Gourmet Traders International, Pasadena, California; ability to determine specific identify of southeast Asian shrimp from tails alone for A. Ward and R. Cozzolina, US Customs, Newark, New Jersey; distribution and correct name of crab for C. Kilbright, NMFS, Gloucester, Massachusetts; catalogue numbers of type-specimens of three species of African fishes for J.P. Gosse, Institut Royal des Sciences Naturelles, Brussels; scombroid relationships for B. Prescott, Storrs, Connecticut; a list of *Penaeus* shrimp species from both the western Atlantic and the eastern Pacific (including their ranges) for P. Heald, Transpack International, Berkeley, California; correct scientific names of shimps for C. Smith, Sea Grant Program, Cornell University; information on the distribution and some aspects of the biology of *Penaeus (Penaeus) semiscucatus*, "green tiger shrimp," and *P. (P.) monodon*, "giant tiger prawn," for L. Robinson, of Joseph Slavin Co., Washington, D.C., and Mr. I. Brown, of Transpack International, San Francisco, California, respectively.

Curatorial: Loaned several lots of galatheids to C.L. Van Dover, University of California at Los Angeles, and E. Kirsteuer, American Museum Natural History, New York.

Manuscripts were reviewed for *Science*, the *Biological Bulletin* (Woods Hole), and for two authors at their request.

### Publications

- Cohen, Daniel M., and J. Barry Hutchins. Description of a new *Dinamaticthys* (Ophidiiformes:Bythitidae) from Rottneest Island, Western Australia. *Rec. West. Aust. Mus.* 1982, 9(4):341-347. (P)
- Collette, Bruce B. Rediscovery of *Hyporhamphus xanthopterus*, a halfbeak endemic to Vembanad Lake, Kerala, Southern India. *Matsya* 7:29-40, 1982. (P)
- Reams, R.C., and A.B. Williams. The mud crab, *Panopeus herbatii* H.M. Edw., s. 1. Populations in Alabama, U.S.A. *Fish. Bull. U.S.* (S)

- Sullivan, B., K. Miller, K. Singleton, A.G. Scheer, and A.B. Williams. The mud crab, *Panopeus herbstii* H.M. Edw., s. l. Electrophoretic analyses of hemocyanins from four forms with observations on the ecology of form *obesa*. Fish. Bull. U.S. (S)
- Williams, A.B. The mud crab, *Panopeus herbstii*, s.l. Partition into six species (Decapoda:Xanthidae). Fish. Bull. U.S. (S)

## Miscellaneous

### Travel, Meetings, and Presentations

Dr. Collette attended the Fourth Congress of European Ichthyologists in Hamburg, 20-24 September, and presented a paper entitled, "Revision of the Spanish Mackerels, *Scomberomorus*." Dr. Collette worked on a catalogue of the Scombridae of the world at the Fisheries Division of the UN Food and Agriculture Organization in Rome from 12-18 September. He also studied fishes in the Zoological Museum, University of Hamburg, and in the Museum Nationale d'Histoire Naturelle in Paris.

Dr. Williams participated in a meeting of the American Fisheries Society, Committee on Common Names of Invertebrates.

### Visitors

Dr. Canet was visited by L.B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden, Holland, to discuss available information on the members of *Metapenaeus*, one of the most important commercial shrimps of the Indo-west Pacific, as well as the transfer to the National Museum of an extensive collection of shrimps from the latter region and D.L. Felder, of the University of Southwestern Louisiana, to discuss the preparation of a key to the western Atlantic species of *Sicyonia* based on color pattern. Dr. Collette was visited by J.C. Tyler, National Science Foundation, to study osteology of the louvar.

Dr. Williams was visited by D.L. Felder, University of Southwestern Louisiana to review data on revision of the stone crab in the Gulf of Mexico, J. Clamp, North Carolina State Museum, Raleigh, to study the parasite *Lagenophryx* on crawfishes, and J.D. Thomas, Newfound Harbor Marine Institute, Big Pine Key, Florida, to discuss reef and burrowing decapod crustaceans, and publications.

### University Affairs

Dr. Collette participated on October 8 in a program to recognize the development of the Northeastern University Marine Science and Maritime Studies Center in Nahant.

## NOVEMBER-DECEMBER

### Systematics of Fishes

Added sections on biology and fisheries to each of the 18 species accounts of Spanish mackerels (*Scomberomorus*) for the Spanish mackerel monograph. Modified versions of these sections will also be used in a UN Food and Agriculture Organization World Catalogue of the Scombridae which is nearly completed. Drafted a manuscript on the interrelationships of the Spanish mackerels for submission to *Advances in Cladistics*, the proceedings of the third meeting of the Willi Hennig Society at the invitation of the

editor. A first draft of a manuscript describing a new species of toadfish was written.

### Systematics of Crustaceans

Reviewed literature on spiny lobsters and slipper lobsters in world fisheries and began constructing keys for identification of slipper lobster tails found in US trade.

Measurements were taken from a series of stone crabs, *Menippe mercenaria*, from the southeastern US for comparison with some characters in a population of stone crabs in the northwestern Gulf of Mexico. Literature for these populations was reviewed.

Finished correcting edited manuscript of, "Shrimps, lobsters and crabs of the Atlantic Coast of the United States, Maine to Florida," for the Smithsonian Press.

Completed illustrations for draft manuscript describing a new *Munidopsis* from submarine thermal vents of the East Pacific Rise at 21°N (Anomura:Galatheidae).

Completed an investigation of *Sicyonia laevigata*, the only rock shrimp species occurring in both the western Atlantic and the American Pacific. The study -- based on extensive collections made in shallow water from Cape Hatteras, North Carolina, to Santa Catarina, Brazil, and from Cabo San Lucas, Baja California Sur, to Punta Paitilla, Panama -- includes a detailed description of morphological features, analysis of intraspecific variation, discussion of affinities of this shrimp to other members of the genus, and observations on geographical and bathymetric distribution.

### Scientific Services

Identifications were made of needlefish from Morocco and two species of scombrids from Tanzanian waters for the UN Food and Agriculture Organization; of a xanthid crab associated with West Indian corals for E. Chornesky, University of Texas at Austin; and collections of shrimps from off Belize and the Bermudas and from the Cantabric Sea were identified for the Smithsonian Institution.

Information was provided on squamation of turbot to a New York rabbi concerned with whether turbot are kosher; systematic status of the Argentine population of the bonito *Sarda sarda* to an Argentine ichthyologist; systematic status of a tuna similar to both the skipjack *Katsuwonus pelamis* and the little tuna *Euthynnus affinis* to Dr. E. Silas, Director of the Central Marine Fisheries Research Institute, Cochin, India; on identities of 10 species of Peruvian fishes and whether these species occur in US waters to the Food Safety Division, US Department of Agriculture; on scientific and common names of Cancroid and lithodid crabs from Peru and Chile to Frank Giovino, Westwood International, Boston, for crab meat labels; on common names of *Cancer edwardsii* from Chile to Faye Gibson, US Food and Drug Administration; on host crabs and general ecology of *Porcellana sayana* for R. Wilder, *Science Digest*, New York; on specific differences in setation of gnathal appendages of five species of *Penaeus* occurring in the American Pacific for Billy Drummond, Director of Aquaculture, SEAFMAN, C.A. Manta, Ecuador. A bibliography on peraeoid and palaemonid shrimps from the waters of Mexico was provided to Biol. Maco A. Lovillo, of Xalapa, Mexico. Translations were made from English to Spanish

for the Director of the National Museum of Natural History and the Department of Paleobiology.

Curatorial: paratypes of triglids were loaned to a researcher at Kochi University in Japan and the holotype of an anchovy from Fiji was examined for Wayne Baldwin, University of Hawaii at Manoa, in connection with baitfishes used in the skipjack fishery around Fiji.

Two grant proposals were reviewed for the Biological Research Resources Program and one for the Systematic Biology Program at the National Science Foundation.

