RUTGERS/NOAA COOPERATIVE MARINE EDUCATION AND RESEARCH PROGRAM

2002 Annual Report and Statement of Program Direction

Shannon Newby uses a Van Veem grab to collect sediment that will be used in surf clam predation experiments.

Young-of-the-year goosefish being examined for morphological development

In situ image taken from a submersible of an adult goosefish in typical habitat on the continental shelf

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Executive Summary

The Rutgers/NOAA Cooperative Marine Education and Research (CMER) Program is now completing its tenth year. Established in 1993 under a Cooperative Agreement between Rutgers, The State University of New Jersey, and the National Oceanic and Atmospheric Administration (NOAA), the CMER Program combines university and agency expertise to address marine issues affecting the state, region, and nation. Base funds for the Rutgers/NOAA CMER Program are provided by NOAA through the National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center (NEFSC). As of December 2002, cooperative projects funded with base funds through the Rutgers/NOAA CMER Program totaled $1,113,067 and supported twenty-eight cooperative projects (Table 1). Fifteen faculty from five University departments, eighteen students from six graduate programs, five post-doctoral fellows, and numerous undergraduate students have participated in the first ten years of base funded projects. Numerous NOAA scientists serve as co-principal investigators or advisors on these projects. Additional funds are contributed to the Rutgers/NOAA CMER Program from a variety of sources within and outside the NEFSC to support specific research projects. During the first ten years, the Rutgers/NOAA CMER program received approximately $6.8 million in external funds to support thirty-one projects (Table 1). Base funds available to the CMER Program in 2002 were used to fund one continuing project and two new projects.

The program direction for base and external funded projects during 2002 included: surfclam larval predation; manganese in lobsters as an indicator of hypoxic stress; support of fisheries research experiences for undergraduates; Bluefish/striped bass ecology and interactions; spatial dimensions of fisheries; essential fish habitats of goosefish; relationship between hydrodynamics and fish ecology; biotechnological investigations-ocean margins; chemical composition and bioavailability of DON in atmospheric wet deposition; field, laboratory, and modeling programs examining eutrophication in coastal ecosystems; relationships between measured geochemical rates and gene expression for specific processes; and biocomplexity in sedimentary microbial systems.

INTRODUCTION

The Rutgers/NOAA Cooperative Marine Education and Research (CMER) Program was established in early 1993 under the aegis of a cooperative agreement between Rutgers the State University of New Jersey and the National Oceanic and Atmospheric Administration (NOAA). The Rutgers Program joins cooperative programs established in 1989 at the University of Massachusetts and the University of Rhode Island. In 2000 a cooperative program was established in Virginia (Hampton University and Virginia Institute of Marine Sciences). All CMER Programs were built upon a long history of cooperation between NOAA and these institutions.

The Rutgers/NOAA CMER Program is intended to foster enhanced interactions between all elements of NOAA and the University; however, special emphasis is placed upon projects of mutual interest to the University and the Northeast Region (NER) of NOAA'S National Marine Fisheries Service (NMFS). The proximity of these institutions offers enhanced opportunities for: (a) joint research involving faculty, students and NOAA personnel; (b) training opportunities for both students and federal employees; and (c) shared use of specialized facilities and equipment. The CMER Program combines university and agency expertise to address marine issues affecting the state, region, and nation.

Graduate research and education are at the core of the Rutgers/NOAA CMER Program. Fifteen faculty from five University departments, eighteen students from six graduate programs, five post-doctoral fellows, and a number of undergraduate students participated in the first ten years of base funded projects.

The CMER program is a truly cooperative program with all parties contributing towards the objectives of the program. A coordinating committee, consisting of two University representatives and two NOAA representatives, determines program direction and funding priorities. A NOAA employee (Dr. Sybil Seitzinger) stationed on the Rutgers campus serves as Program Director. The Director has adjunct faculty status, conducts an active research program, and teaches and supervises graduate students. Dr. Seitzinger is a Visiting Professor at Rutgers and a member of the Graduate Oceanography Program faculty. Dr. Hilairy Hartnett, (a Visiting Assistant Professor at Rutgers) was the Associate Director of the Rutgers/NOAA CMER program while Dr. Seitzinger was on sabbatical (through June 2002).

The Rutgers/NOAA CMER program has received continuous support from the NEFSC. The program has received a total of approximately $7.9 million during the first ten years from NEFSC and external sources. Base funding provided by the NEFSC has ranged from $67,000 to $153,000 per year for a total of $1,113,067 during the first ten years (Figure 1). In addition to base funds, the Rutgers/NOAA CMER program has received a total of $6,763,715 in external funding from sources inside and outside the NEFSC. External funding has ranged from $100,000 to $1,169,300 per year (Figure 1). Projects supported by base and external funds encompass a variety of topics including habitat studies, socioeconomics, education and training, fishery products, biology and life history, and studies of pollutants and their effects. Studies of pollutant effects, biology and life history, and habitat account for over 75% of the projects (Figure 2) and funding (Figure 3) in the Rutgers/NOAA CMER program to date.

Figure 1. Base funds and external funds recieved by the Rutgers/NOAA CMER Program 1993-2002

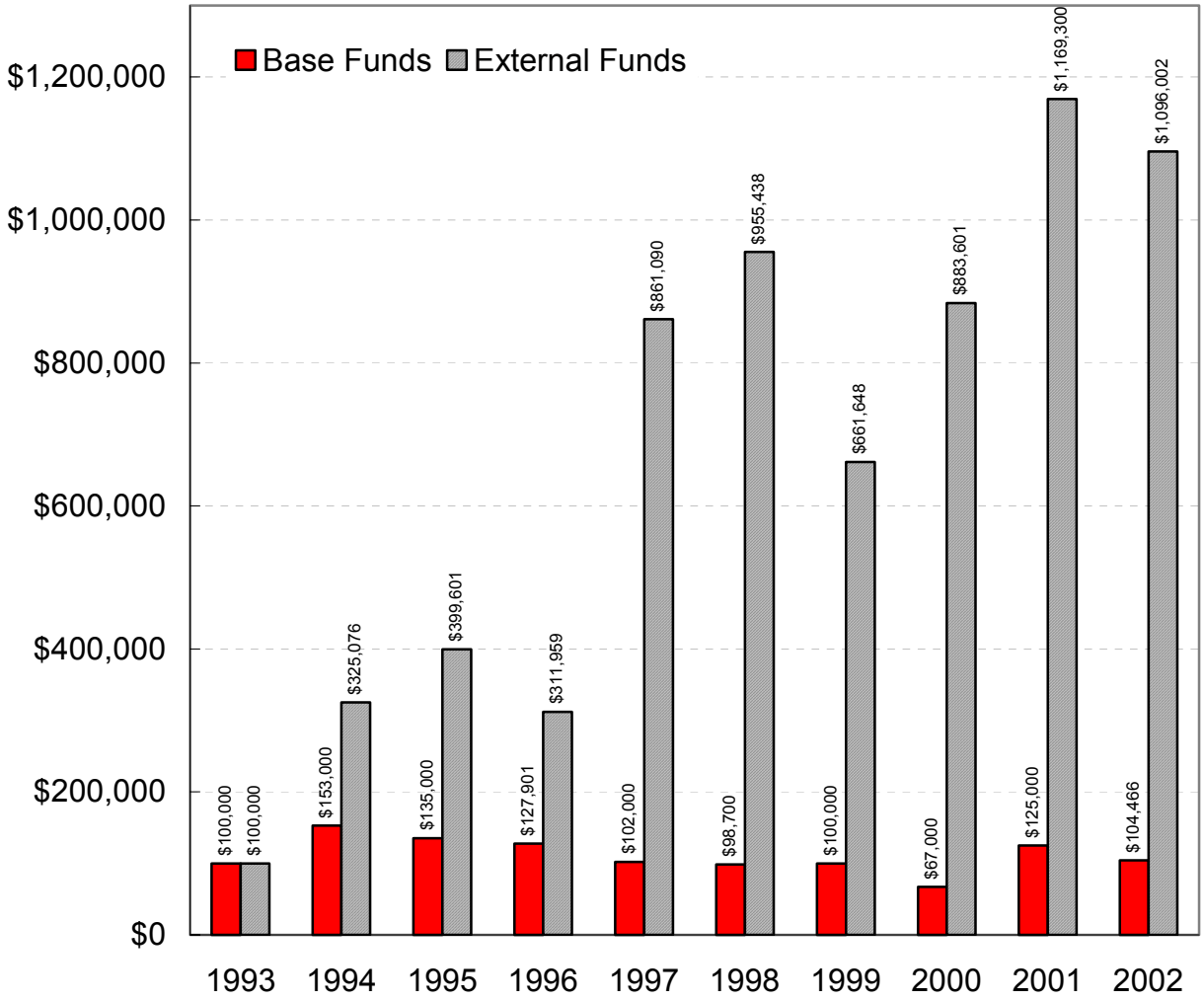


Figure 2. Number of projects in each topic addressed by the Rutgers/NOAA CMER Program, 1993-2002

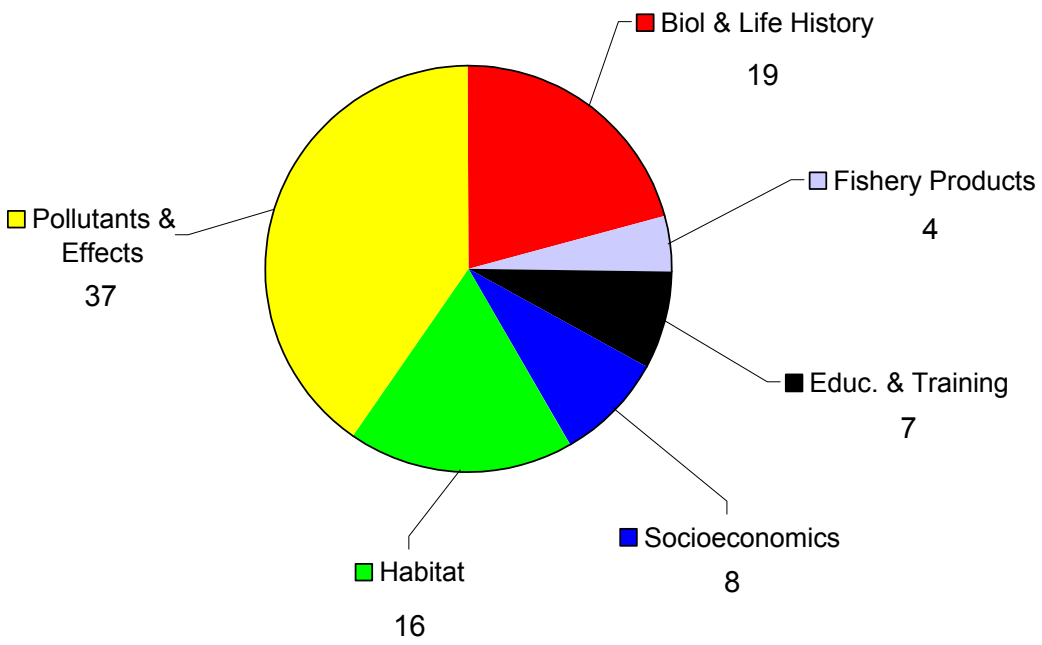
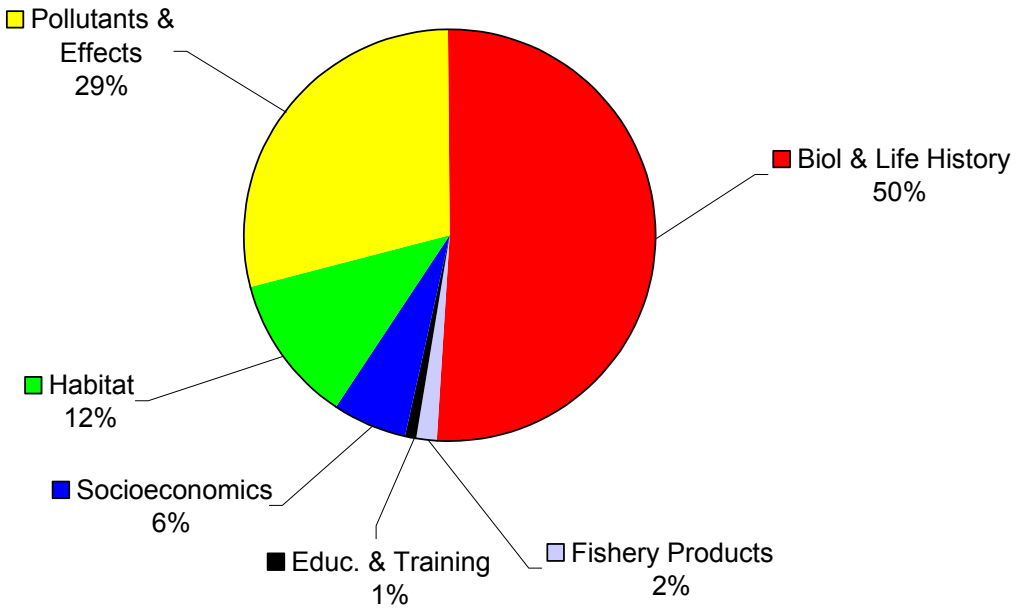


Figure 3. Relative expenditures for each topic addressed by the Rutgers/NOAA CMER Program 1993-2002



BASE FUNDED PROJECTS IN 2002

Base funding for the CMER Program is provided by NOAA through the Northeast Fisheries Sciences Center. Continuing work under multi-year projects receives high priority for funding, given satisfactory performance in the preceding year. This policy helps to insure continuity of support to graduate students. A listing of students supported by the CMER Projects is provided in Table 2.

