New Jersey Sea Grant Extension Program – A/S-1

One of the New Jersey Sea Grant College Program's main objectives is providing marine-related information to people who depend on coastal and ocean resources for their livelihoods or for recreational purposes. Staff members' areas of expertise include commercial and recreational fisheries, marine recreation and safety, aquaculture, seafood marketing, and marine and coastal processes. Working daily with residents and other organizations, agents and other specialists deliver the latest marine information and related research results to stakeholders. They also bring to program management new or potential problems and needs that should be addressed by research and education. Through this project, residents and target user groups have access to and benefit from program-generated information about managing, utilizing, and conserving the state's marine and coastal resources.

Program Management – M/M-1

Through this project, the Director and staff of the New Jersey Sea Grant College Program manage and implement the program by planning, coordinating and evaluating activities. These efforts maintain and improve both the program and its relationship with educational institutions, federal, state and local agencies and marine and coastal businesses and industries.

Program Development – M/M-2

This project component provides support for research and other activities that respond to the needs of the state, industry and businesses on short notice. Information obtained from activities supported through program development is often used for long-range planning and encourages the submission of future full proposals to address these needs.

Communications – A/S-2

The Communications program is responsible for collecting, cataloging and distributing all information generated by the New Jersey Sea Grant College Program. Information about research, education and extension activities and accomplishments is distributed and publicized through *The Jersey Shoreline* magazine, brochures, fact sheets, newsletters, print and electronic news media, the Internet, technical reports, conferences, workshops, and other outlets. Communications develops, produces, distributes and organizes all of these products and events. Scientists, educators, legislators, industry, the news media and the general public all use and benefit from Communications' products and services.

Education – E/T-1

The Education Program performs a wide range of marine related environmental science education and outreach services for audiences that include pre-kindergarten, pre-college and college students, professional educators, family groups, youth groups and the general public. Private sector partnerships allow the program to contribute to formal education reform by providing professional educators with classroom tools and the necessary skills to bring marine and marine-related environmental science-based curricula that support achievement of high standards by all students in all subject areas while promoting marine stewardship. The Education staff works with Communications and the Extension Program to make this transfer of information possible. The well-established infrastructure of NJMSC education programs and audiences and this collaborative approach also provides an efficient way to transfer information about Sea Grant research to the public.

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Isolation and Identification of Antimicrobial Compounds from Marine Epiphytic Bacteria R/D 2005-1
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Genetic Stock Assessment of NJ Bay Scallops using Microsatellite Primers R/D 2005-2
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State Policymaking Institutions and Managing Biodiversity in Delaware Bay R/D 2005-3
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Distribution of *Corbicula fluminea* in New Jersey R/D 2005-4
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Developing the Proficiency to Monitor PolyBrominated Diphenyl Ether (PBDE) Contamination Levels in Barnegat Bay R/D 2005-5
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Root Dynamics and Population Performance in American Beachgrass, *Ammophilia breviligulata* R/D 2005-6
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Modeling the Sensitivity of Acoustic Telemetry Gate Escapement to Seven User-defined Variables R/D 6605-0002
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Selectivity of Salinity, Municipal Sewage, Herbicides and Heavy Metals Toward the Development of Brown Tide Bloom R/6605-0001
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Sea Grant New Jersey

Congress established the National Sea Grant College Program in 1966, to foster research, outreach and education that focus on marine issues. The program represents a unique partnership between the nation's universities and the National Oceanic and Atmospheric Administration.

The National Sea Grant College Program works closely with 32 state Sea Grant programs located in every coastal and Great Lakes state, Puerto Rico and Pennsylvania. These programs serve as the core of a dynamic, national, university-based network of over 300 institutions involving more than 3,000 scientists, engineers, educators, students and outreach experts. Through their research, education and outreach activities, Sea Grant has helped position the United States as the world leader in marine research and the sustainable development of coastal resources. Sea Grant activities exist at the nexus of local, state, national and sometimes international interests. In this way, local needs receive national attention, and national commitments are fulfilled at the local level.