Manuscripts were reviewed for NOAA Technical Report NMFS Special Scientific Report-Fisheries, Bulletin of Marine Science.

### Publications

- Collette, B.B. Scombrids of the world. An annotated and illustrated catalogue of tunas, mackerels, bonitos and related species. FAO Species Catalogue Vol. III. FAO Fish. Synop. No. 125. (S)
- Collette, B.B. South American freshwater needlefishes of the genus *Potamorhaphis* (Beloniformes:Belonidae). Proc. Biol. Soc. Washington 95(4):714-747. (P)
- Collette, B.B. Review: multilingual dictionary of names of marine foodfishes of world fauna. G.U. Lindberg, A.S. Heard, and T.S. Rass. Copeia. (S)
- Collette, B.B. Review: resources of tunas and related species and their fisheries in the Indian Ocean. E.G. Gilas and P.P. Pillai. Copeia. (S)
- Collette, B.B., and J.L. Russo. Interrelationships of the Spanish mackerels (*Scomberomorus*). Advances in Cladistics, Proc. 3rd Meet. W. Hennig Soc. (S)
- Reams, R.C., and A.B. Williams. The mud crab, *Panopeus herbstii* H.M. Edw., s.l. Populations in Alabama, U.S.A. Fish. Bull., U.S. (A)
- Sullivan, B., K. Miller, K. Singleton, A.G. Scheer, and A.B. Williams. The mud crab, *Panopeus herbstii* H.M. Edw., s.l. Electrophoretic analyses of hemocyanins from four forms with observations on the ecology of form *obesa*.
- Williams, A.B. The mud crab, *Panopeus herbstii*, s.l. Partition into six species (Decapoda:Xanthidae). Fish. Bull., U.S. (A)

### Miscellaneous

#### Travel, Meetings, and Presentations

Dr. Collette presented a seminar, "Interrelationships of Spanish mackerels (*Scomberomorus*)," at the Virginia Institute of Marine Sciences on November 12. Dr. Collette and former Systematics Laboratory staff member Joseph Russo attended the third annual meeting of the Willi Hennig Society at the University of Maryland in College Park November 20-22. Dr. Collette presented a co-authored paper on interrelationships in Spanish mackerels at the meeting, was asked to submit a manuscript to the proceedings of the meeting, and was invited to participate in a Society of Systematic Zoologists symposium on biogeography to be held at the annual meeting of the American Institute of Biological Sciences in August 1983. Drs. Collette and Williams participated in a taxonomy code workshop held by the National Oceanographic Data Center on December 7.

### Visitors

Dr. Collette was visited by T. Gloerfelt-Tarp, UN Food and Agriculture Organization, Bali, Indonesia, for assistance with a field guide to Indonesian trawl-caught fishes (November 8-10).

### University Affairs

Dr. Collette participated in the qualifying examination for the Ph.D. degree of Mr. T. Munro at the Virginia Institute of Marine Science on November 12 and attended the thesis defense of Charles Karnella of the Washington Office at The George Washington University on November 23. Dr. Collette completed reviewing the Ph.D. dissertation of former Systematics Laboratory staff member Joseph Russo for presentation to the dissertation review committee at The George Washington University. Dr. Collette has been invited to present the lectures on fishes in a new course in vertebrate zoology being organized at the University of Maryland for the spring term. Arrangements were completed for a Colgate coed to spend January in the Systematics Laboratory as part of Colgate's Career Exploration Program.

### Personnel

Ruth Gibbons completed a course, "Introduction to Time Series Analysis and Modeling System," given by Automated Data Processing Network Services.

## JANUARY-FEBRUARY

### Systematics of Fishes

Dissected frozen specimens of two forms of double-lined mackerels (*Grammatorcynus*) and summarized meristic and morphometric data to ascertain if the two forms represent separate species. Prepared a draft manuscript on beloniform fishes for the Ahlstrom Memorial Symposium on the Ontogeny and Systematics of Fishes. Revised a draft of a manuscript describing a new species of toadfish from the Gulf of Mexico.

### Systematics of Crustaceans

Studied species of rock shrimps, genus *Sicyonia* from the Mediterranean Sea, eastern Atlantic and Pacific oceans to define the genus and discuss its distribution.

Wrote a key for identification of slipper lobsters that may occur in US trade.

Measurements of specimens of stone crabs, *Menippe mercenaria*, that are in the US National Museum collection were completed. Populations in the Carolinas-Florida-Yucatan region were compared with populations in the northern-western Gulf of Mexico with the aid of ANCOVA.

Laboratory review of a draft manuscript coauthored with Cindy Lee Van Dover, "A new species of *Munidopsis* from submarine thermal vents of the East Pacific Rise at 21°N (Anomura:Galtheidae)," was completed.

Revised and resubmitted three manuscripts on the mud crab, *Panopeus herbatii*, complex which has been accepted by the *Fishery Bulletin*.

## Scientific Services

Identifications were made of 12 lots of mackerels, needlefishes, and halfbeaks from Fiji, collected by V.G. Springer, Division of Fishes, National Museum of Natural History; three lots of juvenile dolphin fishes (*Coryphaena*) from the Galapagos for Jack Grove; a collection of shrimps from the east and south China Sea for the California Academy of Science; *Penaeus* shrimp from the Bahamas for the NMNH Department of Marine Invertebrates, and from the Gulf of Mexico for C. Hueges, NMFS, Galveston Laboratory; and a xanthid crab from San Salvador for K. Flaherty, George Washington University.

Information was provided on the names of two West African fishes for the Food and Drug Administration; sources of illustrations for four species of fishes from St. Helena to the Crown Agents Stamp Bureau, England; on what hermit crabs might be expected on the beaches of Long Island, New York, for Linda Cullen, *Ranger Rick Nature Magazine*, Vienna, Virginia; on common names of a mojarra from Mexico for Glenn Kiel, NMFS Western Field Inspection Office.

Manuscripts were reviewed for *Contributions in Marine Science*, *Journal of Crustacean Biology*, UN Food and Agriculture Organization, and at authors' requests.

Curatorial: identified oversized specimens of crabs in US National Museum crustacean collection prior to moving them to the new Museum Support Facility in Silver Hill, an ongoing task.

A proposal was reviewed for the John Simon Guggenheim Memorial Foundation.

Reviewed and translated into Spanish a manuscript, "Shrimp culture in Latin America," for *Americas*, Organization of American States.

## Publications

Collette, B.B. Scombrids of the world. An annotated and illustrated catalogue of tunas, mackerels, bonitos and related species. FAO Species Catalogue Vol. III. FAO Fish. Synop. No. 125. (A)

Collette, B.B. Review: multilingual dictionary of names of marine food-fishes of world fauna. G.U. Lindberg, A.S. Heard, and T.S. Rass. Copeia. (A)

Collette, B.B. Review: resource of tunas and related species and their fisheries in the Indian Ocean. E.G. Silas and P.P. Pillai. Copeia. (A)

Collette, B.B., and J.L. Russo. Interrelationships of the Spanish mackerels (*Scomberomorus*). Advances in Cladistics, Proc. 3rd Meet. W. Hennig Soc. (A)

Moore, K.H., and B.B. Collette. Review: dictionary of Japanese fish names and their foreign equivalents. Ichthyological Society of Japan. Copeia. (S,A)

## Miscellaneous

### Travel, Meetings, and Presentations

Dr. Collette travelled to Wilmington, North Carolina, January 18-20 to participate in the Peer Review Committee meeting to review research proposals for the Southeastern Undersea Research Facility at the University of North Carolina at Wilmington. Dr. Collette participated in the NEFC

Board of Directors meeting in Woods Hole February 14-15. Dr. Collette travelled to Philadelphia February 24-25 to present a seminar, "Interrelationships of Spanish mackerels (*Scomberomorus*)," at the Academy of Natural Sciences. At an organizing meeting of a new association, the American Association for Zoological Nomenclature, at the National Museum of Natural History on February 18, by-laws were approved and Dr. Collette was elected to membership in the Council.