All projects involve a high degree of cooperation among University and NOAA personnel. Two of the three base funded projects in 2002 have NOAA employees as advisor or co-principal investigators (Table 1). A brief description of projects supported with 2002 base funds follows.

NEW PROJECTS SUPPORTED WITH 2002 BASE FUNDING

02-03 The Effects of Bottom Roughness On Surf Clam (*Spisula*) Predation (Judith Grassle and Shannon Newby, Institute for Marine Sciences, Rutgers University)
This research will examine the role played by bottom roughness elements (shell hash) on predation in recruitment success of the surfclam, *Spisula solidissima*. Areas of shell hash may provide refuge to small *S. solidissima* from omnivorous predators. Laboratory studies will be conducted in the annular flumes at Rutgers. Experiments to determine if habitat structure affects the predatory success of crustaceans will be conducted at different flow velocities. The experiments will also determine if a refuge density exists at which surfclams are less likely to be preyed upon and if that density is altered with the presence of habitat structure. This research will add to the understanding of key elements of the Essential Fish Habitat of surfclams and to factors affecting their recruitment.

02-04 Manganese in Lobsters as an Indicator of Hypoxia-Induced Stress (Robert Sherrell and Andrew Draxler, Institute of Marine and Coastal Sciences - Rutgers University)
The goal of this study is to determine whether manganese (Mn) uptake in lobsters can be related to bottom water hypoxia through oxidation-reduction (redox) mediated sources in surface sediments. If so, Mn content in lobster tissue may serve as an indicator of recent exposure to chemical stressors associate with low ambient oxygen levels, such as ammonium or hydrogen sulfide. As such, Mn could be a useful and simple means of determining the relationship between chemical exposures associated with bottom water hypoxia and vulnerability to disease or death in lobsters. The study builds on previous laboratory studies of the kinetics of Mn uptake and elimination by lobsters, but is the first of its kind to apply these principles to a spatial/temporal design in the context of lobster disease and death in Long Island Sound (an HAPC where the US lobster fishery lost 12 million lobsters in 1999). This metals study augments an ongoing NMFS field study to determine the relationship between the exposure of lobsters to the ambient chemical and biological environment of Long Island Sound and lobster health.

CONTINUING PROJECTS SUPPORTED WITH 2002 BASE FUNDING

02-02 CMER Research Experiences for Undergraduates (Michael P. DeLuca, Institute of Marine and Coastal Sciences - Rutgers Univ.)
This project will fund three summer undergraduate interns in 2003. The interns will be involved in research projects at one of the NEFSC laboratories.

BASE PROJECTS BEING COMPLETED IN 2002

01-02 Spatial Dimensions of Fisheries and Their Implications for Property Rights Alternatives: A Case Study of Three Major Scalloping Areas (Kevin St. Martin, Department of Geography- Rutgers University, New Brunswick, NJ and Bonnie McCay, Department of Human Ecology- Rutgers University, New Brunswick, NJ)
Recent legislation necessitates a focus on "communities" and "ecosystems" in fisheries management. These concerns suggest a spatial understanding of fisheries across multiple scales and species. As management incorporates more spatial approaches, knowledge about the range of fishing activities in specific areas and the characteristics of who harvests in particular areas will be essential for successful implementation and social/economic impact analyses of fishing communities. These are key areas that Geographical Information Systems are uniquely suited to investigate. The research focuses on the scallop fishery to address general issues of increasingly spatial forms of management and the implications for potential property rights regimes. This is an excellent case study because the fishery is moving toward some form of 'area management' and the fishery is important to the both the New England and Mid-Atlantic regions.

01-05 Biotic Interactions Between Bluefish (*Pomatomus saltatrix*) and Associate Piscivorous Predators: Comparisons of Habitat Use, Movements, Diet and Growth (Kenneth W. Able, Rutgers Marine Field Station, Tuckerton, NJ and R. Christopher Chambers, NOAA/NMFS, James J. Howard Marine Sciences Laboratory, Highlands, NJ)
A developing consensus suggests that mortality occurring during the early life-history of fishes is critical to the subsequent contribution of a species to commercial and recreational fisheries and that it may be habitat-based. Bluefish are a priority species in recreational and commercial fisheries and basic ecological information is needed on the biotic factors effecting bluefish population dynamics. The objectives of this proposal are to address biotic interactions between young-of-the-year bluefish and associated predators (weakfish, striped bass, white perch, summer flounder, and others) with emphasis on predator-prey and competition dynamics are they relate to recruitment. This project is funded in part by the Rutgers Bluefish/Striped Bass Dynamics Research Program.

00-01 Essential Fish Habitat for Young-Of-The-Year Goosefish (*Lophius americanus*) in the Middle Atlantic Bight (Kenneth W. Able, Rutgers Marine Field Station, Tuckerton, NJ and R. Christopher Chambers, NOAA/NMFS, James J. Howard Marine Sciences Laboratory, Highlands, NJ)
Goosefish ranks among the most valuable groundfish fisheries in the region and has the second highest value among all Atlantic finfish. However, there are considerable uncertainties in the status of the goosefish stock. This multi-year project is a collaboration between the fishing

industry, Rutgers University scientists, and NMFS scientists to study the biology and habitat use of YOY goosefish in the Middle-Atlantic Bight. Larval size, size at settlement and distribution and abundance for YOY will be measured to determine critical components of their benthic habitat, and the role of predation (cannibalism).

99-05 Effects of Bottom Roughness on Surf Clam (*Spisula solidissima*) Larval Settlement and Recruitment (Judith P. Grassle and Shannon G. Newby, IMCS, Rutgers University)
This two-year project will examine factors affecting settlement of surf clam larvae. Laboratory studies will be conducted in the racetrack flume at Rutgers. After characterizing the flow fields over ripple beds and shell-hash in the flume, settlement patterns of surfclam larvae will be determined as a function of bottom roughness parameters. The results of these studies will then be compared to field measurements conducted at the LEO-15 site on the continental shelf off Tuckerton, NJ.

99-06 Fish Movements in the Dynamic Ecoscape of a Shallow Flood Dominated Estuary (Robert J. Chant, Institute of Marine and Coastal Sciences, Rutgers University and Allan Stoner, The James J. Howard Laboratory, NMFS)
This two-year project will examine aspects of the changing temporal and spatial structure of essential fish habitat by studying the relationships between the dynamic physical environment and movements by fishes in the Navesink River estuary. Turbidity in the estuary exhibits strong temporal (and spatial) patterns due to tidal circulation. The high turbidity areas are hypothesized to serve as a refuge for juvenile winter flounder, bluefish, and blue crabs from their predators. The approach combines time series measurements (tidal time scales) of turbidity, particle size distribution, temperature, salinity, dissolved oxygen and fish distribution (biotelemetry).

PROJECTS SUPPORTED WITH 2002 EXTRAMURAL FUNDING

In addition to the base funds provided by the Northeast Fisheries Science Center, funds were contributed from a variety of sources within and outside the NEFSC to Rutgers University for the following projects (Table 1). These projects were approved for inclusion in the Rutgers/NOAA CMER Program by the Coordinating Committee.

NEW EXTRAMURAL PROJECTS IN 2002

02-Ex1 Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight (VI) (Michael DeLuca, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)
Participants at prior bluefish workshops expressed an interest in shifting the existing program from a theme-based series of projects to a more focused approach on understanding bluefish dynamics over a large spatial scale, as determined by management and fishing community needs. In response, Rutgers sponsored a dedicated session at the 2002 national meeting of the American Fisheries Society to present a coastwide strategy for bluefish stock assessment to researchers and fishery managers/regulators. Select Bluefish Program PIs and fishery managers reviewed the draft strategy and endorsed the concept of a scientific workshop to develop the framework for program redirection with participation from academic, legislative, management/regulatory, industry, and commercial and recreational fishing representatives.

The Steering Committee for the present program endorsed this approach and recommended key individuals to help develop the workshop. A workshop steering committee was formed to assemble the agenda and list of participants for the workshop, expected to be held in May 2003 at Baltimore.

One new project, entitled, "Migration dynamics of striped bass in the middle Atlantic bight using recent advances in telemetry technology," was initiated to incorporate a biological component into a Long-term Ecosystem Observatory (LEO-15). Ken Able and Tom Grothues at Rutgers University received support to install monitoring buoys to track striped bass with acoustic tags. Information is expected to enhance understanding of habitat use and migratory patterns of this species in association with an existing array of samplers and sensors that collect physical-chemical information. A website (stripertracker.org), adopt-a-fish program, and science education initiatives complement this study.

These projects were in their second year of two-year funding: "Coastal dependency of juvenile bluefish in the Middle Atlantic Bight," David Secor and Ed Houde, University of Maryland; "Verifying the identification and contribution of spring and summer cohorts in Atlantic coast bluefish," David Conover, SUNY, Stony Brook; "Exploring uncertainty in the bluefish stock assessment: incorporating potential changes in distribution, catchability, selectivity, and natural mortality," Andrew Cooper, University of New Hampshire; Estuarine recruitment of juvenile bluefish during winter," Francis Juanes, University of Massachusetts at Amherst; "Development of a spatial dynamic biophysical fishery model for Atlantic Coast multispecies assessments: interactions between bluefish and striped bass," Lisa Kline and Geoff White, Atlantic States Marine Fisheries Commission, Jiangang Luo and Jerald Ault, University of Miami, Kyle Hartman, West Virginia University.

"Age-specific trophic interactions of bluefish in the mainstem Chesapeake Bay," James Gartland, College of William and Mary was funded as a one-year pilot project and "Biotic interactions between bluefish and associated piscivorous predators: Comparisons of habitat use, movements, diet and growth," Ken Able, Rutgers University is in its final year.

CONTINUING EXTRAMURAL PROJECTS

02-EX4 Biotechnological Investigations-Ocean Margins Program (BI-OMP); Geochemical Rate/RNA Integration Study (GRIST): A Pilot Field Experiment for Inter-Calibration of Biogeochemical Flux and Nucleic Acid Measurements. (Lee Kerkhof, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ, Sybil P. Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ, and H. Hartnett, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)
In this pilot study, we propose to monitor several important biogeochemical processes (e.g., primary production, bacterial production, DOM production/uptake, N-assimilation, and N redox cycling) in water column and sediment samples concurrently with the molecular approaches to assess how the flux measurements and conventional approaches can be enhanced using gene-based methodologies. Although the simultaneous measurement of carbon and nitrogen cycling processes has occurred infrequently, the concurrent measurement of the expression of carbon and nitrogen cycling genes has never before been attempted. Furthermore, a coordinated field experiment with simultaneous monitoring of geochemical processes and gene products has never been tried. We plan an integrated field experiment to assess the different biogeochemical measurements and molecular based approaches to focus on how the combination of the flux determinations and the knowledge of the active players will help us better understand regulation and response in overall system performance to different environmental parameters.

01-Ex3 Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight V (Michael DeLuca, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)
A planning workshop for the Bluefish-Striped Bass Dynamics Research Program was held at Rutgers University. Representatives from academe, industry, state and federal government, and regional fishery management councils gathered to review the results of program research efforts to date, and discuss how the program can continue to address and support the needs of the management community effectively. In response to management needs, three thematic areas for future program research were identified as a result of the workshop: historical information synthesis, basic demographic information, and ecological information needs. Stock assessment also remains a high priority area for future research.

Projects funded during this grant period included: "Potential competitive interactions in two pelagic piscivores: effects of striped bass on size- and number-impaired bluefish groups," Jeffrey A. Buckel , North Carolina State University; "Population ecology of western North Atlantic bluefish: A review," David O. Conover and Stephan B. Munch, Marine Sciences Research Center State University of New York at Stony Brook; "Winter distribution, ecology and energetics of young-of-the-year bluefish in the South Atlantic Bight," Thomas Lankford, North

Carolina State University; "The Reproductive Biology of Bluefish in the Middle and South Atlantic Bights," Christian Reiss, Cynthia Jones and Brian Wells, Old Dominion University; "Neritic Habitat use by Young-of-the-Year Bluefish in Maryland Coastal Waters," Secor, D.H., L. Takata, J. Bichy, and E.D. Houde, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science; "Predator-prey interactions between bluefish, *Pomatomous saltatrix*, and shortfin mako, *Isurus oxyrinchus*, and other pelagic sharks off the northeast U.S. coast," Cheryl Wilga, University of Rhode Island; and "Identifying crucial life stages of bluefish (*Pomatomous saltatrix*): A synthetic modeling approach," Timothy Essington, State University of New York at Stony Brook.