Projects & Progress

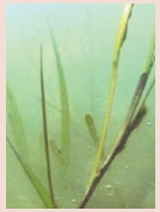
Since 1975, the New Jersey Sea Grant Program has been managed by the New Jersey Marine Sciences Consortium (NJMSC), an alliance of 25 colleges and universities, private organizations and individuals interested in maintaining a healthy balance between economic growth and environmental stewardship of our marine resources. In 1989, having met the high standards of research and academic excellence set by the National Sea Grant Program, New Jersey Sea Grant became the 26th program in the nation to earn the status of Sea Grant College.

For the past 32 years, New Jersey Sea Grant researchers have conducted extensive research in areas like coastal ecosystems health, biotechnology, nonpoint source pollution, fisheries and aquaculture, habitat restoration and dredge materials management. Information gathered from this research impacts New Jersey and its coastal environment on all levels: economically, environmentally and aesthetically.

This publication includes capsule descriptions of research and program activities sponsored by the New Jersey Sea Grant College Program between 2006 and 2008. For additional information about a specific project, contact information for the Principal Investigator has been included with each project write-up.

2006-2008 Research Projects

Assessing the population genetic structure of eelgrass *(Zostera marina L.)*: implications for management and restoration of a coastal habitat R/6642-001



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Seagrasses have undergone dramatic declines worldwide due to both natural and anthropogenic factors. Seagrasses serve as a barometer of the health of the ecosystem by being one of the most sensitive indicators of long-term water quality and changes in their distribution may equate to system-wide decline. Assessing these important communities provides better understanding of impacts of loss and community linkages.

Eelgrass *(Zostera marina)* is one of the most widely distributed seagrasses in the world. It serves as essential fish habitat for many commercially and recreationally important species and provides stability to coastal systems through reductions in water velocity, increased wave attenuation and stabilization of sediments. However, due to coastal eutrophication, *Z. marina* has undergone significant declines in spatial coverage throughout much of its range. Along the mid-Atlantic Coast, *Z. marina* declines have been linked to disease and changes in water quality and the problems facing many coastal managers relate to minimizing losses and increasing coverage through restoration efforts. In New Jersey, the wasting disease outbreak in the 1930's is thought to be responsible for the elimination of *Z. marina* in the southern part of the state.

Since limited natural transport of seeds can occur across these distances, active restoration may lead to significant increases in spatial coverage if successfully reestablished in these regions. Essentially, once small populations are established, they can expand vegetatively and through seed dispersal. This project will provide a critical assessment of the genetic structure of *Z. marina* populations in New Jersey and guidance for future restorations efforts.

Estimation of the settling velocity of suspended sediment in the Passaic River, NJ R/6640-003

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In New Jersey, contaminated sediments in the Passaic River and Newark Bay are the result of long periods of industrialization and manufacturing. Contaminants such as dioxin, heavy metals, organic chemicals and pesticides adhere strongly to suspended sediments in the water column and put the Passaic River on the EPA's National Priorities List. Although much of the polluting activity has abated, contaminated sediment continues to be transported out of the Passaic River. Transport pathways of the contaminated sediment are controlled by hydrodynamics and by particle dynamics. Although many aspects of the hydrodynamics in these waterways have been characterized by state-funded projects (NJDEP, NJDOT), our knowledge of the particle dynamics in the system is lacking.

While the general form of the equations that predict suspended sediment transport are well understood, the key inputs to these equations remain elusive. One of the most important, but difficult-to-measure parameters is the rate at which suspended particles fall through the water. Suspended particles in estuaries are complicated aggregates of mineral and organic materials with different sizes, densities, porosities and degrees of stickiness. These characteristics can change on very short time scales depending upon changes in tidal and riverine currents and other factors. Because of the fragility of aggregates, they must be measured in-situ to obtain accurate estimates of their sizes and densities.