Dr. Canet travelled to the NMFS Southeast Fishery Center, Miami, to revise illustrations of six species of shrimps with the artist Maria M. Dieguez and to make sketches of diagnostic features of postlarval *Penaeus* from the American Pacific.

#### Visitors

Dr. Collette was visited by Dr. Richard Dudley, Oregon State University, to obtain assistance with identification of fishes on a tour of duty in Indonesia; Dr. Grace Klein McPhee, EPA, Narragansett, to discuss flatfish systematics; Lt. Steven Jameson, NOAA Corps to discuss proposed research in coral taxonomy.

Dr. Canet was visited by Tom J. Costello, formerly with the NMFS Southeast Fisheries Center, and Horton E. Scott, in charge of a shrimp farm in Ecuador, for discussion of identification of postlarval *Penaeus* being intensively reared in various countries of South and Central America. Both indicated the urgency of preparing a key for the identification of postlarvae because the breeders would benefit immensely through the selection of the fastest growing species.

#### University Affairs

Sally Rothwell, a Colgate undergraduate student, spent the month of January at the National Systematics Laboratory as part of Colgate's Career Exploration Program. She dissected specimens of two forms of the double-lined mackerel and compared their morphometric and meristic characteristics to determine if one or two species are involved.

Dr. Collette presented six lecture on fishes as part of a new course in vertebrate zoology at the University of Maryland, College Park.

Dr. Collette participated in the proposal review process for the Southeastern Undersea Research Facility at the University of North Carolina, Wilmington, January 18-20.

### ATLANTIC ENVIRONMENTAL GROUP

submitted by

Dr. Merton C. Ingham, Director

#### SEPTEMBER-OCTOBER

##### Ocean Monitoring and Climatology Task

Analysis of two years (1976, 1977) of monthly collections of phytoplankton and zooplankton made from ships of opportunity along a transect extending southeastward across the continental shelf and slope off Sandy Hook, New Jersey, has shown the presence of tropical and subtropical plankton on several occasions. The transect occupations through the New

York Bight involved collection of plankton with a Hardy Continuous Plankton Recorder towed at 10 m depth and surface water samples for salinity analysis at the locations of hourly drops of expendable bathythermograph probes.

Tropical or subtropical phytoplankton were found in shelf water three times in 1976 and twenty-seven times in 1977. A similar pattern was found for zooplankton; 6 in 1976 and ten in 1977. The greater occurrences in 1977 corresponded with greater frequency of passage of Gulf Stream warm core rings in the slope water along the shelf edge. The richest tropical/subtropical zooplankton sample ( $234 \cdot m^{-3}$ ) collected over the shelf was found in a tongue of  $13^{\circ}$  water pushed onto the shelf by an eddy in December 1977. This apparent association between eddies and plankton introduction to the shelf environment revealed by the monitoring program supports the hypothesis forwarded by Cox and Wiebe (1979) that rings are the source of tropical plankton in the Middle Atlantic Bight.

Some samples of tropical plankton were collected as far inshore as the Hudson Shelf Valley, apparently transported there from an eddy injection (93 km away) by up-valley bottom currents in response to wind-driven, down-valley surface currents.

A report of these and other results, by Dan Smith and Jack Jossi, was submitted for publication as a NOAA Technical Report (SSR-F) in late September.

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Reference: Cox, J., and P.H. Wiebe. 1979. Origins of oceanic plankton in the Middle Atlantic Bight. *Est. Coast. Mar. Sci* 9:509-527.

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The announcements of eddy conditions in the Georges Bank - Middle Atlantic Bight area shown on pages 130 and 131 were sent to Commander, Atlantic Area, US Coast Guard, for publication in the October and November 1982 issues of the *Atlantic Notice to Fishermen*.

The cooperative Ship of Opportunity Program obtained twelve expendable bathythermograph (XBT) transects and 4 continuous plankton recorder (CPR) transects in September-October: 4 XBT and 2 CPR transects in the Gulf of Maine, 2 XBT off southern New England, 4 XBT and 2 CPR transects across the shelf and slope off New York, and 2 XBT transects across the Gulf of Mexico.

### Publications

- Armstrong, R.S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. *Annls. biol. Copenh.* 38. (S)
- Chamberlin, J. Lockwood. Application of satellite infrared data to analysis of ocean frontal movements and water mass interactions off the Northeast Coast. *Proc. Northwest Atlantic Fisheries Organization, NAFO Sci. Coun. Studies*, 4:21-30. (P)
- Crist, R.W., and J.L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1981. *Annls. biol. Copenh.*, 38. (S)
- Crist, R.W., and J.L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1980. *Annls. biol. Copenh.*, 37. (A)

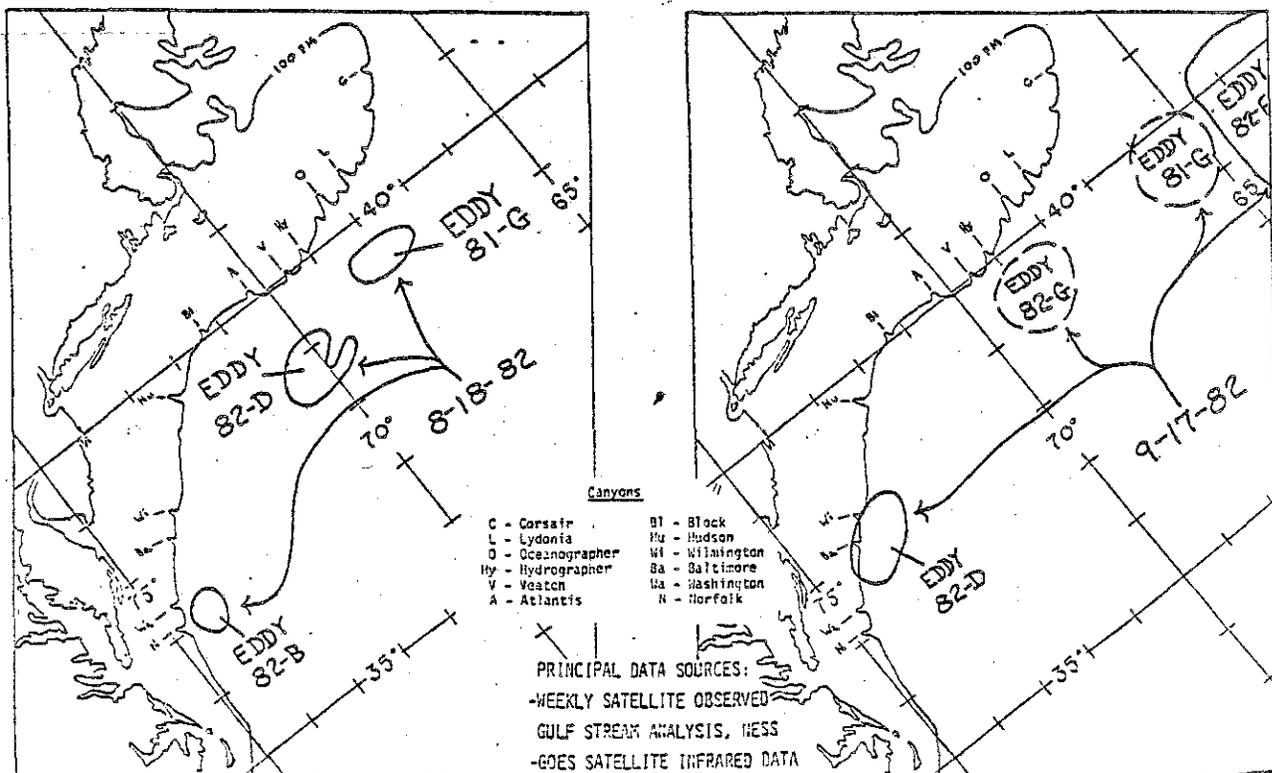
GULF STREAM EDDY LOCATIONS

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

Eddy 82-D traveled in a southwesterly direction 309 km (167 nm), and is centered east of Baltimore Canyon, at 38.0°N 73.6°W. The movement of Eddy 81-G was somewhat difficult to monitor over the past thirty days due to persistent cloud cover and lack of thermal contrast in the satellite imagery. Recent analyses locate the eddy center at 39.5°N 65.5°W. Its southeastward movement, 148 km (≈80 nm) from its last known position south of Lydonia Canyon was influenced by a northward propagating Gulf Stream meander. Two new eddies formed during September. Eddy 82-F formed from a large northward propagating meander of the Stream, and is centered at 39.5°N 63.4°W. A second eddy, 82-G, formed from the same meander that had influenced 81-G. Its center is at 39.3°N 68.8°W, in the vicinity of Hydrographer Canyon. Eddy 82-B was resorbed by the Stream in late August.