01-Ex4 Chemical Composition and Bioavailability of Dissolved Organic Nitrogen in Atmospheric Wet Deposition from Urban and Rural New Jersey Sites (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ and Monica Mazurek, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ)
The overall goal of the proposed research is to identify the current and potentially future processes (natural and anthropogenic) and technologies that are major contributors to atmospherically deposited organic-N compounds and to assess the effect of these specific chemicals on receptor ecosystems. Specific objectives of this project are to: 1) Characterize the chemical composition of total dissolved N, both inorganic and organic nitrogen in atmospheric deposition 2) begin to identify sources of organic nitrogen in atmospheric deposition at those sites, 3) identify which of the compounds, and therefore which potential sources are bioavailable and thus contributing to ecological changes in ecosystems. This work will ultimately provide information that can be linked to the decision making needs of environmental managers. Funding by NJ Department of Environmental Protection.

01-Ex5 Biocomplexity: The Roles of Resources, Competition, and Predation in Microbial Degredation of Organic Matter (Sybil Seitzinger, Gary, Tahon, L.Young, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ and many others)
The Biocomplexity project's goal is to investigate the roles of resources, competition and predation in the microbial degradation of organic matter. The project seeks to understand at a mechanistic (and thus quantitative) level what factors affect the activity of bacteria in natural systems. This problem is by its very nature 'complex' in that it deals with several levels of biological organization (individual, population and community) as well as micro-scale spatial heterogeneity of the environments in which bacteria function. The approach includes both modeling and empirical studies and considers both top-down and bottom-up controls on bacterial activity in estuarine sediments. The models will consider both biotic and abiotic processes, spatial heterogeneity, population dynamics, nutrient and organic substrate mass transfer, and molecular dynamic simulations. Complexity will be built up from simple systems to more complex systems as indicated by coupling model predictions and experimental results. The interdisciplinary nature of this project and research team draws on the expertise encompassing ecology, engineering, environmental geochemistry and microbiology. The work will ultimately provide a unifying framework for understanding microbial degradation processes. Funding from NSF.

00-Ex1 Model Development and Chemical Characterization of Bioavailable Nitrogen Loading to Coastal Ecosystems (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ and Monica Mazurek, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ)

The overall goal of the proposed research is to provide new tools for environmental managers to more accurately assess the consequences of various development and nutrient management scenarios on coastal eutrophication. Specific objectives of this project are to: 1) develop a model to predict bioavailable N inputs to estuaries that accounts for bioavailable dissolved organic-N (DON) and inorganic-N inputs as a function of land use, 2) apply the model to a number of estuarine watersheds in New Jersey and throughout the east coast of the US, 3) further develop new analytical methodologies for chemically characterizing DON in natural and pollutant sources, and 4) apply those analytical methods to begin to characterize the bioavailable and refractory components of the DON from the non-point and point sources. Funding by NJ Sea Grant.

99-Ex1 Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight III, IV (Michael DeLuca, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)

Research efforts continued to address the factors governing the apparent decline in bluefish abundance along the Atlantic coast. Four projects received continuation funding and one new project received support. These were: "Modeling Bluefish Fluctuations: Interactions among Bluefish, Striped Bass, and Forage Fish," Anne Richards, National Marine Fisheries Service; "Comparison of Habitat Use by Juvenile Bluefish between Chesapeake Bay Sub-estuaries and Maryland's Coastal Bays," David Secor and Ed Houde, Chesapeake Biological Lab, U. Maryland; "Habitat Use by Young-of-the-Year Bluefish: Are Ocean Beaches Important?," Ken Able and Philip Rowe, Institute of Marine and Coastal Sciences, Rutgers University; "Recruitment of Spring and Summer-Spawned Bluefish: Genetic Structure, Cohort Identification, and Relative Contribution to the Adult Stock," David Conover, Marine Sciences Research Center, SUNY-Stony Brook; and "Impact of prey abundance and size-structure on growth of spring- and summer-spawned juvenile bluefish in the Hudson River estuary: an individual-based modeling approach," Francis Juanes, U. Massachusetts-Amherst.

EXTRAMURAL PROJECTS BEING COMPLETED in 2002

01-Ex1 Recreational Fisheries and National Standard 8 (Kevin St. Martin, Department of Geography- Rutgers University, New Brunswick, NJ)

National Standard 8 of the Magnuson-Stevens Fishery Management Act is one of several new federal level standards that must be considered by regional fisheries management councils when producing or adjusting Fisheries Management Plans (FMP's). This initiative introduced 'communities' into the federal regimen of fisheries management as objects/units for data collection, social/economic impact analysis and regulatory impact considerations. The Northeast with its large and growing recreational fisheries sector is well suited as a test case for this study. NMFS survey data, on-site interviews and GIS for spatial analysis will be used to develop a

social science protocol/methodology for establishing the economic an social significance of recreational fishing to communities. The protocol will incorporate methods for assessing the economic and social impacts of regulations (e.g. FMP's) on fishing communities. Such a protocol should reflect and contribute to current statutory definitions of fishing communities as well as provide guidance to the Northeast region.

01-Ex2 Fishing Communities of the Mid-Atlantic (Bonnie McCay, Department of Human Ecology- Rutgers University, New Brunswick, NJ)
We propose the creation of social, cultural and economic profiles for the fishing communities of the Mid-Atlantic region of the United States. The goal is to provide information that can be used to assess the impacts of changes in the regulatory environment on fisheries and fishing communities. The project builds on previous work by McCay and Cieri, profiling the fishing ports of the Mid-Atlantic state, and on recently completed work by Madeleine Hall-Arber and others which develops more detailed information for New England states, on the major fishing communities. The work will help the state and federal agencies and fishery management councils develop and implement appropriate fishery management plans and to meet legal requirements for fishery impact and social impact analyses including NEPA, RIR, Small Business Administration and National Standards of the Magnuson-Stevens Fishery Conservation and Management Act.

99-Ex2 Bottom Habitat Classification and Mapping of the New York Bight (Richard G. Lathrop, Ecology, Evolution and Natural Resources - Rutgers University, New Brunswick, NJ)
The fishery resources of coastal marine habitats are among the most diverse and economically valuable along the East Coast. The diversity, quality, and extent of coastal marine habitats are important determinants of distribution, abundance and diversity of fishery resources. This project will develop and test strategies for remotely mapping the benthic habitats of commercial fish species and investigate the influence of sea floor geology and sea floor disturbance on the distribution, abundance and diversity of fishery resources. Recent high resolution geologic mapping of the sea floor of the New York Bight region provides a new, detailed regional framework for defining sea floor habitats.

CMER-SPONSORED PRESENTATIONS (1993-2002):

Able, K. and R. Rowe. 1999. Essential Fish Habitat for Bluefish (*Pomatomus saltatrix*): Comparison of the Role of Ocean Beaches and Estuarine Habitats. IMCS/NMFS Bluefish Project Symposium, Mystic, CT, November. (CMER Project #97-Ex1)

Barbeau, S., R.C. Chambers, D. Witting, and K.W. Able. 1998. Effect of Relative Body Size and Temperature-Dependent Growth of Juvenile Summer Flounder on the Window of Vulnerability to Predation by Sevenspine Bay Shrimp. Flatfish Biology Conference, Mystic, CT. Paper. (CMER Project #97-04)

Barbeau, S., R.C. Chambers, D. Witting, and K.W. Able. 1999. Size-Specific Predation on Juvenile Summer Flounder, *Paralichthys dentatus*, and the Duration of the Window of

Vulnerability. American Fisheries Society - Larval Fish Conference, Beaufort, NC. Paper. (CMER Project #97-04)

Barbeau, S., R.C. Chambers, D. Witting, and K.W. Able. 1999. Effect of Size-Dependent Predation and Temperature-Dependent Growth on Juvenile Summer Flounder Vulnerability to Benthic Invertebrate Predation. CMER Symposium, Falmouth MA. Paper. (CMER Project #97-04)

Bell, J.L. 1995. Molecular Approaches to Larval Bivalve Identification. 1995 Benthic Ecology Meeting, New Brunswick, NJ. Poster. (CMER Project #93-05)

Bell, J.L. 1995. Probe Development for Identification of Larval Bivalves. Molecular Approaches to Marine Ecology and Evolution, Keystone Symposium, Santa Fe, NM (organized by H.R. Lasker, M.A. Coffroth and E. Bermingham). Poster. (CMER Project #93-05)

Bell, J.L. 1996. Identification of Larvae of the Surfclam, *Spisula solidissima* From Plankton Samples. Sixth Science Symposium of the Northeast Fisheries Science Center, National Marine Fisheries Service, NOAA, Falmouth, MA. (CMER Project #93-05)

Bell, J.L. 1996. Species-Specific Identification of Larval Bivalves Using an 18S rRNA Probe and RFLP Analysis. Ocean Sciences Meeting, AGU/ASLO, San Diego, CA. (CMER Project #93-05)

Bevilacqua, R.A. 1998. Animal-Sediment Relationships in a Mid-Atlantic Estuarine System and Spatial Patterns of Benthic Community Structure in the Navesink River, New Jersey. (CMER Project #98-05)

Bosley, K.L. and S.C. Wainright. 1997. Turnover Rate of Nitrogen and Carbon in Juvenile Winter Flounder, *Pleuronectes americanus*, as Determined by Stable Isotope Ratios. 14th International Conference of the Estuarine Research Federation, Providence, RI. (CMER Project #96-05)

Bosley, K.L., D.A. Witting, R.C. Chambers, and S.C. Wainright. 1998. Ontogenetic Diet Shifts of Larval and Juvenile Flatfish: Estimating Turnover Rates with Stable-Isotope Ratios. NOAA/NMFS Flatfish Biology Conference, Mystic, CT. (CMER Project #96-05)

Bosley, K.L, D.A. Witting, R.C. Chambers, and S.C. Wainright. 1999. Ontogenetic Diet Shifts of Larval and Juvenile Fish: Estimating Turnover Rates with Stable Isotopes. 23rd Larval Fish Conference, Beaufort, NC. (CMER Project #96-05)

Chant, R.J., M.C. Curran, K.W. Able, S.M. Glenn. 1996. Circulation in Little Egg Harbor and Its Role in Larval Winter Flounder Distributions: Preliminary Results. The Barnegat Bay Ecosystem Workshop. November 14, Toms River, NJ. (CMER Project #96-08)

Chant, R.J. 1997. Circulation Patterns in the Barnegat Bay/Little Egg Harbor/Great Bay Estuarine System. Institute of Marine and Coastal Sciences weekly seminar series, June 9. (CMER Project #96-08)

Chant, R.J. 1997. Low Frequency Circulation in a Multiple Inlet/Bay System. The Gordon Conference, June 8-12, Colby-Sayer College. (CMER Project #96-08)

Chant, R. J. 1998. Particle Trapping in a Stratified Flood Dominated Estuary. Woods Hole Oceanographic Institution, August. (CMER Project #97-03)

Chant, R.J. 1998. Particle Trapping in a Stratified Flood Dominated Estuary. National Marine Fishery Service, Sandy Hook, NJ, September. (CMER Project #97-03)

Chant, R.J. and A. Stoner. 1998. Particle Trapping in a Stratified Flood Dominated Estuary. Mid-Atlantic Bight Physical Oceanography and Meteorological meeting (MABPOM), St. Michaels, MD, October. (CMER Project #97-03)

Chant, R.J. 1998. Particle Trapping in a Stratified Flood Dominated Estuary. IMCS, Rutgers University, New Brunswick, NJ, December. (CMER Project #97-03)

Chant, R.J. 1999. Low Frequency Circulation in a Multiple Inlet/Bay System. Estuarine Research Foundation meeting, September 25-30, New Orleans. (CMER Project #97-03)

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and Specific Studies on the Soft-Shell Clam, (*Mya arenaria*). DIOXIN '95 Edmonton, Canada. (CMER Project #93-08)

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Ma, H. and J.P. Grassle. 2001. Surfclam Larval Distribution and Settlement on the New Jersey Continental Shelf. Estuarine Research Federation 2001: An Estuarine Odyssey, St. Pete Beach, FL. (CMER Project #99-05)

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McCay, B.J.. 2001. Fishing Communities. Social Science Workshop: Social & Economic Impacts of Input Controls, Social Science Advisory Committee, New England Fishery Management Council, Gloucester, MA, 5/23/2001. (CMER Project #01-EX2)

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Sherrell, R.M. 1997. Trace Metal Dynamics Off Southern New Jersey: Seasonal Variations and Evidence of Pollutant, Input. Department of Environmental Sciences, Rutgers University, New Brunswick, NJ, November 7. (CMER Project #95-05)

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Stoner, A.W. 1998. A Multidisciplinary Approach to Fishery Biology. South Florida Water Management Districut, West Palm Beach, FL, May. (CMER Project #99-06)

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Weissberger, E.J. 1998. Effects of Timing and Magnitude of Settlement on Recruitment of Surfclams: Insights from a Model. Benthic Ecology Meeting, March 12-15, Melbourne, FL. (CMER Project #93-05)

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Zhang, H.-Z., W. Zeng, and T.-C. Lee. 2000. Simultaneous Determination of Moisture, Protein and Fat in Fish Meal Using Near-Infrared Spectroscopy. J. of Food Sci. and Tech. Res. 6(1): 19-23.