This project will determine the relationship between the aggregate size and the settling velocity of suspended aggregates in Newark Bay and the Passaic River. Once this relationship is known, the settling velocity may be determined for any given aggregate size. The project will also help determine the relationship between median aggregate size in the water and ambient conditions, such as the salinity, turbulent shear and proximity to the bottom. These two relationships allow prediction of the settling velocity of aggregates depending upon the local conditions in the water column. Characterization of the particle dynamics in Newark Bay and the Passaic River will greatly improve the prediction of sediment transport using numerical models in these systems.

Development of an HF radar derived nearshore wave and current product: Application to rip current probability along the New Jersey coast R/6640-001

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Rip currents are the number one cause of ocean drowning and rescue incidents along the coasts of the United States. Mechanisms for rip formation include interactions with the ocean floor and the surface waves. Different mechanisms can dominate on different beaches at different times and more than one mechanism can be at work at a given time. This has led to the development of a daily rip current warning issued by NOAA's National Weather Service (NWS) in areas most often at risk.

Inputs to the rip current warning system typically include estimates of nearshore environmental parameters such as the wave height, period and direction, the wind speed and direction, and the alongshore current. Long-term monitoring of local waves and currents in many different locations is needed to get stable statistics on the potential mechanisms to drive these semi-empirical models. CODAR High Frequency (HF) radar measures waves and currents providing the means to monitor surface currents and waves remotely near the coast. Data can be collected continuously over a large range of environmental conditions. At present, over 65 CODAR HF radars are deployed nationally, and the current plan is to expand to a national network of over 200. Systems deployed along the New Jersey coast have supported scientific research, Coast Guard search and rescue, pollution spill response and fisheries research.

The ability to use this growing network as the driver for nearshore rip current warning systems depends on the development and testing of refined wave processing algorithms to bring the wave data products to the same level as the existing current mapping products. The increased wave and current observations nearshore will help researchers better understand the conditions favorable for rip current formation, and ultimately provide the necessary statistics and boundary conditions to predict rip currents. The Rutgers HF Radar testbed located at Sandy Hook was chosen for this effort, since it is the only facility in the world with co-located HF radars operating simultaneously in the same three frequency bands as those deployed worldwide.

Phragmites australis invasion and consequent effects on Fiddler Crab behavior and bioturbation R/6646-001

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Fiddler crabs are important elements in Atlantic Coast salt marshes. As they dig burrows into the marsh sediments, they increase the oxygen content of the sediments, which allows for faster breakdown of decaying material by bacteria and increases the levels of nutrients in the sediments. This, in turn, increases the growth of marsh plants and provides more food for blue crabs, finfish, wading birds and other animals who depend on the marsh directly or indirectly for food. Historically, New Jersey salt marsh plants have been dominated by the grass species *Spartina alterniflora*, which occurs in a tall-growth and a short-growth form, with the short form covering about 90% of marsh surfaces. Recently, however, New Jersey salt marshes have been invaded by the common reed, *Phragmites australis*, which is replacing *S. alterniflora*.

Research to-date which has been dedicated to investigating the impacts of this plant change on the activities of fiddler crabs indicates that areas of tall-form *S. alterniflora* which have been replaced by *P. australis* have significantly reduced numbers of burrows which are also more clumped together, although the average size of burrows does not change. These changes should tend to reduce the turnover of sediment and production of nutrients. In areas of short-form *S. alterniflora* replaced by *P. australis*, the situation is reversed, with the number and size of burrows increasing, and the burrows becoming more randomly spaced. Thus, invasion in these areas may act to increase sediment turnover and nutrient regeneration.

This project is currently focusing on experimentally determining the exact cause of these changes in crab behavior. The research also indicates the fiddler crab response to the specific shapes and sizes of the roots as they burrow into the sediment. In addition, the project is examining the activity of various naturally-occurring radioactive elements in marsh sediments, which will provide a measurement of exactly how much sediment turnover is occurring in native and invaded marshes. These studies will provide a better understanding of how *P. australis* invasion is affecting the food webs of New Jersey salt marshes.