During the next thirty days, 82-D can be expected to move past Norfolk Canyon and may be resorbed by the Gulf Stream. Eddy 81-G may be expected to move in a westerly direction, possibly centered in the vicinity of Oceanographer Canyon. Eddy 82-F may be expected to move west-northwest and possibly approach Lydonia Canyon. Eddy 82-G can be expected to move west-southwest to a position centered in the vicinity of Block Canyon.

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



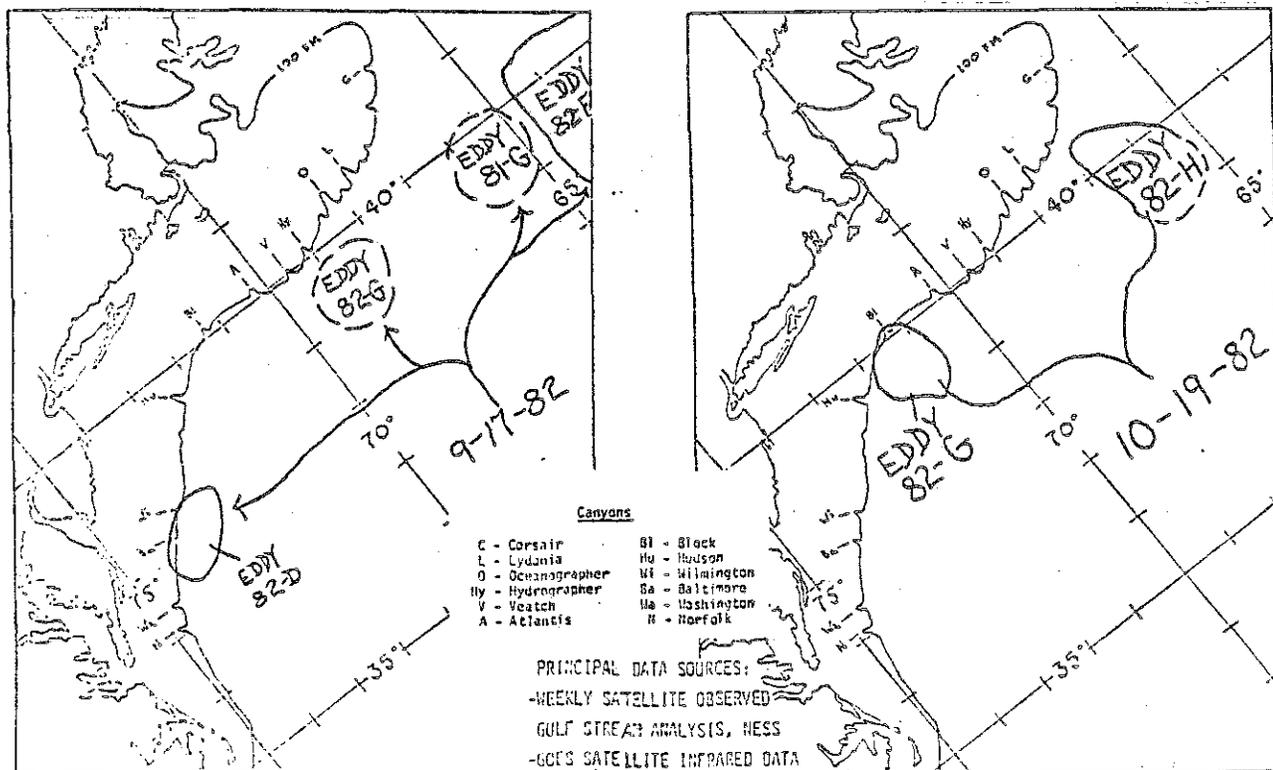
## GULF STREAM EDDY LOCATIONS

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

Eddy 82-D traveled southward to become centered on 37.0°N where it became associated with a Gulf Stream meander and was resorbed during the first week of October. Eddy 82-G traveled 222 km (120 nm) westward during the past thirty days to become centered south of Block Canyon at 39.5°N 71.3°W. Both eddies 81-G and 82-F were resorbed by a Gulf Stream meander which spawned a new eddy 82-H centered at 39.6°N 66.1°W. during the second week in October.

During the next thirty days, 82-G can be expected to travel southwestward past Hudson Canyon and possibly becoming centered in the area of Wilmington Canyon. Eddy 82-H is expected to move westward along the edge of Georges Bank into the area south of Hydrographer and Oceanographer Canyons.

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



- Fitzgerald, J.L., and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1981. *Annls. biol. Copenh.*, 38. (S)
- Fitzgerald, J.L., and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1980. *Annls. biol. Copenh.*, 37. (A)
- Hilland, J.E. Variation in the shelf water front position in 1980 from Georges Bank to Cape Romain. *Annls. biol. Copenh.*, 37. (A)
- 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. (S)
- Hughes, M.M., and S.K. Cook. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey, in 1980. *Annls. biol. Copenh.*, 37. (A)
- Ingham, M.C. Weather conditions and trends in the Maine-Virginia coastal and offshore area during 1970-79. Proc. Northwest Atlantic Fisheries Organization (NAFO) annual meeting, Halifax, Nova Scotia, Sept. 13-16, 1981. (S)
- Ingham, M.C., R.S. Armstrong, J.L. Chamberlin, S.K. Cook, D.G. Mountain, R.J. Schlitz, J.P. Thomas, J.J. Bisagni, J.F. Paul, and C.E. Warsh. Summary of the physical oceanographic processes and features pertinent to pollution distribution in the coastal and offshore waters of the northeastern United States, Virginia to Maine. NOAA Tech. Mem. (NMFS-F/NEC). (S)
- Ingham, M.C., and D.R. McLain. Sea-surface temperatures in the northwestern Atlantic in 1980. *Annls. biol. Copenh.*, 37. (A)
- Jossi, J.W., D.E. Smith, and G.A. White. Continuous plankton records: the sampling program of the US National Marine Fisheries Service. *Annls. biol. Copenh.*, 38. (S)
- McLain, D.R., and M.C. Ingham. Sea-surface temperatures in the northwestern Atlantic in 1981. *Annls. biol. Copenh.*, 38. (S)
- Murray, T., S LeDuc, and M. Ingham. Impact of climatic factors on early life stages of Atlantic mackerel, *Scomber scombrus* L.: an application of meteorological data to a fishery problem. *J. Applied Meteorology*.
- Smith, D., and J.W. Jossi. Phytoplankton, zooplankton and environmental relationships in the New York Bight - January 1976 to February 1978. NOAA Tech. Rep. NMFS/SSRF. (S)

## Miscellaneous

### Travel, Meetings, and Presentations

Steve Cook attended the Oceans '82 Exposition in Washington, D.C, on 20 September.

On 21 September Steve Cook visited the Keystone Shipping Company in Philadelphia, Pennsylvania, to discuss the Ship of Opportunity Program.

