NERRS Graduate Research Fellowship Projects
At the Narragansett Bay Research Reserve

As of 2004, the Narragansett Bay Research Reserve has supported the research of five graduate students with funding through the NERRS Graduate Research Fellowship (GRF). Four of these fellows have come from Brown University, and one fellow each has come from the University of Rhode Island and Yale University. These students have conducted research on the ecology of cobble-beach plant communities, the ecology of migratory salt marsh sharp-tailed sparrows, salt marsh trophic dynamics, and the use of isotopic signatures to identify different nitrogen sources to Narragansett Bay.

John Bruno from Brown University received his initial funding in 1997. John's research investigated various aspects of the ecology of cobble beach plant communities in Narragansett Bay. The first part of his research found that fringing *Spartina alterniflora* beds along cobble beach shorelines facilitate the formation of diverse plant assemblages behind them (Bruno 2000). These communities formed because the *S. alterniflora* beds reduced water flow velocity and stabilized the substrate, thus enabling other plant seedlings to survive. Further research showed that the relationship between the foundation *S. alterniflora* beds and the coble beach plant communities behind them depended on the size of the *S. alterniflora* bed. Most beds were less than 30 meters in length and did not support any cobble beach plant species (Bruno and Kennedy 2000). There was a strong, positive correlation between *S. alterniflora* bed size and cobble beach plant species richness, due to the fact that longer beds reduced wave-related disturbance more than shorter beds.

Deborah DiQuinzio from the University of Rhode Island also received her initial funding in 1997. Deborah's research as an NBNERR GRF focused on the ecology of the salt marsh sharp-tailed sparrow (*Ammodramus caudacutus*) in Rhode Island salt marshes. More specifically, her research examined migratory sharp-tailed sparrow site fidelity patterns, return rates, survival rates and movement patterns among salt marshes in Rhode Island . This work showed that sharp-tailed sparrows exhibited moderate breeding site fidelity and strong natal philopatry in Rhode Island (e.g., these birds showed strong tendency to return to breed within their natal home range) (DiQuinzio and Paton 2000). Further research examined the nesting ecology of sharp-tailed sparrows in a tide-restricted salt marsh in southern Rhode Island compared to unrestricted marshes elsewhere, including in the NBNERR. From this work it was shown that salt marsh sharp-tailed sparrows tended to nest in short grasses including salt marsh hay (*Spartina patens*), short cordgrass (*S. alterniflora*), and short common reed (*Phragmites australis*). After restoration of the tide-restricted site, 91% of nests failed due to increased tidal flooding, indicating that restoration efforts may have short-term negative impacts on sharp-tailed sparrow populations (DiQuinzio et al. 2002).

Brian Silliman from Brown University focused his research on investigating the degree to which top-down and bottom-up forces control the structure of salt marsh plant communities at different latitudes. This included conducting similar studies in both the NBNERR in Narragansett Bay and at the Sapelo Island NERR in Georgia. A major finding from this work was that top-down forces have a significant effect on salt marsh plant assemblages and on primary production of salt marshes at lower latitudes; in other words, a trophic cascade in these southern marshes was revealed (Silliman and Bertness 2002). More specifically, Brian discovered that when top predators in Georgia salt marshes (e.g., the blue crab, *Callinectes sapidus*) were excluded from the marsh, predation pressure on a primary grazer (the snail *Littorina littorea*) was relieved, resulting in significant effects on the biomass and production of *S. alterniflora* . The same result was not observed further north in the NBNERR where an abundant predator (the mummichog, *Fundulus heteroclitus*) was excluded from Rhode Island salt marsh habitats. Here, top down forces were less important and instead coastal eutrophication is driving shifts in salt marsh plant assemblages. This work illustrates the power of using multiple NERR sites at different locations and latitudes to investigate the applicability of research results to different areas.

Andrew Altieri from Brown University received a GRF from 2001-2003. His research focused primarily on investigating the effects of hypoxia (low dissolved oxygen levels) on the blue mussel *Mytilus edulis*, in Narragansett Bay. One impetus for this research was a large die-off of *M. edulis* in Narragansett Bay that coincided with hypoxic events during the warm summer months of 2001. Events such as this have the potential to severely alter the community structure and function of the benthic communities in estuaries such as Narragansett Bay. Part of Andrew's research examined this in more detail, and used laboratory experiments to quantify the tolerance of three important bivalve species to low dissolved oxygen levels. This work found that mortality of blue mussels, hard-shelled clams (*Mercenaria mercenaria*), and soft-shelled clams (*Mya arenaria*) differed in response to varying levels of hypoxia. For example, fifty percent mortality was observed at three, seven, and nineteen days for blue mussels, soft-shell clams, and quahog clams, respectively. This clearly shows that blue mussels are the most susceptible of the three species to hypoxic events in Narragansett Bay, which typically last up to five days. It also shows that if the frequency and duration of hypoxia were to increase, other species such as *Mya arenaria* will also be threatened.

Jon Duke from Brown also received funding beginning in 2004. During 2004- 2006, Jon's research will focus on quantifying the effects of three anthropogenic stressors in New England salt marshes. This research will use manipulative experiments in NBNERR salt marshes to investigate the effects of global warming, sea-level rise, and eutrophication, the results of which will be used to better inform coastal managers and to direct conservation strategies.