CMER-SPONSORED THESES & DISSERTATIONS (1993-2002):

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Brandt, S. 2001. Coase and The Clams: Constructing Markets for Property Rights in Fisheries. Ph.D. Dissertation, Department of Agricultural and Resource Economics, University of California, Berkeley.

Chen, C.M. 1994. Evaluation of 2,3,7,8-TCDD, 1,2,3,7,8-TCDD and 2,3,7,8-TCDF in Japanese Medaka (*Oryzias latipes*) Using Toxicity and Enzyme Induction as Endpoints. Toxicology, Ph.D. Dissertation. (CMER Project #93-08)

Chintala, M. 1997. Population Biology of Surfclams, *Spisula solidissima*, in Inshore New Jersey Waters: Factors Affecting Recruitment Success. Ecology and Evolution, M.S. Thesis. (CMER Project #93-05)

Gregg, C.S. 2002. Effects of Biological and Physical Processes on the Vertical Distribution and Horizontal Transport of Bivalve Larvae in an Estuarine Inlet. Ph.D. Dissertation. (CMER Project #97-07)

Liu, H. 1995. DNA Adduct Formation of 7, 12-Dimethylbenz (a) Anthracene in the Embryo of the Japanese Medaka (*Oryzias latipes*). Environmental Science, M.S Thesis. (CMER Project #93-08)

Longo, S. 1995. Effects of Methyl tert-butyl Ether and Naphthalene on the Embryo of the Japanese Medaka (*Oryzias Latipes*). Toxicology, M.S. Thesis. (CMER Project #93-08)

Ma, H. 1997. Time Series Analyses of Meroplankton in Moored Pump Samples at LEO-15: The Relationship Between the Abundance of Surfclam Larvae and Nearshore Upwelling Events. Oceanography, M.S. Thesis. (CMER Project #93-05)

Ma, H. 2001. Physical Mechanisms and Temporal and Spatial Patchiness in Bivalve Larval Supply and Settlement on the Inner Shelf of the Mid-Atlantic Bight. Ph.D. Dissertation. (CMER Project #99-05)

Metzger, K.T. 1998. Trace-Metal-Phytoplankton Interactions on the New Jersey Inner Shelf. George H. Cook Honors thesis (undergraduate) (CMER Project #95-05).

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Olivieri, C. 1996. Toxicity of 2-3-7-8 TCDD in Embryos and Larvae of the Fathead Minnow (*Pimephales promelas, rafinesque*). Environmental Sciences, Ph.D. Dissertation. (CMER Project #93-08)

Price, M.K. 1998. Sustaining the Atlantic Sea Scallop Fishery: Viability in a Restricted Industry. Master's Thesis. (CMER Project #97-06)

Probasco, P.G. 2000. Dissolved Nitrogen Gas, Ammonium and Nitrate Levels in Groundwater along the Millstone River. George H. Cook Honors Thesis. (CMER Project #96-Ex1)

Schnitz, A. 1997. Transfer of Benzo(a)pyrene from Two Invertebrate Prey Species to the Winter Flounder, *Pleuronectes americanus*. Environmental Sciences, Ph.D. Dissertation. (CMER Project #94-03)

Senyk, N. 2000. Mapping Bottom Type as Part of the New York Bight Apex Sea Floor Mapping Project. Cook College, Undergraduate Thesis, May 2001. (CMER Project #99-Ex2)

Watts, S.I. 1997. Denitrification, Organic Matter Decomposition, and N Mineralization in Organic and Mineral Soils of Two Riparian Ecosystems. Ph.D. Dissertation. (CMER Project #94-Ex3)

ADDITIONAL COOPERATIVE PARTICIPATION OF NOAA OR RUTGERS SCIENTISTS IN SEMINARS, WORKSHOPS AND MEETINGS, AND JOINT USE OF NOAA OR RUTGERS FACILITIES:

Dr. J.P. Grassle (Institute of Marine and Coastal Sciences) participated in the 19th Northeast Regional Stock Assessment Review Committee (SARC), held at the NEFSC in Woods Hole in September 1994.

Dr. T.-C. Lee (Department of Food Science) participated in the NOAA sponsored workshop on Future Emphasis for Research on Atlantic Mackerel held in December 1994.

Dr. L. Kerkhof (Institute of Marine and Coastal Sciences) presented a seminar entitled Developing a specific growth rate assay for a marine bacterium at the James J. Howard Laboratory in November 1994.

Dr. C. Curran (Institute of Marine and Coastal Sciences) presented a seminar entitled Daily Rhythms, Hibernation and Starvation in the Cunner, *Tautogolabrus adspersus*, at the James J. Howard Laboratory1995.

Dr. K. Keating (Cook College) presented a seminar entitled Natural Products of Phytoplankton: Allelochemicals, Antibiotics (Biotoxins), Probiotics, at the James J. Howard Laboratory, 1995.

Mr. Kim (Environmental Science) spent 4 months during 1995 working with NOAA researchers at the James J. Howard Laboratory learning extraction techniques for lobster tissues.

Dr. C. Reimers (Institute of Marine and Coastal Sciences) used Howard Laboratory facilities to process samples during and after NOAA/NURP funded cruises in the New York Bight apex during the summer of 1995. Howard Laboratory scientists, Andrew Draxler and co-workers, participated in those cruises and made their laboratory space available for sample processing.

Dr. P. Rona (Institute of Marine and Coastal Sciences) presented a seminar entitled Drilling of a Sea Floor Hydrothermal Field, at the James J. Howard Laboratory, 1995.

Dr. K. Smith (Institute of Marine and Coastal Sciences) presented a seminar entitled Processes Regulating Habitat Use by Salt Marsh Nekton in a Southern New Jersey Estuary, at the James J. Howard Laboratory, 1995.

Dr. C. Chambers (NEFSC, James J. Howard Marine Sciences Laboratory, Highlands, NJ) presented a seminar entitled Early life history variation and recruitment processes in marine fishes, at the Institute of Marine and Coastal Sciences, Rutgers University, 1996.

Dr. J.T. Duffy (Rutgers University Marine Field Station) presented a seminar entitled Factors affecting the vital rates of the two sciaenids, the weakfish and the red drum: experiments in field enclosures, at the James J. Howard Laboratory, 1996.

Dr. S. Glenn (Institute of Marine and Coastal Sciences) presented a seminar entitled Observations and models of coastal upwelling off New Jersey, at the James J. Howard Laboratory, 1996.

Dr. R. Tucker (Ecopolicy Center, Rutgers University) presented a seminar entitled Policy Issues Related to Dioxin, at the James J. Howard Laboratory, 1996.

Mr. D. Witting (Institute of Marine and Coastal Sciences) presented a seminar entitled Ichthyoplankton community stability: Analysis of a 6-year data set from southern New Jersey, at the James J. Howard Laboratory, 1996.

Dr. Anthony Paulson (James J. Howard Marine Science Laboratory, Northeast Fisheries Science Center) presented a seminar entitled Distributions and modeling of trace metals in Puget Sound, at the Institute of Marine and Coastal Sciences, Rutgers University, 1997.

Dr. C. Reimers (Institute of Marine and Coastal Sciences) used Howard Laboratory facilities to process samples during and after NOAA/NURP funded cruises in the New York Bight apex during the summer of 1997.

Dr. Al Stoner (James J. Howard Marine Science Laboratory, Northeast Fisheries Science Center) presented a seminar entitled: The need for multidisiplinary approach to fisheries biology: An example from Bahamian seagrass meadow, at the Institute of Marine and Coastal Sciences, 1997.

Dr. Sam C. Wainright (Institute of Marine and Coastal Sciences) used the R/V Gloria Michelle for a field trip for the Biological Oceanography class (Spring 1996 and Spring 1997).

Dr. Jennifer Francis and Dr. Yuan Gao (Institute of Marine and Coastal Sciences) used Howard Laboratory office space for their research programs (1998-2000).

The Rutgers/NOAA CMER van was used by a number of Rutgers students and faculty for CMER-related projects (1994-2000).

Dr. Judith P. Grassle (Institute of Marine and Coastal Sciences) participated in the SAW-27/SARC held at the NEFSC in Woods Hole in June, 1998.

E.J. Weissberger and J.P. Grassle provided reports on Essential Fish Habitat for three bivalve species: *Arctica islandica, Placopecten magellanicus,* and *Spisula solidissima*. These reports were incorporated into the EHF reports developed by the NMFS/NEFC/James J. Howard Laboratory EHF reports, 1998.

Eric Simms (Institute of Marine and Coastal Sciences) organized the Bluefish Symposium at the Atlantic States Marine Fisheries Commission annual meeting in Mystic, CT, November 3, 1999.

Drs. Hilairy Hartnett and Robert Chant from Rutgers and Drs. Fabrizio, Despande, Noji and Meise from the J.J. Howard Laboratory submitted a five-year proposal to investigate Multiple Stressors in the Navesink River/Sandy Hook Estuary system.

Drs. T.Noji, S.Seitzinger, J. Grassle and H.Hartnett worked to develop a new course entitled "Marine Ecosystems Research and Fisheries Management" to be offered at Rutgers University, through the Department of Oceanography and the Institute of Marine and Coastal Sciences, in the Spring of 2002. The course will provide opportunities for students with interests in fish, shellfish and fisheries management and policy to interact with experts from the NEFSC and the NMFS. Course given again in 2003.

Drs. Robert J. Chant and Fred Scharf presented Seasonal Patterns of Movement and Feeding By Bluefish in Relation to Prey Distributions and Estuarine Turbidity Fields at the 2002 American Fishery Society annual meeting.

McCay, B.J. 2002. NOAA sponsored Workshop on Social and economic measures of fishing community participation in fisheries. April. Silver Spring, MD. (CMER Project #01-EX2)

COMPLETED PROJECTS FUNDED THROUGH THE RUTGERS/NOAA CMER PROGRAM (Base Funding 1993-2002)

Requests for reprints or information should be directed to the principal investigators.

99-08 Ontogenetic Diet Shifts of Larval and Juvenile Flatfish: Validating the Use of Stable-Isotope Ratios to Track Changes in Feeding Behavior (Sam C. Wainright, Institute of Marine and Coastal Sciences, Rutgers University and Christopher Chambers, The James J. Howard Laboratory, NMFS)

This one year study will examine two critical periods in fish early life history: the transition from dependence on a maternal source of nutrition to exogenous sources of nutrition, and the transition from zooplanktivory to piscivory. Laboratory studies will be conducted at the Howard Lab. In the first set of studies, the isotopic signature (N and C) of winter flounder eggs will be determined, as will the isotopic signature of exogenous prey (rotifers). These will be followed throughout the winter flounder yolk-sac stage and through metamorphosis and settlement. Summer flounder studies will be used to examine the dietary transition that occurs later in the early-life history of fish, namely the shift from zooplanktivory to piscivory, again using isotopically distinct prey (zooplankton). The effect of temperature on the time transitions in both of these life-history stages will be examined.

98-03 Selective Feeding in Post-Larval Winter Flounder (Oscar Schofield and Pat Shaheen, Institute of Marine and Coastal Sciences - Rutgers Univ. and Alan Stoner, NOAA/NMFS, J.J. Howard Lab)

This one-year project addresses the pelagic food resources of post-larval winter flounder. Recent studies have indicated that the relative composition of prey species in the guts of recently settled winter flounder differ from the relative abundance of the prey species (copepods) in the environment, indicating selective feeding. The proposed study had two major components: 1) a spring field study in which the copepod community and post-larval winter flounder gut contents were concurrently characterized and 2) a laboratory feeding study in which the relative abundance of *Acartia* and *Eurytemora* were experimentally manipulated.