Amy Friedlander participated in a warm core ring cruise aboard the *Delaware II* from 21-28 September.

Steve Cook attended an IGOSS, SEAS meeting in Silver Springs, Maryland, on 22 September to discuss the Ship of Opportunity Program and satellite data transmission systems.

Peter Celone and Grayson Wood met with the Chinese delegation from the National Bureau of Oceanography, The Peoples Republic of China, when they were on a visit to the Woods Hole Laboratory on 28 September. Peter spoke on satellite imagery, particularly Geostationary Orbiting Environmental

Satellite-TAP activities; and Grayson's topic was the undulating oceanographic recorder.

On 29 September Reed Armstrong gave a presentation at the Graduate School of Oceanography, University of Rhode Island, "Replenishment of deep and bottom water in the Gulf of Mexico."

Woody Chamberlin visited Harvard University on 4 October to consult on ecological theory and to obtain biological specimens.

Mert Ingham attended the 70th statutory meeting of the International Council for the Exploration of the Sea which was held in Copenhagen, Denmark, from 10-21 October.

During 19-21 October Reed Armstrong, Steve Cook and Dan Smith attended the 1982 MABPOM Workshop hosted by the Horn Point Environmental Laboratories of the University of Maryland's Center for Environmental and Estuarine Studies.

Mert Ingham attended a NEFC Board of Directors meeting held at Woods Hole, Massachusetts, on 25-28 October.

### Seminars

During 13-17 September Woody Chamberlin, Reed Armstrong, Peter Celone, and Amy Friedlander attended a satellite oceanography workshop held at the University of Rhode Island Graduate School of Oceanography.

Mert Ingham, Jack Jossi, and Steve Cook attended a seminar on "Why Japanese management works," which was conducted at the Narragansett Laboratory on 27-28 September.

### Visitors

Eric Schneider, staff assistant at NOAA, visited AEG on 13 October and conferred with Woody Chamberlin.

### University Affairs

Woody Chamberlin, Reed Armstrong, Peter Celone, and Amy Friedlander attended a satellite oceanography workshop held at the University of Rhode Island Graduate School of Oceanography on 13-17 September.

On 29 September Reed Armstrong gave a presentation at the University of Rhode Island Graduate School of Oceanography, "Replenishment of deep and bottom water in the Gulf of Mexico."

### Personnel

Gregory Alonso, computer aide, left our employ as of 30 September.

Maia Champlin, computer clerk; Stephen Matteson, physical science technician; and Carol Price, oceanographer, were selected in October as employees of the AEG and started in their respective positions as of 1 November.

## NOVEMBER-DECEMBER

### Ocean Monitoring and Climatology Task

The cooperative Ship of Opportunity Program obtained 12 XBT transects and 4 CPR transects in November-December: 4 XBT and 2 CPR transects in the Gulf of Maine, 2 XBT transects off southern New England, 4 XBT and 2 CPR transects across the shelf and slope off New York, and 2 XBT transects across the Gulf of Mexico.

In December the Ship of Opportunity Program successfully sea tested an XBT/Meteorological Data Acquisition System that includes data transmission via Geostationary Orbiting Environmental Satellite to shore in a timely fashion. A cooperative systems development effort involving the AEG, National Weather Service, and Bathymetry Systems begun last spring has led to the interfacing of a Hewlett-Packard HP-85 desktop computer and a Bathymetry Systems SA-810 XBT controller unit (digitizer) with a Synergetics Geostationary Orbiting Environmental Satellite Data Transmission System. The hardware interfacing and necessary software for entering meteorological data, and automatically computing inflection points for transmission in the JJXX Bathymetry message format was developed by Bathymetry Systems. This completed system will allow the AEG to receive detailed XBT data in Narragansett within an hour of the time it was collected at sea. Presently this system is operated twice monthly on the M/V *Oleander* between New York and Bermuda.

The announcements of eddy conditions in the Georges Bank - Middle Atlantic Bight area shown on pages 135 and 136 were sent to Commander, Atlantic Area, US Coast Guard, for publication in the December 1982 and January 1983 issues of the *Atlantic Notice to Fishermen*.

During the reporting period there were two significant developments at the University of Rhode Island Graduate School of Oceanography Remote Sensing Laboratory: (1) the RSMAS data handling and image display system reached functional status. On 16 December, AEG and Narragansett Laboratory personnel attended a tutorial by Peter Cornillon of the Graduate School of Oceanography on the operation of the system. (2) furniture was delivered and installed in the laboratory workspace designated for NMFS personnel.

### Publications

- Armstrong, R.S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. *Annls. biol. Copenh.*, 38. (A)
- Crist, R.W., and J.L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1980. *Annls. biol. Copenh.*, 37. (A)
- 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)
- Fitzgerald, J.L., and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1980. *Annls. biol. Copenh.*, 37. (A)
- Hilland, J.E. Variation in the shelf water front position in 1980 from Georges Bank to Cape Romain. *Annls. biol. Copenh.*, 37. (A)
- 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)
- Hughes, M.M., and S.K. Cook. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey, in 1980. *Annls. biol. Copenh.*, 37. (A)
- Ingham, M.C. Weather condition and trends in the Maine-Virginia coastal and offshore area during 1970-79. Proc. Northwest Atlantic Fisheries Organization (NAFO) annual meeting, Halifax, Nova Scotia, Sept. 13-16, 1981. (S)
- Ingham, M.C., R.S. Armstrong, J.L. Chamberlin, S.K. Cook, D.G. Mountain, R.J. Schlitz, J.P. Thomas, J.J. Bisagni, J.F. Paul, and C.E. Warsh. Summary of the physical oceanographic processes and features pertinent