Effects of bulkheads on horseshoe crab spawning and egg availability to shorebirds R/6644-001

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Bulkheads along the sandy shorelines of the estuaries in New Jersey provide protection for human settlements by preventing erosion and flooding. Many bulkheads are built incrementally over time and intersect the shoreline at different elevations. Many older structures were originally built landward of mean high water but are now located on the intertidal beach due to erosion. The discontinuous alignment has created enclaves of relatively wide sandy intertidal beach between segments of exposed bulkhead. Bulkheads are considered hard protection structures because their function is to alter coastal processes by reflecting wave energy away from the shoreline. In some cases, they can eliminate important habitat for species that use the intertidal beach for spawning or foraging.

An example of habitat elimination is found in Delaware Bay where the intertidal beaches are used by horseshoe crabs to spawn and by migratory shorebirds to feed. Shorebirds migrate thousands of kilometers from South America to the Artic and stop in Delaware Bay to feed on horseshoe crab eggs, increasing their body mass before their final flight to their breeding grounds. Population stress on some of the shorebird species, such as the Red Knot, has been attributed to the loss of staging habitat (sandy beaches) as well as the harvesting of horseshoe crabs that has reduced spawning levels and egg availability.

Elimination of horseshoe crab spawning areas by bulkheads built low on the intertidal beach has been noted by previous researchers, but the ecological ignificance of bulkheads high on the beach or within non-bulkheaded beach enclaves between adjacent bulkheaded segments has not been examined. Bulkheads high on the beach may still allow for spawning lower on the beach; habitats and horseshoe crab egg sources may be retained in the sandy beach enclaves between bulkhead segments; and horseshoe crab eggs from outside bulkheaded segments may be transported alongshore seaward of bulkheads and be deliv ered to the sandy enclaves. This study will assess the effect of different configurations of bulkheads on horseshoe crab spawning and the degree to which mobilization and transport of sediments into and within the bulkheaded enclaves increase delivery of horseshoe crab eggs to locations where they can be consumed by shorebirds.

Slipping away? What can glass eel stages tell us about the decline of the American eel *(Anguilla rostrata)* in Middle Atlantic Bight estuaries? R/6640-002

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Eels are critical components of local estuarine ecosystems as well as an important source of bait for recreational fisherman. Commercial catches, trawl/seine surveys and upstream passage counts indicate the number of American eels (*Anguilla rostrata)* are dropping at an alarming rate in multiple regions throughout North America. Population estimates are so dire the American eel is currently being petitioned for inclusion on the endangered species list. Despite these warning signs, the early life of the American eel is still poorly understood, making it difficult to accurately determine its status.

Adult eels migrate out of North American rivers and streams to reproduce in the Sargasso Sea, yet their oceanic young (called "leptocephalus" eels) have remained elusive to scientists. Thus, transformed "glass eels" entering estuaries, including those in New Jersey, represent a first glimpse into American eel early life history. Unfortunately, little is known about long-term trends in glass eel numbers, how their distribution varies in space and time or the environmental factors influencing arrival. Because the abundance and size of young fishes entering estuaries may function as indicators of population health, information related to the arrival of early stage eels is critical for validating the reported declines in the stock.

The primary objectives of this 2-year project on American eel early life history are centered around three themes: (1) Quantifying glass eels entering the Mullica River-Great Bay estuary using long-term data sets and expanded local sampling; (2) Evaluating the consistency of patterns across two river systems (Mullica River-Great Bay, Great Egg Harbor estuaries) in southern New Jersey using arrays of glass eel collectors and (3) Conducting analyses into the environmental cues moderating variability in glass eel supply using long-term data sets and two years of expanded collections. Given the current lack of available data, this information is potentially relevant to the biology and management of local eel fisheries along the entire U.S. east coast. In New Jersey alone, this research will help address the concerns of recreational fisherman who rely on eels as bait for the economically important striped bass fishery.