98-04 Sustaining the Atlantic Sea Scallop Fishery: Simulating Policy and Management Options (Peter J. Parks/Michael K. Price, Department of Agricultural Economics and Marketing, Rutgers University)

This is for the second year of funding to expand CMER project 97-06 initiated last year. The overall objective of the first year was to develop an analytical framework to help quantify the necessary economic conditions for a sustainable Northeastern sea scallop fishery. The research proposed in the renewal proposal will use this framework to simulate changes in economic, biological or policy conditions, and expand the scope to potentially include the Northeastern scallop fishery.

97-03 Linkages Between Circulation and Distribution of Marine Organisms in a Shallow Well Mixed Estuary: An Observational Approach (Scott Glenn and Robert J. Chant, Institute of Marine and Coastal Sciences - Rutgers Univ.; Alan Stoner, NOAA/NMFS - Howard Lab)

Recent observations in the Navesink/Sandy Hook estuary indicate that the distribution of winter flounder and blue crabs appear to be associated with specific locations within the tidal flow field. Enhanced abundance of these species are found across a broad region of the estuary where several different habitat types occur. Preliminary observations indicate that these areas are regions of particulate organic material accumulation. This project investigated the physical properties (Glenn, Chant) influencing the distribution of fishery resource species (Stoner) in the Navesink by combining a description of the hydrodynamic properties of suspended particles within the estuary, the behavior of the organisms, and a detailed understanding of circulation.

97-04 Environmental Influences on Metamorphosis in Summer Flounder (*Paralichthys dentatus*) (Kenneth W. Able, Institute of Marine and Coastal Sciences - Rutgers Univ.; Chris Chambers, NOAA/NMFS - Howard Lab)

This project addresses the effect of the physiological and ecological challenges imposed during flatfish metamorphosis on recruitment success in summer flounder populations in the northern Middle Atlantic Bight. The hypothesis being tested is that stage duration, which is influenced by temperature, influences the rate of mortality through prolonged exposure to predators during metamorphosis and settlement of summer flounder. Laboratory experiments will manipulate stage duration by controlling temperature, and the resultant effects on survival during late larvae and metamorph stages will be determined, in the presence and absence of predation. The information from this project will clarify the role of winter temperatures on survival and subsequent recruitment of summer flounder to estuaries, which are in the northern part of their range in the Mid-Atlantic Bight.

97-06 Sustaining the Northeastern Sea Scallop Fishery: An Economic Analysis of Consolidating Days-At-Sea (Peter J. Parks and Michael K. Price, Agri. Econ. & Mktg. - Rutgers Univ.; Steve Edwards, NOAA/NMFS - Woods Hole Lab)

An analytical framework was developed to help quantify the necessary economic conditions for a sustainable Northeastern sea scallop fishery. The model can be used to: determine the relationship between days-at-sea (DAS) and average catch size; measure the sensitivity of operational costs to vessel size and capital equipment size; and provide quantitative recommendations for fishermen and regulators that may help sustain the fishery.

97-07 Physical Transport of Bivalve Larvae through a Tidal Inlet: Molecular Probe Applications (Judith P. Grassle, Institute of Marine and Coastal Sciences - Rutgers Univ.)

The flux of commercially important bivalve larvae (*Mercenaria* or *Mya*) through the tidal inlet of the mouth of Great Bay was studied using species-specific molecular probes that allow species level identification of transported larvae. This project was conducted in collaboration with an ongoing CMER project (Haidvogel and Chant, #96-08) in which water exchange between Great Bay/Little Egg Harbor and the coastal ocean is being investigated. Molecular probe techniques developed in this study could be applied to a range of habitats and to other commercially important bivalves.

96-05 Isotopic Turnover Rate and Marginal Growth Increment Validation for Young-of-the-Year Winter Flounder (Sam Wainright, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ; Beth Phelan, NOAA/NMFS, Northeast Fisheries Science Center - James J. Howard Laboratory, Highlands, NJ)
A concurrent NOAA/Coastal Ocean Program project examined habitat utilization and trophic linkages between juvenile fish and estuarine habitats in three Northeastern estuaries. A significant component of the study involved confining juvenile winter flounder in cages within different estuarine habitats, yielding habitat-specific growth rates. To establish trophic linkages, stable isotope ratios of tissue samples of the caged fish were measured and compared with stable isotope ratios of prey and vegetation. However, interpretation of the isotopic data requires knowledge of the time required for a fish to acquire the isotopic "label" of its habitat, i.e., turnover time. This study examined the isotopic turnover time for winter flounder.

96-08 Development of a Hydrodynamic/Fishery Recruitment Model of Great Bay-Little Egg Harbor Estuarine System (Dale Haidvogel and Robert Chant, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)
A three-dimensional numerical model with the immediate objective of assessing linkages between hydrodynamics and an identified settlement habit of winter flounder *Pseudopleuronectes americanus* in the Great Bay-Little Egg Harbor estuarine system was developed. Efforts focus on the interaction between larval behavior, secondary flows and dispersion in the vicinity of the settlement habitat. The work complemented an ongoing multi-year study of *P. Americanus* that involved scientists at both Rutgers (Ken Able, Sam Wainright) and the National Marine Fisheries (Ann Studholme, Anthony Calabrese) which was funded by NOAA/COP. Results from this work will aid in both the interpretation of sparse biological measurements and in the design of future field campaigns in the Great Bay-Little Egg Harbor Estuarine system. Furthermore, this work is the first step in developing a comprehensive model of fish recruitment processes in shallow estuarine systems.

96-11, 97-08, 98-05, and 99-10, 01-04 CMER Research Experiences for Undergraduates (Michael De Luca, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)
Funding for these projects supported two summer undergraduate interns each year. The interns were involved in research projects at the James J. Howard Laboratory. Each student undertook a research project, the results of which were presented in a written report and in an oral presentation at both the NEFSC Lab and at Rutgers.

95-05 Assimilation of Metals by Phytoplankton in the Mid-Atlantic Bight: Controls on Introduction to the Coastal Marine Food Web (Robert Sherrell, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; Vincent Zdanowicz, NEFSC - James J. Howard Laboratory, Highlands, NJ)
Uptake of metals by phytoplankton is an important pathway for the introduction of potentially toxic elements into the marine food web. Environmental and physiological controls on the assimilation of dissolved metals, both nutrient and nonessential, have only recently begun to be understood in culture studies. This project combined remote sensing-targeted sampling, *in situ* size-fractionating filtration methods, and state-of-the-art ultra-trace analyses using recent developments of Inductively Coupled Plasma Mass Spectrometry (ICPMS) to examine

assimilation of metals by phytoplankton in the Mid-Atlantic Bight. This project used facilities and analytical equipment at the Howard Laboratory, and was integrated with a UMASS CMER funded project.

94-03 Transfer of Xenobiotic Contaminants from Prey to Predator (Gary Taghon, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ)
The potential transfer of oil and oil components (e.g., polycyclic aromatic hydrocarbons - PAHs) through trophic levels and the effect this may have on the structure of the ecosystem were investigated. Experiments were conducted of *in vivo* metabolism and the biological fate and bio-transfer of a carcinogenic PAH in organisms inhabiting marine sediments (softshell clam, *Mya arenaria* and the sand worm, *Neanthes virens*) and in a predator (winter flounder, *Pleuronectes americanus*) on those organisms.

93-01 Life History and Ecology of the Windowpane Flounder (*Scophthalmus aquosus*) in the Mid-Atlantic Bight (Kenneth Able, Marine Field Station, Institute of Marine and Coastal Sciences, Rutgers University, Tuckerton, NJ; Wallace Morse, NEFSC, Howard Laboratory, Highlands, NJ)
The aim of this project was to better understand the life history and ecology of windowpane flounder in order to better manage this resource and contribute to our understanding of flatfishes in the northeastern U.S. The specific objectives of the project were to: 1) determine the patterns of metamorphosis and settlement during the first year of life in the Great Bay/Little Egg Harbor estuarine system; 2) identify the nursery habitats and patterns of distribution through space and time; and 3) compare life history characteristics in Mid-Atlantic Bight populations with those on Georges Bank.

93-05 Studies on Surf Clam (*Spisula solidissima*) Recruitment (Judith Grassle, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ)
This research effort focused on the causes of year-to-year variation in settlement and recruitment success in the surf clam. The temporal and spatial settlement patterns, size distributions, and growth rates of surfclams and their predators were investigated. The death assemblage was used to examine size-preference in predators. The relationship between surfclams and two of their major predators: the moon snail *Euspira heros* and the starfish *Asterias forbesi*, were examined with laboratory experiments. Predation rates, size selectivity, interactions between the two predators, and the possible role of dead surfclam valves as a refuge from predation were examined.

93-06 Identification of Major Chemical Compounds Relating to Quality Determination of Mackerel and Other Fatty Fish by a GC/MS Method; Development of a Novel Rapid and Nondestructive NIR Method to Determine these Compounds and Their Application to Fish Quality Assessment and Processing Improvement (Tung-Ching Lee, Department of Food Science, the Fisheries and Aquaculture TEX Center and the Center for Advanced Food Technology, Rutgers University, New Brunswick, NJ; Judith Krzynowek, NMFS, Gloucester Laboratory, MA)
Gas chromatography/mass spectrometry (GC/MS) and near infrared (NIR) technology, and sensory panel evaluation were used to identify major chemical compounds relating to quality

deterioration of mackerel and other fatty fish. Novel rapid and nondestructive methods based on NIR technology were developed to determine these compounds as indicators of quality.

93-08 Evaluation of Toxicity of Dioxins, Furans, and PCBs on Commercially Important Species Inhabiting and Migrating Through the Newark Bay Systems (Keith Cooper, Claudia Olivieri, and Sharon Longo, Department of Biochemistry and Microbiology and Joint Program in Toxicology, Environmental Occupational Health Sciences Center, Rutgers University, New Brunswick, NJ; Sharon McLean, NMFS, Narragansett Laboratory, RI; Anne Studholme NEFSC, Howard Laboratory, NJ)
This effort addressed the hypothesis that the chlorinated pollutants specifically dioxins, furans, PCBs and PAHs present in the Newark/Raritan Bay Estuary are of sufficient levels to impact the fisheries of these areas. This research combined both field and laboratory studies to examine causal relationships between body burdens of these compounds and the impact on the fishery. Histological lesions, selected biomarkers and reproductive success were evaluated in relation to contaminant levels in important fish species.

COMPLETED PROJECTS FUNDED THROUGH THE RUTGERS/NOAA CMER PROGRAM (External Funding 1993-2002)

98-Ex1 Costs of Surf Clamming and Ocean Quohogging (Bonnie McCay, - Department of Human Ecology - Rutgers University, New Brunswick, NJ)
This project is an extension of 96-Ex2 on the costs and earning of the "for hire" charter and party boat fisheries of Maine, New Jersey, and New York. The current project moves from the charter and party boats to the boats engaged in catching surfclams and ocean quahogs (SCOQ), most of which come primarily from Mid-Atlantic ports. The economic analyses of this project will contribute to assessing the extent to which the SCOQ ITQ fishery management regime addresses National Standards 4 (no discrimination between residents of different States) and 8 (importance of fishery resources to fishing communities) of the Magnuson-Stevens Fishery Management and Conservation Act. Funding from NMFS NEFSC.

98-Ex3 Sensors for Direct Observation for use in Stock Assessment (W. Wakefield, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ; W. Overholtz and W. Gabriel, NOAA/NMFS, Woods Hole, MA)
This project will initiate development and application of sensors and capabilities of direct observation (e.g., video imaging systems) for use in conjunction with various gears used in stock assessment (acoustics, trawls, and dredges). Specifically it will include a preliminary effort for a self-contained, high-resolution time-lapse video camera system.
This system does not require armored conducting wire, is rather simple and flexible and can be used in a variety of applications to evaluate gear and record direct observations of fish behavior and fish habitat. Many of the main components (e.g., video cameras and lights) may also be used as elements in other future video systems. Funding from NEFSC.

98-Ex4 Chemical Composition and Bioavailability of Dissolved Organic Nitrogen in Atmospheric Deposition (S. Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ and Monica Mazurek, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)

Humans have dramatically altered the Earth's nitrogen (N) cycle by doubling the natural rate of N-fixation and causing atmospheric N deposition rates to increase by three to more than ten fold compared to pre-industrial times. Atmospheric deposition is a major source of nitrogen to many ecosystems: up to 70% of the N inputs to estuarine and coastal marine systems are attributed to atmospheric sources. Marked changes in both terrestrial and aquatic ecosystems are occurring as a result of increased nitrogen (N) deposition from anthropogenic sources. Currently, approximately 80% of the atmospherically deposited N is anthropogenic. To date, most studies of the magnitude, sources and effects of atmospherically deposited N have only considered inorganic N. However, a considerable portion (20 to 85%) of N in rainwater is in the form of organic-N, and almost nothing is known of the chemical composition, sources or ecosystem effects of the bulk of that organic-N. The objectives of this three-year study are to: 1) characterize the chemical composition of dissolved organic nitrogen (DON) in atmospheric deposition in a relatively perturbed site in the Northeastern U.S.; 2) determine how much of the total DON in rainwater is biologically available to coastal plankton communities; and 3) characterize the chemical composition of the DON compound classes that are bio-available and thus contributing to ecological changes in receiving ecosystems. Funding from NSF.