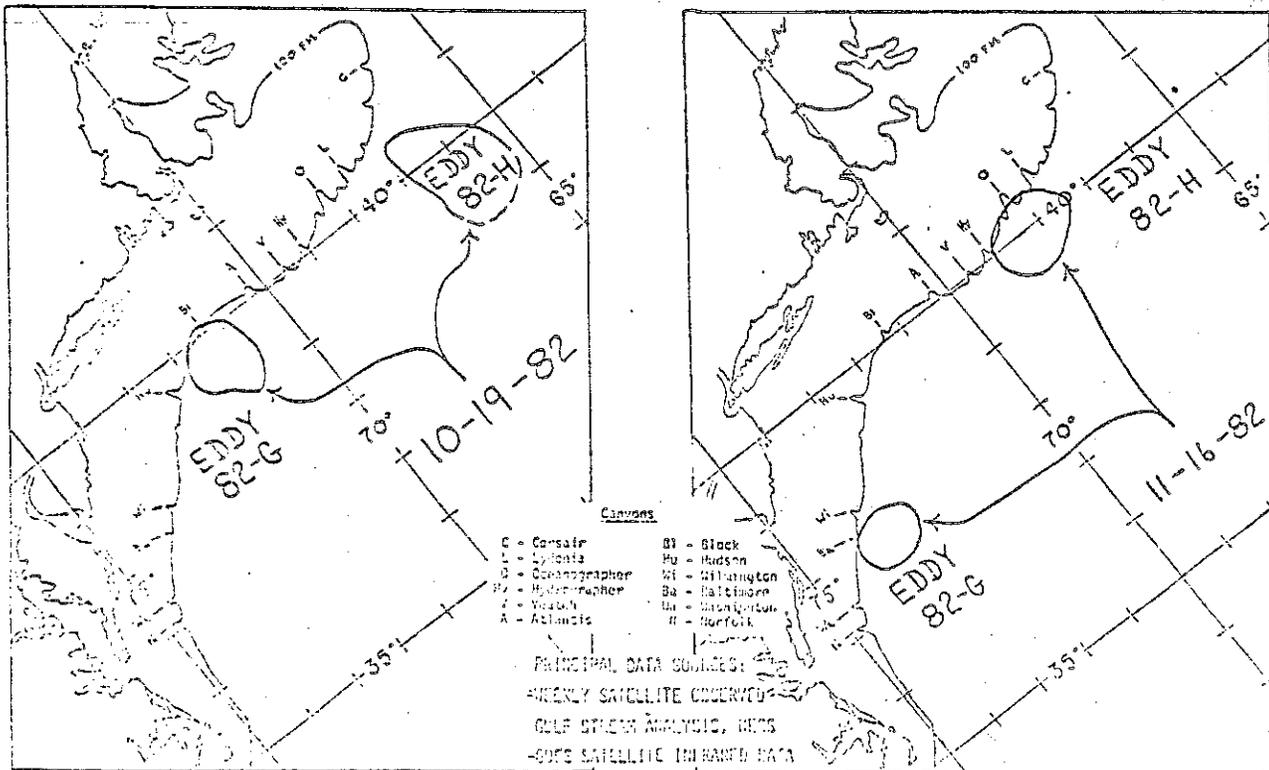
GULF STREAM EDDY LOCATIONS

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

Eddy 82-G traveled southwestward 260 km (≈140 nm) during the past thirty days to become centered southeast of Baltimore Canyon at 37.9°N 73.5°W. Eddy 82-H traveled west-northwest 195 km (105 nm) to a position centered at 39.9°N 68.2°W, south of Oceanographer Canyon.

During the next thirty days, 82-G can be expected to travel southward and may be resorbed by the Gulf Stream near Cape Hatteras. Eddy 82-H can be expected to move westward along the southern edge of Georges Bank and may approach Atlantis Canyon. A new eddy, 82-I, centered at 41.6°N 64.5°W, although not included in this month's analysis, can be expected to move southwest along the edge of Georges Bank and be centered between Corsair and Lydonia Canyons by mid-December.

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



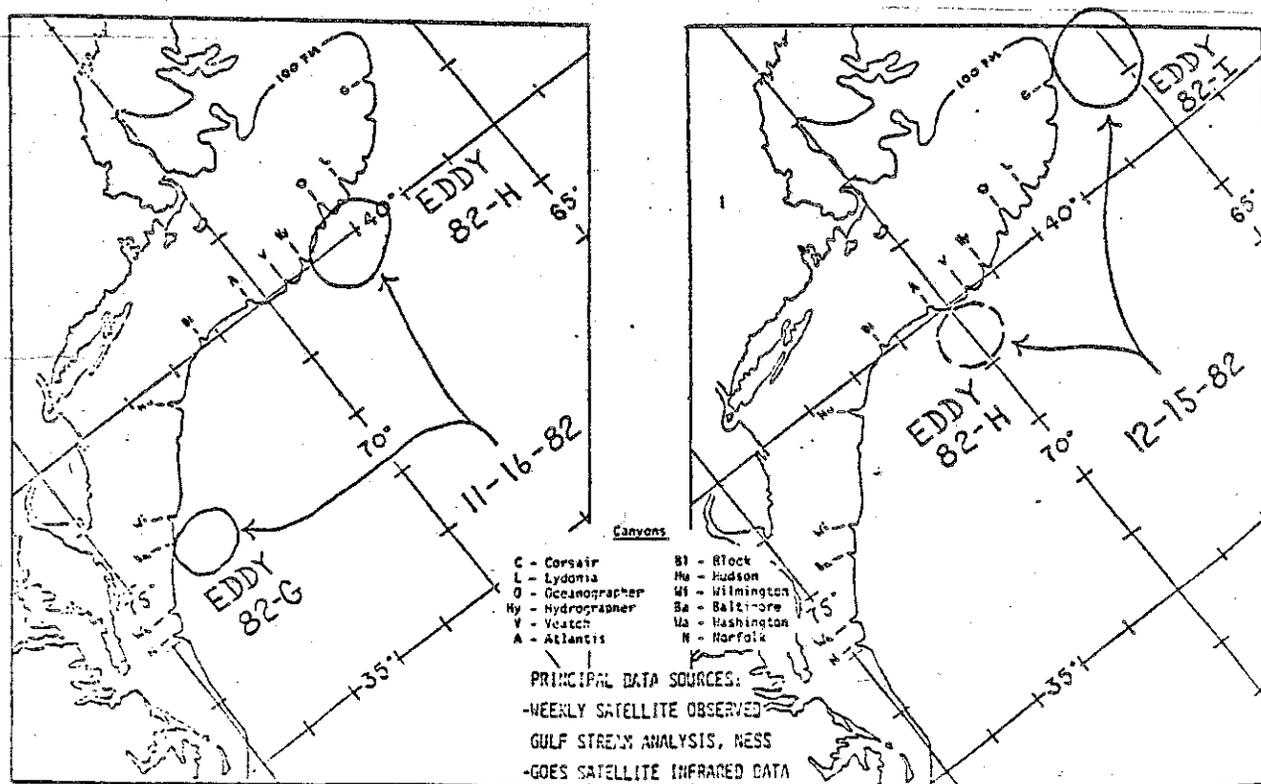
GULF STREAM EDDY LOCATIONS

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

Eddy 82-G travelled southwestward 240 km (130 nm) and was resorbed by the Gulf Stream in the vicinity of Cape Hatteras during the second week of December. Eddy 82-H was last observed in cloud free satellite imagery on 8 December, centered at 39.5°N 69.6°W. Its position as of 15 December was estimated to be centered at 39.5°N 70.0°W, between Atlantis and Veatch Canyons. Distance travelled during the past thirty days was estimated to be 167 km (=90 nm). Eddy 82-I traveled southwestward 74 km (=40 nm) to a position centered at 41.3°N 65.3°W, east of Corsair Canyon.

During the next thirty days, eddy 82-H can be expected to move west-southwest, to a position centered south of Hudson Canyon. Eddy 82-I can be expected to travel southwestward along the southern edge of Georges Bank and approach Lydonia Canyon.

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



to pollution distribution in the coastal and offshore waters of the northeastern United States, Virginia to Maine. NOAA Tech. Memo (NMFS-F/NEC). (A)

Ingham, M.C., and D.R. McLain. Sea-surface temperatures in the northwestern Atlantic in 1980. *Annls. biol. Copenh.*, 37. (A)

Jossi, J.W., D.E. Smith, and G.A. White. Continuous plankton records: the sampling program of the US National Marine Fisheries Service. *Annls. biol. Copenh.*, 38. (A)

McLain, D.R., and M.C. Ingham. Sea-surface temperatures in the northwestern Atlantic in 1981. *Annls. biol. Copenh.*, 38. (A)

Murray, T., S. LeDuc, and M. Ingham. Impact of climatic factors on early life stages of Atlantic mackerel, *Scomber scombrus* L.: an application of meteorological data to a fishery problem. *J. Applied Meteorology*. (A)

Smith, D., and J.W. Jossi. Phytoplankton, zooplankton and environmental relationships in the NE York Bight - January 1976 to February 1978. NOAA Tech. Rep. NMFS/SSRF.

## Miscellaneous

### Travel, Meetings, and Presentations

Lianne Armstrong visited the Crimson Group Annual Show in Boston on 22 and 23 November and attended a seminar on audio-visual systems, camera technical sales, etc.

Amy Friedlander boarded the M/V *Oleander* on 11 November to participate in a research cruise to Hamilton, Bermuda, to collect environmental data and plankton. She returned to Narragansett on 18 November.

On 15 November Mert Ingham and Steve Cook travelled to Norfolk, Virginia, to attend a briefing with US Navy personnel at the Eastern Oceanography Center. Mert also met with Virginia Institute of Marine Science personnel the next day.

Steve Cook travelled to New York on 3 November to visit with a training representative of the Merchant Marine Academy and to confer with Moore McCormack personnel.

During 24-26 November Reed Armstrong visited the National Earth Satellite Service in Suitland, Maryland, to examine coastal zone color scanner satellite imagery for oceanographic applications.