98-Ex5 An Initiative to Gain a Regional Perspective on Coastal Eutrophication (Sybil P. Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ and Tracy N. Wiegner, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)

The primary objective of this 1 year development project is to strengthen the relationship among Sea Grant funded research teams from New York to Georgia working on issues surrounding coastal eutrophication. The project brought together Sea Grant funded researchers from New Jersey (Dr. Sybil Seitzinger), Maryland (Dr. Patricia Glibert), Georgia (Dr. Deborah Bronk), and New York (Dr. Julie LaRoche) to begin addressing the contribution of organic nitrogen to coastal eutrophication on a regional scale. Specifically, the team will begin collecting information on the quantity and biological availability of the organic molecules from a variety of rivers throughout the east coast of the United States. Funding from NJ Sea Grant Development Fund.

98-Ex6 Barnegat Bay National Estuary Program Data Synthesis (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ; R. Lathrop, Ecology, Evolution & Natural Resources - Rutgers University, New Brunswick, NJ; K.Hunchak-Kariouk, R. Nicholson, and R.E. Hickman, USGS, Water Resources Division, Trenton, NJ)

As part of the Barnegat Bay National Estuary Program, a synthesis of existing information on pollution inputs, land and bay use changes and human activities in the Barnegat Bay watershed region was conducted. This is a joint effort between Rutgers University and the USGS. Funding from the Barnegat Bay NEP.

97-Ex1, 98-Ex2 Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight I, II (Michael DeLuca, Frederick Grassle and Kenneth Able, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ

Recently, Congress expressed concern with the decline in abundance of bluefish stocks along the Atlantic coast. This decline has been attributed to a variety of factors ranging from competition with other species to dwindling forage species and unusual migratory pathways. Rutgers University is administering a collaborative effort with NMFS scientists to address concerns with the status of bluefish stocks. A workshop was held to prioritize research areas, a call for proposals was issued, and four research projects were funded that address the decline of Atlantic bluefish stocks, including: "Empirical Modeling of Bluefish Population Fluctuations: Interactions among Bluefish, Striped Bass and Forage Species," Anne Richards, University of Maryland; "System Recruitment of Young-of-the Year Bluefish: Patterns, Pulses and Processes in the Chesapeake Bay Estuarine System," Ed Houde, University of Maryland Center for Environmental Science; "Influence of Coastal Oceanography on Habitat Use and Recruitment Success of Bluefish (*Pomatomus saltrix*) in New Jersey," Ken Able, Rutgers University Marine Field Station; "Recruitment of Spring- and Summer-Spawned Bluefish: Genetic Structure, Cohort Identification, and Relative Contribution to the Adult Stock," David Conover, Florida State University.

97-Ex2 Essential Fish Habitat (Judith P. Grassle and Waldo W. Wakefield, Institute of Marine and Coastal Sciences; Richard G. Lathrop, Ecology, Evolution and Natural Resources - Rutgers University, New Brunswick, NJ; Jeffrey Cross and Anne Studholme, NOAA/NMFS - Howard Lab)

The recent reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (also known as the Sustainable Fisheries Act (SFA)) requires that essential fish habitat (EFH) be identified and described for each species or species assemblage covered by a Fisheries Management Plan (FMP). All Fishery Management Councils are required to submit FMP amendments to implement EFH by October 1998. Responsibility for supporting the New England Fishery Management Council (NEFMC) and Mid Atlantic Fishery Management Council (MAFMC) rests with the Northeast Regional Office and Northeast Fisheries Science Center. The Howard Laboratory at Sandy Hook prepared information on the life history and habitat requirements for species managed by the NEFMC and the MAFMC; the information will be used by the Council/NMFS EFH Teams to write the EFH amendments. The current study was conducted cooperatively between Rutgers University and the Howard Laboratory to develop EFH reports for the following species: Atlantic sea scallop, surf clam, ocean quahog, squid, mackerel, and butterfish. Funding by NEFSC.

97-Ex3 Denitrification and Microbial Dynamics in Continental Shelf Sediments: An Annual Study (Sybil P. Seitzinger, Rutgers/NOAA CMER Program and Lee Kerkhof, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)

Nearly 50% of the global marine primary production occurs in continental margin waters, supporting a rich marine fisheries. Nitrogen is an important element controlling this primary production. Processes that affect the availability of nitrogen will likely have a direct impact on the primary productivity within the continental shelf ecosystem, and ultimately influence the associated marine fisheries. Denitrification in continental shelf sediments is important because it can decrease the amount of nitrogen for phytoplankton in the overlying waters. According to

current estimates, up to 50% of the total nitrogen input to the oceans is removed from the system through denitrification in continental shelf sediments. However, few direct measurements of denitrification in shelf sediments exist. In the current study methods developed with CMER 96-Ex1 will be used to: 1) assess seasonal variability in denitrification rates at 3 sites on the continental shelf at LEO-15; 2) assess microbial population dynamics on a seasonal basis at the same 3 sites; and 3) investigate physical/chemical/and biological mechanisms/factors controlling denitrification and microbial population dynamics in the continental shelf. The results of this study will provide critical information needed for local and ocean scale N models, global models of nitrous oxide (N_2O), and the overall contribution of denitrification in continental shelf sediments as a global marine N sink. Funding from NOAA/Mid-Atlantic Bight, National Undersea Research Program.

97-Ex4 Estuarine Eutrophication: Seasonal Cycle of the Contribution of Dissolved Organic Nitrogen from Non-Point and Point Sources (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ; Monica A. Mazurek, Institute of Marine and Coastal Sciences - Rutgers University; Robert W. Sanders, Temple University, Department of Biology Philadelphia, PA)
This project is evaluating the seasonal differences in the contribution to estuarine eutrophication of dissolved organic nitrogen (DON) from non-point and point sources. DON is a major source of pollutant related N to coastal waters. However, the biological availability of DON in various non-point and point sources, and thus its contribution to eutrophication has received little attention. Traditionally, DON has been considered to be refractory. This project is a continuation of CMER 95-Ex1 in which summer studies of the biological availability of dissolved organic nitrogen in specific non-point and point sources of pollution to estuarine ecosystems were studied. In the current study, the seasonal differences in the bioavailability of DON from various pollutant sources are being examined. Sources included in the study are urban storm water runoff, agricultural runoff, as well as natural sources from forested watersheds. The results of these studies will be made available to state and regional managers for use in the development of nutrient reduction plans and eutrophication models. Funding by NOAA, New Jersey Sea Grant.

96-Ex1 Denitrification and Microbial Dynamics in Continental Shelf Sediments: Use of *In Situ* Methods (Sybil P. Seitzinger and Lee Kerkhof, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)
Nearly 50% of the global marine primary production occurs in continental margin waters, supporting a rich marine fisheries. Nitrogen is an important element controlling this primary production. Processes that affect the availability of nitrogen will likely have a direct impact on the primary productivity within the continental shelf ecosystem, and ultimately influence the associated marine fisheries. Denitrification in continental shelf sediments is important because it can decrease the amount of nitrogen for phytoplankton in the overlying waters. According to current estimates, up to 50% of the total nitrogen input to the oceans is removed through denitrification in continental shelf sediments. However, few direct measurements of denitrification in shelf sediments exist. In the current study a new, high sensitivity method for measuring *in situ* rates of denitrification in continental shelf sediments was developed and the first direct denitrification measurements in Atlantic shelf sediments were made. The preliminary measurements strongly support the original hypothesis that denitrification in shelf sediments is a

major removal term for N on both a local, as well as global, scale. In addition, molecular techniques (PCR/probing of nitrous oxide reductase genes) to examine the dynamics of bacterial populations capable of denitrification were developed. The results of this study provided information necessary to begin evaluation of the contribution of denitrification as a global marine N sink. Funding from NOAA/Mid-Atlantic Bight, National Undersea Research Program.

96-Ex2 Effects of Fisheries Regulation on the Economic Viability of the Charter and Party Boat Fishing Industry in the Northeast Region of the U.S. (Bonnie McCay, Department of Human Ecology - Rutgers University, New Brunswick, NJ; S. Steinback, NMFS, Woods Hole, MA)

The Northeast Fisheries Science Center (NEFSC) of the National Marine Fisheries Service (NMFS) conducted an economic valuation study of marine recreational anglers in the Northeast region of the U.S. This CMER project was part of a cooperative project among the NEFSC and CMER institutions in the Northeast Region: University of Rhode Island, University of Massachusetts, and Rutgers the State University of New Jersey. Work on the recreational service industry (charter and party boats) is coordinated with work on two other poorly-documented sectors of the Northeast region's fisheries, the "hook" and the small trawler fisheries. The purpose of this cooperative project was to develop a data collection system that will become part of the core statistics collected through NMFS for use by NMFS and the cooperating universities for the assessment of fishery management issues and other fishery economics research needs. Specific objectives included the development of survey instruments to be tested in pilot surveys of the Northeast U.S. hook, small trawler, and recreational party and charter fleets, to compare and statistically validate various survey methods, to design the framework for a possible ongoing cost/earnings data base that will eventually encompass all Northeast fisheries of interest, and to begin building research tools based on these data.

95-Ex1 Estuarine Eutrophication: Contribution of Dissolved Organic Nitrogen from Non-Point and Point Sources (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ; Renée Styles, Institute of Marine and Coastal Sciences - Rutgers University; Robert W. Sanders, Academy of Natural Sciences, Division of Environmental Research, Philadelphia, PA)

This project evaluated the contribution of dissolved organic nitrogen (DON) from non-point and point sources to estuarine eutrophication during summer. DON is a major source of pollutant related N to coastal waters. However, the biological availability of DON in various non-point and point sources, and thus its contribution to eutrophication, was not known. Traditionally, DON has been considered to be refractory. This project is a continuation of CMER 94-Ex1 in which DON in major rivers was investigated. In this project summer experiments were conducted to examine the biological availability of dissolved organic nitrogen in urban storm water runoff, agricultural runoff, as well as natural sources from forested watersheds. A substantial portion of the DON from all sources was found to be biologically available to estuarine organisms and resulted in stimulation of bacterial and phytoplankton production. The results have important implications for state and regional management plans and eutrophication models. Funding by NOAA, New Jersey Sea Grant.

95-Ex2 The Bioavailability of Dissolved Organic Nitrogen at the Ocean Boundary of Chesapeake Bay (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; Robert DeKorsey, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; Robert W. Sanders, Academy of Natural Sciences, Division of Environmental Research, Philadelphia, PA)

Approximately 40% of the total tracked nitrogen loading to the Chesapeake Bay enters from ocean boundary bottom water, and approximately 90% of the N in ocean boundary bottom water is in the form of organic nitrogen. However, the biological availability of organic N in ocean boundary bottom water was not known; thus, its contribution to eutrophication was unknown. Traditionally, organic N has been considered to be refractory. This study examined the biological availability of organic nitrogen in ocean boundary bottom water and its ultimate contribution to phytoplankton production and eutrophication in the bay. The information was incorporated in eutrophication models of Chesapeake Bay. Funding provided by US Environmental Protection Agency, Chesapeake Bay Program.

95-Ex3 The Importance of Understanding Ecological Complexity to Predicting Effects of Multiple Stressors on Coastal Ecosystems (Denise Brietburg, Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory; Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences Rutgers University, New Brunswick, NJ; plus 15 other Principal Investigators from 7 institutions)

In order to understand the cumulative effects of numerous stressors on coastal ecosystems, the complexity of such systems must be recognized and dealt with. In this six-year study complexity is addressed by studying an estuarine system at multiple levels of organization. The experimental approach includes: 1) a multilevel large-scale experimental study of the effects of stressors on ecological processes within the estuary, 2) an examination of the relationships between land-use patterns, geology and the watershed loadings of stressors, 3) modeling of the ecological effects of stressors from the individual through the ecosystem level, including spatially explicit fisheries models, and 4) an economic evaluation of management practices. The principal classes of stressors that are being examined include inorganic toxins and high nutrient inputs. S. Seitzinger's portion of the project focuses on ecosystem level responses (benthic processes, whole-system primary production, respiration and net ecosystem metabolism). Funding by NOAA Coastal Ocean Program.

95-Ex4 An Evaluation of Shallow Water Drift Material in the Arthur Kill and Kill van Kull (Kenneth Able and Uwe Kils, Marine Field Station, Institute of Marine and Coastal Sciences - Rutgers University, Tuckerton, NJ; A. Studholme, NEFSC, James J. Howard Laboratory, Highlands, NJ; Gary Taghon, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ)

Throughout the New York Harbor, the removal of deteriorating piers, bulkheads, pilings, derelict vessels and other debris is the objective of a major drift removal program undertaken by the U.S. Army Corps of Engineers. Of special concern are shallow water structures in and around Arthur Kill and Kill van Kull, which are major sources of drift material. While these artificial structures can contribute to habitat degradation, alternatively they may serve to attract migratory and resident fish species, providing essential shelter, a critical factor for highly vulnerable early life history stages. This program evaluated the role that these man-made structures play, particularly as nursery areas of juvenile fishes. Funding by U.S. Army Corps of Engineers.

94-Ex1 Role of Dissolved Organic Nitrogen in Estuarine Eutrophication (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; Robert W. Sanders, Academy of Natural Sciences, Division of Environmental Research, Philadelphia, PA)
This project was designed to evaluate the contribution to estuarine eutrophication of dissolved organic nitrogen (DON) transported to estuaries by polluted rivers. DON is a major source of pollutant related N to coastal waters. However, the biological availability of DON, and thus its contribution to eutrophication, was not known; traditionally, DON has been considered to be refractory. Inputs of DON from the Hudson and Delaware rivers were quantified and the extent to which the DON from these sources increases algal and microbial production was examined. The results of this study are being used to refine estuarine eutrophication models. Funding by NOAA, New Jersey Sea Grant.

94-Ex2 Inputs and Cycling of Nutrients in NY/NJ Harbor (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ)
The role of sediments in nutrient, trace metal, and oxygen cycling throughout the New York/New Jersey Harbor ecosystem was examined. In addition, external inputs of nutrients (both inorganic and organic) from 41 different point sources were quantified. The biological availability of dissolved and particulate organics in those inputs were studied during spring and summer experiments. The results of this study were used in eutrophication models of the New York/New Jersey Harbor ecosystem. Funding by EPA National Estuaries Program in New York/New Jersey Harbor.

94-Ex-3 Mitigation of Non-point Pollution by Riparian Forest Buffers in Agricultural Watershed of the Mid-Atlantic Piedmont (Sybil Seitzinger, Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; Denis Newbold, Academy of Natural Sciences of Philadelphia; Susan Watts, Institute of Marine and Coastal Sciences, Rutgers University, Camden, NJ)
Buffer strips are used for non-point source nutrient removal, to reduce nutrient runoff from agricultural systems to aquatic ecosystems. Mechanisms responsible for nitrogen and phosphorus retention and removal in riparian buffer strips were examined. The rate of nitrogen removal by denitrification and the overall mass balances of nitrogen and phosphorus were quantified. Factors controlling nutrient removal/retention in the buffer strips were investigated. Both newly planted and mature forested buffer strips were included in this study. Funding by Chesapeake Research Consortium.

93-Ex1 Fish Recruitment in the Northeastern United States: The Role of Estuarine Habitats (Kenneth Able, Sam Wainright, Institute of Marine and Coastal Sciences - Rutgers University, New Brunswick, NJ; Anthony Calabrese, NEFSC, Milford Laboratory, Milford, CT; Anne Studholme, NMFS, James J. Howard Laboratory, Highlands, NJ)
A comprehensive approach was used to identify critical habitats in three northeastern estuaries and to access functional value as nursery areas for young-of-the-year fishes especially winter flounder (*Pleuronectes americanus*) and tautog (*Tautoga onitis*). This project was related to two CMER funded projects (93-01; 96-05). Funding by NOAA Coastal Ocean Program, Estuarine Habitat Research Program.

Table 1. Projects Supported Through Rutgers/NOAA CMER Program (Base Funding & External Funding 1993-2002):

Year	Project No.	Short Title	Investigator	Amount
1993	93-01	Windowpane Flounder Early Life History and Ecology	K. Able[1], W. Morse[2]	$25,041
	93-05	Surf Clam Recruitment	J. Grassle[3]	$17,032
	93-06	Mackerel Quality	T.C. Lee[4],J.Krzynowek[5]	$30,658
	93-08	Toxicity of Dioxins, Furans and PCBs	K Cooper[6], S. McLean[7], A.Studholme[2]	$27,269
	93-Ex1	Estuarine Habitats	K. Able[1], S. Wainright[3] A.Calabrese[8], A.Studholme[2]	$100,000
1994	93-01	Windowpane Flounder Early Life History and Ecology	K. Able[1], W. Morse[2]	$27,480
	93-05	Surf Clam Recruitment	J. Grassle[3]	$33,482
	93-06	Mackerel Quality	T.C. Lee[4],J.Krzynowek[5]	$36,164
	93-08	Toxicity of Dioxins, Furans and PCBs	K Cooper[6], S. McLean[7], A.Studholme[2]	$30,292
	94-03	Pollutant Transfer in an Estuarine Food Chain	G. Taghon[3]	$25,582 (2Yr.award)
	93-Ex1	Estuarine Habitats	K. Able[1],S. Wainright[3], A.Calabrese[8], A.Studholme[2]	$100,000
	94-Ex1	Eutrophication and Dissolved Organic Nitrogen	S. Seitzinger[9] R. Sanders[10]	$150,936
	94-Ex2	Inputs and Cycling of Nutrients in NY/NJ Harbor	S. Seitzinger[9]	$54,140
	94-Ex3	Nitrogen Removal in Riparian Buffer Strips	S. Seitzinger[9],S.Watts[11]	$20,000
1995	93-01	Windowpane Flounder Early Life History and Ecology	K. Able[1], W. Morse[2]	$26,909
	93-05	Surf Clam Recruitment	J. Grassle[3]	$30,731
	93-06	Mackerel Quality	T.C.Lee[4], J.Krzynowek[5]	$36,314
	95-05	Controls on Introduction of Trace Metals to Coastal Marine Food Web	R.Sherrell[3],V.Zdanowicz[2]	$41,046
	95-Ex1	Eutrophication and Dissolved Organic Nitrogen from Non-Point Sources	S. Seitzinger[9],R. Styles[3], R.W. Sanders[10]	$81,336
	95-Ex2	Organic Nitrogen Inputs in Chesapeake Bay Ocean Boundary Water	S. Seitzinger[9], R. DeKorsey[3],R.Sanders[10]	$55,000
	95-Ex3	Multiple Stressors and Ecological Complexity in Coastal Ecosystems	D. Breitburg[12] S. Seitzinger[9]	$24,165
	95-Ex4	Evaluation of the Habitat Value of Man-made Structures in Urban Estuaries	K. Able[1],U. Kils[1], A.Studholme[2],G. Taghon[3]	$239,100

Table 1. Projects Supported Through Rutgers/NOAA CMER Program (Base Funding & External Funding 1993-2002): (cont.)

Year	Project No.	Short Title	Investigator	Amount
1996	95-05	Controls on Introduction of Trace Metals to Coastal Marine Food Web	R. Sherrell[3] V.Zdanowicz[2]	$28,917
	96-05	Isotopic Turnover Rate and Marginal Growth Increment Validation for Young-of-the-Year Winter Flounder	S. Wainright[3], B. Phelan[2]	$30,788
	96-08	Development of a Hydrodynamic/Fish Recruitment Model of Great Bay-Little Egg Harbor Estuarine System	D. Haidvogel[3], R. Chant[3]	$61,606 (2 Years)
	96-11	CMER Research Experiences for Undergraduates	M. De Luca[3]	$6,590
	95-Ex1	Eutrophication and Dissolved Organic Nitrogen from Non-Point Sources	S. Seitzinger[9],R. Styles[3], R.W. Sanders[10]	$84,510
	95-Ex3	Multiple Stressors and Ecological Complexity in Coastal Ecosystems	D. Breitburg[12] S. Seitzinger[9]	$32,656
	95-Ex4	Evaluation of the Habitat Value of Man-made Structures in Urban Estuaries	K. Able[1], U. Kils[1], A.Studholme[2],G. Taghon[3]	$65,450
	96-Ex1	Denitrification and Microbial Dynamics in Continental Shelf Sediments: Use of in situ Methods	S. Seitzinger[9], L. Kerkhof[3]	$69,343
	96-Ex2	Effects of Fisheries Regulation on the Economic Viability of the Charter and Party Boat Fishing Industry in the Northeast Region of the U.S.	B. McCay[13],S.Steinback[14]	$60,000
1997	97-03	Linkages between Circulation and Distribution of Marine Organisms in a Shallow Well Mixed Estuary: An Observational Approach	Scott Glenn[3] Robert J. Chant[3] Al Stoner[2]	$26,814
	97-04	Environmental Influences on Metamorphosis and Survival in Summer Flounder (*Paralichthys dentatus*)	Kenneth Able[1] Chris Chambers[2]	$24,938
	97-06	Sustaining the Atlantic Sea Scallop Fishery: An Economic Analysis of Consolidating Days-At-Sea	Peter Parks[15] Michael Price[15] James Kirkley[16] Steve Edwards[14]	$31,527
	97-07	Physical Transport of Bivalve Larvae through a Tidal Inlet: Molecular Probe Applications	Judith Grassle[3]	$10,905
	97-08	Research Experiences for Undergraduates – Summer 1998	Michael De Luca[3]	$7,816
	95-EX3	Multiple Stressors and Ecological Complexity in Coastal Ecosystems	D. Breitburg[12] S. Seitzinger[9]	$44,223
	96-EX2	Effects of Fisheries Regulation on the Economic Viability of the Charter and Party Boat Fishing Industry	Bonnie McCay[13] Scott Steinback[14]	$60,000
	97-EX1	Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight - I	Michael DeLuca[3] F. Grassle[3] Kenneth Able[1] Sybil Seitzinger[9]	$442,000
	97-EX2	Essential Fish Habitat	Judith P. Grassle[3] Waldo Wakefield[3] Richard Lathrop[17] Jeff Cross[2] Anne Studholme[2]	$73,000

Table 1. Projects Supported Through Rutgers/NOAA CMER Program (Base Funding & External Funding 1993-2002): (cont.)

Year	Project No.	Short Title	Investigator	Amount
1997 cont.	97-EX3	Denitrification and Microbial Dynamics in Continental Shelf Sediments: An Annual Study	S. Seitzinger[9] L. Kerkhof[3]	$180,366
	97-EX4	Estuarine Eutrophication: Seasonal Cycle of the Contribution of Dissolved Organic Nitrogen from Non-Point and Point Sources	S. Seitzinger[9] R. Sanders[10]	$61,500
1998	97-04	Environmental Influences on Metamorphosis and Survival in Summer Flounder (*Paralichthys dentatus*)	Kenneth Able[1] Chris Chambers[2]	$25,942
	98-03	Selective Feeding in Post-Larval Winter Flounder	Oscar Schofield[3] Pat Shaheen[3]	$26,196
	98-04	Sustaining the Atlantic Sea Scallop Fishery	Peter Parks[15]	$38,030
	98-05	Research Experiences for Undergraduates	Michael De Luca[3]	$8,532
	95-EX3	Multiple Stressors and Ecological Complexity in Coastal Ecosystems	S. Seitzinger[9] D. Breitburg[12]	$33,508
	97-EX4	Estuarine Eutrophication: Seasonal Cycle of the Contribution of Dissolved Organic Nitrogen	S. Seitzinger[9] R. Sanders[10]	$61,500
	98-EX1	Costs of Surf Clamming and Ocean Quohogging	Bonnie McCay[13]	$60,000
	98-EX2	Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight - II	M. De Luca[3]	$457,000
	98-EX3	Sensors for Direct Observation for use in Stock Assessment	W. Wakefield[3] W. Overholtz[14] W. Gabriel[14]	$15,791
	98-EX4	Composition and Bioavailability of Dissolved Organic Nitrogen in Atmospheric Deposition	S. Seitzinger[9] M. Mazurek[3]	$182,639
	98-EX5	An Initiative to Gain a Regional Perspective on Coastal Eutrophication	S. Seitzinger[9] T. Wiegner[3]	$5,000
	98-EX6	Barnegat Bay National Estuary Program Data Synthesis	Sybil Seitzinger[9] R. Lathrop[17] K.Hunchak-Kariouk[18] R. Nicholson[18] R.E. Hickman[18]	$140,000
1999	99-05	Effects of Bottom Roughness on Surf Clam (*Spisula Solidissima*) Larval Settlement and Recruitment	Judith P. Grassle[3] Shannon G. Newby[3]	$30,612
	99-06	Fish Movements in the Dynamic Ecoscape of a Shallow Flood Dominated Estuary	Robert J. Chant[3] Al Stoner[2]	$28,409
	99-08	Use of Stable-Isotope Ratios to Track Changes in Feeding Behavior of Larval and Juvenile Flatfish	Sam Wainright[3] Keith Bosley[3] Chris Chambers[2]	$30,589
	99-10	Research Experiences for Undergraduates	Michael De Luca[3]	$10,390

Table 1. Projects Supported Through Rutgers/NOAA CMER Program (Base Funding & External Funding 1993-2002): (cont.)