Mert Ingham attended a Northeast Monitoring Program management meeting in Sandy Hook on 29 and 30 November.

On November 24 Reed Armstrong attended a meeting in Sandy Hook to discuss MARMAP survey results.

On 8 December Steve Cook, Bob Benway, and Steve Matteson installed an XBT/satellite system aboard a Ship of Opportunity in Port Newark, New Jersey.

Mert Ingham attended a conference on environmental studies (Regional Action Plan) at the Milford Laboratory in Connecticut on 15 December.

In Washington, D.C., on 20 December, Steve Cook met with National Weather Service and National Earth Satellite Service personnel for evaluation and critiquing of the prototype XBT/satellite system tested on M/V *Oleander*.

### Visitors

Eric Schneider, Special Assistant to the Administrator of NOAA, visited AEG on 3 December to confer with Mert Ingham.

### University Affairs

On 10 December Mert Ingham attended a meeting with Dean Knauss, University of Rhode Island/Geostationary Orbiting Environmental Satellite, and an ad hoc publications steering committee of the University of Rhode Island Center for Ocean Management Studies.

### Personnel

Elinor Werberger began work as AEG secretary on 27 December, replacing Gertrude Kavanaugh who was scheduled for retirement on 31 December.

### JANUARY-FEBRUARY

#### Ocean Monitoring and Climatology Task

The cooperative Ship of Opportunity Program obtained 15 XBT transects and 4 CPR transects in January-February: 4 XBT and 2 CPR transects in the Gulf of Maine, 5 XBT transects off southern New England, 4 XBT and 2 CPR transects across the shelf and slope off New York, and 2 XBT transects across the Gulf of Mexico.

December was the last month the Ship of Opportunity Program/Office of Marine Pollution Assessment collected data from the M/V *Marine Evangeline*. The *Evangeline* has operated between Portland, Maine, and Yarmouth, Nova Scotia, since December 1977. Thus ended a five-year time series of monthly XBT data. The *Evangeline* is not being replaced on the Portland run and will operate year around from Bar Harbor, Maine, to Yarmouth, Nova Scotia. In an effort to better describe subsurface water column conditions in the Gulf of Maine we have, in cooperation with the Woods Hole fishery oceanography investigation, begun doubling up on our other transect between Boston, Massachusetts, and Cape Sable, Nova Scotia.

The announcements of eddy conditions in the Georges Bank - Middle Atlantic Bight area shown on pages 139 and 140 were sent to Commander, Atlantic Area, US Coast Guard, for publication in the February and March 1983 issues of the *Atlantic Notice to Fishermen*.

The Geostationary Orbiting Environmental Satellite/FAX facsimile recorder used to obtain imagery from geostationary and polar orbiting satellites has been moved into the NEFC trailer in the University of Rhode Island Graduate School of Oceanography Remote Sensing Laboratory. After a short period of testing and adjustments, the machine was returned to full operational capability. Some progress has been made on the development of a Geostationary Orbiting Environmental Satellite/FAX network. A slave recorder is in operation at the NMFS Woods Hole Laboratory and the Bigelow Laboratory in Boothbay Harbor, Maine. Efforts to design and assemble a timer/switch to facilitate after-hours operation of the master facsimile recorder, and thus the network, are continuing.

### Publications

- Armstrong, R.S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. *Annls. biol. Copenh.*, 38. (A)
- Crist, R.W., and J.L. Chamberlin. Bottom temperatures on the continental shelf and slope south of New England during 1980. *Annls. biol. Copenh.*, 37. (A)

GULF STREAM RING LOCATIONS

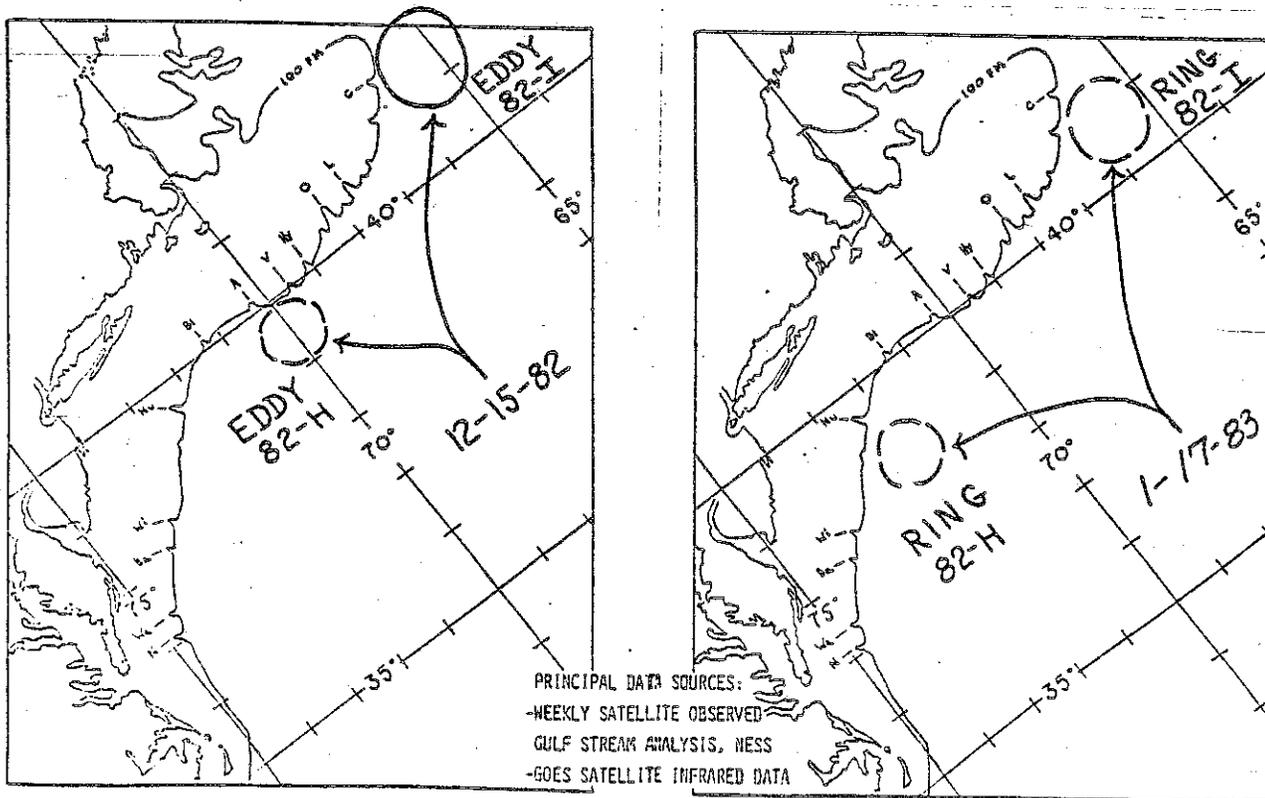
The Atlantic Environmental Group of the National Marine Fisheries Service reports that two warm core Gulf Stream rings were off the northeast coast of the United States in mid-January.

Ring 82-H, not clearly visible in satellite imagery for several weeks, is estimated to be centered at 38.8°N 72.0°W, south of Hudson Canyon. Distance travelled during the past thirty days was estimated to be 194.6 km (105 nm) in a southwesterly direction. Ring 82-I travelled southwestward along the southern edge of Georges Bank 92.7 km (50 nm) to a position centered at 40.7°N 65.7°W.

During the next thirty days, Ring 82-H can be expected to travel southwestward to a position centered between Baltimore and Washington Canyons. Ring 82-I can be expected to move southwest along the edge of Georges Bank to a position south of Lydonia 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 eddies may be obtained by calling the Atlantic Environmental Group (401-789-9326).

NOTE: Starting with this analysis all eddies will now be called rings.



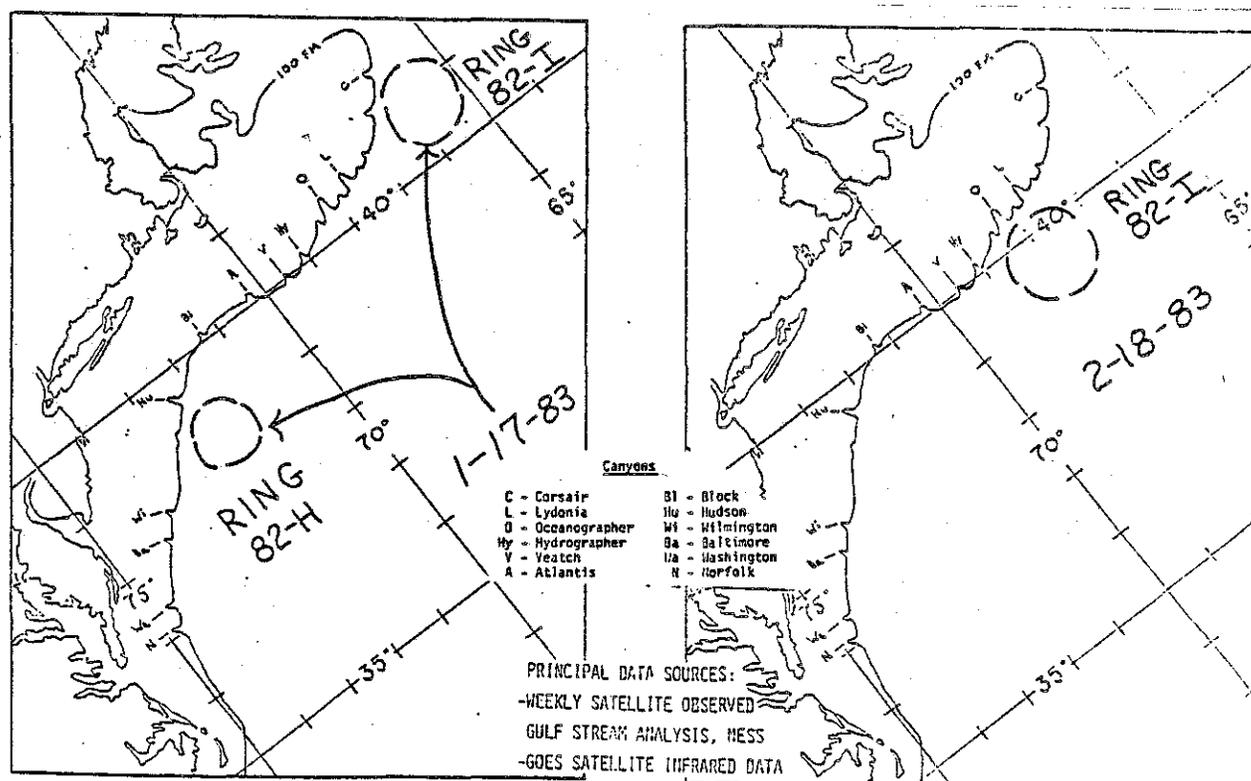
GULF STREAM RING LOCATIONS

The Atlantic Environmental Group of the National Marine Fisheries Service reports that one warm-core Gulf Stream ring was off the northeast coast of the United States in mid-February.

Ring 82-H, not strongly evident in satellite imagery for a number of weeks was determined to have been resorbed by the meandering Gulf Stream southeast of Hudson Canyon. Data from transects through this area show no warm water or strong currents associated with a ring in this region. Ring 82-I travelled southwestward along the edge of Georges Bank 222.4 Km (120 nm) to a position centered at 39.6°N 67.9°W, southwest of Lydonia Canyon.

During the next thirty days, ring 82-I can be expected to travel westward along the edge of the continental shelf to a position centered south of Atlantis Canyon. A new ring centered east of Georges Bank can be expected to travel west-southwest to a position off Corsair 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).



- 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)
- Fitzgerald, J.L., and J.L. Chamberlin. Anticyclonic warm core Gulf Stream eddies off the northeastern United States during 1980. *Annls. biol. Copenh.*, 37. (A)
- Hilland, J.E. Variation in the shelf water front position in 1980 from Georges Bank to Cape Romain. *Annls. biol. Copenh.*, 37. (A)
- 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)
- Hughes, M.M., and S.K. Cook. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey, in 1980. *Annls. biol. Copenh.*, 37. (A)
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- Ingham, M.C., R.S. Armstrong, J.L. Chamberlin, S.K. Cook, D.G. Mountain, R.J. Schlitz, J.P. Thomas, J.J. Bisagni, J.F. Pual, and C.E. Warsh. Summary of the physical oceanographic processes and features pertinent to pollution distribution in the coastal and offshore waters of the northeastern United States, Virginia to Maine. NOAA Tech. Memo (NMFS-F/NEC). (P)
- Ingham, M.C., and D.R. McLain. Sea-surface temperatures in the northwestern Atlantic in 1980. *Annls. biol. Copenh.*, 37. (A)
- Jossi, J.W., D.E. Smith, and G.A. White. Continuous plankton records: the sampling program of the U.S. National Marine Fisheries Service. *Annls. biol. Copenh.*, 38. (A)
- McLain, D.R., and M.C. Ingham. Sea-surface temperatures in the northwestern Atlantic in 1981. *Annls. biol. Copenh.*, 38. (A)
- Murray, T., S. LeDuc, and M. Ingham. Impact of climatic factors on early life stages of Atlantic mackerel, *Scomber scombrus* L.: an application of meteorological data to a fishery problem. *J. Applied Meteorology*. (A)
- Smith, D., and J.W. Jossi. Phytoplankton, zooplankton and environmental relationships in the New York Bight - January 1976 to February 1978. NOAA Tech. Rep. NMFS/SSRF. (S)

## Miscellaneous

### Travel, Meetings, and Presentations

On January 5 Steve Cook installed meteorological equipment onboard the M/V *Oleander* and visited with the training representative of the Merchant Marine Academy in New York. The following day he met with representatives of Moore-McCormack and Farrell Lines.

Mert Ingham travelled to Sandy Hook and Atlantic City, New Jersey, February 10 and 11 to confer with NMFS and National Water Service scientists and participate in a meeting of the Ocean Dumping Research Steering Committee.

Bob Benway boarded the M/V *Oleander* on January 15 to participate in a cruise to Hamilton, Bermuda, to collect environmental data and plankton. He returned to Narragansett on January 19.

During January 11-14 Peter Celone was in Washington, D.C., conferring with oceanographers at NESDIS to obtain satellite data on a real-time basis.

Woody Chamberlin visited Harvard University on January 17 to consult on ecological theory and to return biological specimens.

On January 27 Steve Cook boarded the M/V *Oleander* to make the transect to Bermuda to collect environmental data and plankton. He returned to Narragansett on February 4.

Jack Jossi and Grayson Wood met with Sea Data Corporation personnel in Newton, Massachusetts, on February 2 to review progress in the development of a new data acquisition system for the undulating oceanographic recorder.

Reed Armstrong and Woody Chamberlin attended meetings of the warm core ring study group at Woods Hole Laboratory on February 10 where Woody presented a paper, "Anarchy in Satellite Oceanography."

On February 14 and 15 Mert Ingham attended a meeting of the NEFC Board of Directors in Woods Hole.

Woody Chamberlin travelled to Draper Laboratory in Cambridge, Massachusetts, on February 15 to participate in a working meeting with Dr. Niels K. Højerslev of the Institute of Physical Oceanography, University of Copenhagen.

From February 22-24 Mert Ingham attended the Northeast Monitoring Program Annual Review which was held in Milford, Connecticut.

#### Personnel

Marlou Crisp, a graduate student in library science at the University of Rhode Island, is working half-time as an unpoaid volunteer during the spring semester on the reorganization of the AEG library and data archive. This endeavor has been undertaken as a professional field experience, for which she received graduate credit.