Year	Project No.	Short Title	Investigator	Amount
1999 cont'd.	95-EX3	Multiple Stressors and Ecological Complexity in Coastal Ecosystems	S. Seitzinger[9] D. Breitburg[12]	$12,581
	97-EX4	Estuarine Eutrophication: Seasonal Cycle of the Contribution of Dissolved Organic Nitrogen	S. Seitzinger[9] M. Mazurek[3]	$61,500
	99-EX1	Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight - III	M. De Luca[3]	$457,000
	99-Ex2	Bottom Habitat Classification and Mapping of the New York Bight	Richard Lathrop[17]	$30,000
	98-EX4	Composition and Bioavailability of Dissolved Organic Nitrogen in Atmospheric Deposition	S. Seitzinger[9] M. Mazurek[3]	$87,382
2000	99-05	Effects of bottom roughness on surf clam (*Spisula solidissima*) larval settlement and recruitment	J. Grassle[3] S. Newby[3]	$30,136
	99-06	Fish movements in the dynamic ecoscape of a shallow flood dominated estuary	R. Chant[3] A. Stoner[2]	$6,106 (plus $25,634 fr. 99-Ex1)
	99-10	CMER Research Experiences for Undergraduates	M. DeLuca[3]	$1,837
	00-01	Essential fish habitat for young-of-the-year Goosefish (*Lophius americanus*) in the Middle Atlantic Bight	K.W. Able[1] C. Chambers[2]	$28,921
	95-Ex3	The Importance of Understanding Ecological Complexity to Predicting Effects of Multiple Stressors on Coastal Systems	S. Seitzinger[9] D. Breitburg[12]	$5,303
	98-Ex4	Composition and Bioavilability of Dissolved Organic Nitrogen in Atmospheric Deposition	S. Seitzinger[9] M. Mazurek[3]	$29,980
	99-Ex1	Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight - IV	M. DeLuca[3]	$550,000
	99-Ex2	Bottom Habitat Classification and Mapping of the New York Bight	R. Lathrop[17]	$30,000
	00-Ex1	Model Development and Chemical Characterization of Bioavailable Nitrogen Loading to Coastal Ecosystems	S. Seitzinger[9] M. Mazurek[3]	$61,605
2001	00-01	Essential fish habitat for young-of-the-year Goosefish (*Lophius americanus*) in the Middle Atlantic Bight	K. Able[1] C. Chambers[2]	$33,125
	01-02	Spatial Dimensions of Fisheries and their implications for property rights alternatives: a case study of three major scalloping areas	K. St.Martin[19] B. McCay[13]	39,564
	01-04	CMER Research Experiences for Undergraduates	M. DeLuca[3]	$12,046
	01-05	Biotic interactions between bluefish and associated piscivorous predators: a comparison of habitat use, movements, distribution and growth	K. Able[1]	$40,265
	01-EX3	Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight - V	M. DeLuca[3]	$798,000
	01-EX1	Recreational Fishing and National Standard 8	K. St.Martin[19] B. McCay[13] Peter Parks[15]	$75,000
	01-EX2	Fishing communities of the Mid-Atlantic	B. McCay[13]	$100,000
	00-EX1	Model Development and Chemical Characterization of Bioavailable Nitrogen Loading to Coastal Ecosystems	S. Seitzinger[9] M. Mazurek[3]	$66,576

Table 1. Projects Supported Through Rutgers/NOAA CMER Program (Base Funding & External Funding 1993-2002): (cont.)

2001 cont'd.	01-EX4	Chemical Composition and Bioavailability of Dissolved Organic Nitrogen in Atmospheric Wet Deposition from Urban and Rural New Jersey Sites	S. Seitzinger[9] M. Mazurek[3]	$100,000
	01-EX5	Biocomplexity: The roles of resources, competition and predation in microbial degradation of organic matter.	G.Taghon[3], L. Young[20] S. Seitzinger[9] and others	$29,733 (Seitzinger portion only)
2002	02-02	CMER Research Experience for Undergraduates	M. DeLuca[4]	$15,640
	02-03	Effects of Bottom Roughness on Surf Clam (Spisula) predation by crustaceans	J. Grassle[1]	$31,967
	02-04	Manganese in Lobsters as an indicator of hypoxia-induced stress.	R. Sherrell[1]/A. Draxler[2]	$56,860
	01-EX5	Biocomplexity: The roles of resources, competition and predation in microbial degradation of organic matter.	G.Taghon[3], L. Young[20] S. Seitzinger[9] and others	$81,002 (Seitzinger portion only)
	02-EX1	Bluefish/Striped Bass Interactions in the Mid-Atlantic Bight - VI	M. DeLuca[4]	$827,000
	02-EX2	Chemical Composition and Bioavailability of Dissolved Organic Nitrogen in Atmospheric Wet Deposition from Urban and Rural New Jersey Sites	S. Seitzinger[9], H. Hartnett[3]	$100,000
	02-EX3	Continuing Studies: Model Development and Chemical Characterization of Bioavailable Nitrogen Loading to Coastal Ecosystems	S. Seitzinger[9], H. Hartnett[3]	$58,000
	02-EX4	Biotechnological Investigations/Ocean Margins Program	L. Kerkhof[3], S. Seitzinger[9], H. Hartnett[3] and others.	$30,000 (Seitzinger portion only)

[1]Rutgers University, Marine Field Station, Tuckerton, NJ
[2]NMFS, James J. Howard Laboratory, Highlands, NJ
[3]Rutgers University, Institute of Marine and Coastal Sciences, New Brunswick, NJ
[4]Rutgers University, Dept.of Food Science, the Fisheries and Aquaculture TEX Center and the Center for Advanced Food Technology, New Brunswick, NJ
[5]NMFS, Gloucester Laboratory, Gloucester, MA
[6]Rutgers University, Dept. of Biochemistry and Microbiology and Joint Program in Toxicology, Environmental Occupational Health Sciences Center, Piscataway, NJ
[7]NEFSC, Narragansett Laboratory, Narragansett, RI
[8]NMFS, Milford Laboratory, Milford, CT
[9]Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, New Brunswick, NJ
[10]Temple University, Department of Biology, Philadelphia, PA (formerly at Philadelphia Academy of Natural Sciences)
[11]Rutgers University, Environmental Sciences, Camden, NJ
[12]Philadelphia Academy of Natural Sciences, Benedict Estuarine Research Lab, St. Leonards, MD
[13]Rutgers University, Department of Human Ecology, New Brunswick, NJ
[14]NMFS, Woods Hole, MA
[15]Rutgers University, Department of Agricultural Economics and Marketing, New Brunswick, NJ
[16]College of William and Mary, Virginia Institute of Marine Science, School of Marine Science, Gloucester Point, VA
[17]Rutgers University, Ecology, Evolution & Natural Resources, New Brunswick, NJ
[18]USGS, Water Resources Division, Trenton, NJ
[19] Rutgers University, Department of Geography, New Brunswick, NJ
[20] Rutgers University, Environmental Sciences, New Brunswick, NJ

Table 2. Participation of Rutgers Faculty and Students in CMER Projects (1993-2002):

Project No.	Short Title	**Faculty** (Department)	**Student/Degree Sought/Program**
93-01	Windowpane Flounder	K. Able[1]	Melissa Neuman/Ph.D. (1999) Ecology & Evolution
93-05	Surf Clam Recruitment	J. Grassle[1]	Marnita Chintala/M.S. (1997) Ecology & Evolution Eric Weissberger/Ph.D. (1998) Ecology & Evolution Hongguang Ma/M.S. (1997) & Ph.D. (2001) Oceanography Gregg Kessler/undergraduate Honors Student Pia Rivera/undergraduate Janice Bell/Post-doc
93-06	Mackerel Quality	T.C. Lee[2]	Hui-Zhen Zhang/Ph.D. Food Science H. Liu/M.S. (1995)
93-08	Toxicity of Dioxins, Furans and PCBs	K. Cooper[3]	Claudia Olivieri/Ph.D. (1996) Environmental Science S. Longo/M.S. (1995) Toxicology C.M. Chen/Ph.D. (1994) Toxicology M. Kim/Ph.D. (1998) Environmental Science
94-03	Pollutant Transfer	G. Taghon[1]	Ann Schnitz/Ph.D. (1997) Environmental Science
95-05	Assimilation of Metals	R. Sherrell[1]	Yuan Gao/Post-doc J. Cullen/Ph.D. (2001) Oceanography K. Metzger/B.S. (1998)
95-Ex3	Multiple Stressors	S. Seitzinger[7]	T. Wiegner/Ph.D. (2001) Oceanography A. Laursen/Post-doc
96-05	Isotopic Turnover Rate	S. Wainright[1]	Keith Bosley/M.S. (1997) Environmental Sci.
96-08	Hydrodynamic/Fish Recruitment Model	D. Haidvogel[1]	Robert Chant/Post-doc
97-03	Circulation and Distribution of Marine Organisms	S. Glenn[1]	Robert Chant/Post-doc Mary Carla Curran/Post-doc
97-04	Summer Flounder	K. Able[4]	Stephanie Barbeau/M.S., Ecology & Evolution
97-06	Sea Scallop Fishery	P. Parks[5]	Michael Price/M.S. (1998) Agric. Econ. & Mktg.
97-07	Physical Transport of Bivalve Larvae through a Tidal Inlet: Molecular Probe Applications	J.P. Grassle[1]	Chris Gregg/Ph.D. (2002) Oceanography
97-08	Research for Undergraduates	M. De Luca[1]	Geoffrey Bell/B.S. Michelle Walsh/B.S.
98-03	Winter Flounder	O. Schofield[1]	P. Shaheen/Ph.D., Oceanography
98-05	Research for Undergraduates	M. De Luca[1]	L. Annicchiarico/B.S. K. Tsakiris/B.S.
98-Ex1	Costs Surf-clamming	B. McCay[6]	J. O'Neil/non-degree, Human Ecology S. Brandt/Ph.D., Dept. of Agricultural & Resource Economics, University of California, Berkeley, Fall 2001
98-Ex4	Atmospheric Deposition	S. Seitzinger[7] M. Mazurek[1]	M. Deritter/B.S.
98-Ex5	Regional Eutrophication	S. Seitzinger[1]	T. Wiegner/Ph.D (2001) Oceanography
99-05	Surf Clam Larval Recruitment	J. Grassle[1]	S. Newby/Ph.D., Oceanography
99-06	Fish Movement Shallow Estuary	R. Chant[1]	R. Styles/Post-Doc J. Manderson/Graduate student, UMass Amherst C. Haldeman/Undergraduate, Oceanography C. Esposito/Undergraduate, Oceanography

Table 2. Participation of Rutgers Faculty and Students in CMER Projects (1993-2002):

Project No.	Short Title	**Faculty** (Department)	**Student/Degree Sought/Program**
99-Ex2	Mapping Bottom Type as Part of the New York Bight Apex Sea Floor Mapping Project	R. Lathrop[8]	N. Senyk/Undergraduate Thesis, May 2001
00-01	Essential Fish Habitat for YOY Goosefish	K. Able[4] C. Chambers[10]	P. Clarke/Undergraduate
01-02	Spatial Dimensions of Fisheries and Property Rights Alternatives	K. St. Martin[9] B. McCay[6]	G. Graziosi/Ph.D. Dept. of Geography, Rutgers Univ.
01-04	Research Experience for Undergraduates	M. DeLuca	D. Shrump/ Undergraduate, Rutgers Univ. F. Flores/Undergraduate, Rutgers Univ. J. Siclare/Undergraduate, St. Joseph's Univ. Philadelphia
01-Ex1	Recreational Fisheries and National Standard 8	K. St. Martin[9]	T. Johnson/Ph.D. Ecology and Evolution, Rutgers, Univ.
02-03	Effects of Bottom Roughness on Surf Clam (Spisula) predation by crustaceans	J. Grassle[1]	S. Newby/Ph.D., Oceanography
02-04	Manganese in Lobsters as an indicator of hypoxia-induced stress.	R. Sherrell[1]/A. Draxler[10]	M.LaVigne

[1]Institute of Marine and Coastal Sciences
[2]Department of Food Science
[3]College of Pharmacy
[4]Rutgers Marine Field Station, Tuckerton
[5]Department of Agri. Econ. & Mktg.
[6]Human Ecology
[7]Rutgers/NOAA CMER Program, Institute of Marine and Coastal Sciences, New Brunswick, NJ
[8]Rutgers/Grant F. Walton Center for Remote Sensing & Spatial Analysis
[9]Rutgers University, Department of Geography, New Brunswick, NJ
[10]NMFS, James J. Howard Laboratory, Highlands, NJ