**FINAL** EVALUATION FINDINGS

# GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE
# NEW HAMPSHIRE

*May 2005 – May 2010*

January 2011

Office of Ocean and Coastal Resource Management
National Ocean Service
National Oceanic and Atmospheric Administration

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# I. EXECUTIVE SUMMARY

The Coastal Zone Management Act (CZMA) of 1972, as amended, established the National Estuarine Research Reserve System (NERRS). Sections 315 and 312 of the CZMA require the National Oceanic and Atmospheric Administration (NOAA) to conduct periodic performance reviews or evaluations of all federally approved National Estuarine Research Reserves (NERRs). The review described in this document examined the operation and management of the Great Bay National Estuarine Research Reserve during the period of May 2005 through May 2010. The Great Bay National Estuarine Research Reserve (GBNERR or Reserve) is administered by the New Hampshire Fish and Game Department (NHFG or Department).

This document describes the evaluation findings of the Director of NOAA's Office of Ocean and Coastal Resource Management (OCRM) with respect to GBNERR during the review period. These evaluation findings include discussions of major accomplishments as well as recommendations for program improvement. The fundamental conclusion of the findings is that New Hampshire Fish and Game Department is successfully implementing and enforcing its federally approved NERR.

The evaluation team documented a number of GBNERR accomplishments during this review period. Notable Reserve efforts include facility improvements; conducting research on priority coastal management issues; publishing a 20-year anniversary report *Ecological Trends in the Great Bay Estuary;* continuing to provide and improve highly regarded educational programming; maintaining a strong cadre of long- and short-term volunteers who assist the education and stewardship programs; increasing coordination, outreach, and research around invasive species; and taking a leadership role in facilitating climate change adaptation. In addition, NHFG has strengthened financial and administrative support of GBNERR.

In addition to these numerous accomplishments, the evaluation team identified several areas where the Reserve and its programming could be strengthened. The recommendations for GBNERR are in the form of one necessary action that is mandatory and three program suggestions. The Reserve must have a research coordinator dedicated full-time to implementing the Reserve's research program within three years.

Three program suggestions describe actions that OCRM believes GBNERR could take to improve or enhance its program but that are not mandatory. The Reserve's responsibilities are growing as the Reserve takes on management of new properties and expands its programming. Suggestions thus include encouraging NHFG and GBNERR to explore and pursue opportunities that will enable the Reserve to accept additional funding and to develop a long-term stable source of funding for managing conservation lands in perpetuity. In addition, OCRM also encourages NHFG to develop and implement a system to ensure that NHFG staff can quickly and easily determine if a property is part of the Reserve.

## II. PROGRAM REVIEW PROCEDURES

### A. Overview

NOAA began its review of GBNERR in February 2010. The §312 evaluation process involves four distinct components:

1. An initial document review and identification of specific issues of particular concern;
2. A site visit to New Hampshire including interviews and a public meeting;
3. Development of draft evaluation findings; and
4. Preparation of the final evaluation findings, partly based on comments from the state regarding the content and timetables of recommendations specified in the draft document.

The recommendations made by this evaluation appear in boxes and bold type and follow the findings section where facts relevant to the recommendation are discussed. The recommendations may be of two types:

> **Necessary Actions** address programmatic requirements of the CZMA's implementing regulations and of the GBNERR approved by NOAA. These must be carried out by the date(s) specified;
>
> **Program Suggestions** denote actions that the OCRM believes would improve the program, but which are not mandatory at this time. If no dates are indicated, the state is expected to have considered these Program Suggestions by the time of the next CZMA §312 evaluation.

A complete summary of accomplishments and recommendations are outlined in Appendix A.

Failure to address Necessary Actions may result in future finding of non-adherence and the invoking of interim sanctions, as specified in CZMA §312(c). Program Suggestions that are reiterated in consecutive evaluations to address continuing problems may be elevated to Necessary Actions. The findings in this evaluation document will be considered by NOAA in making future financial award decisions relative to the GBNERR.

### B. Document Review and Issue Development

The evaluation team reviewed a wide variety of documents prior to the site visit, including (1) the federally approved 2006-2010 Management Plan and program documents; (2) financial assistance awards and work products; (3) semi-annual performance reports; (4) official correspondence; (5) previous evaluation findings; and (6) relevant publications on natural resource management issues in New Hampshire.

Based on this review and on discussions with OCRM's Estuarine Reserves Division, the evaluation team identified the following priority issues:

- The Reserve's general administration, including grants and fiscal management;
- Implementation and status of the Management Plan;
- Facilities development and operations planning;
- Implementation of the Reserve's research, stewardship, monitoring, coastal training, and education programs;
- Reserve staffing and needs;
- The manner in which the Reserve coordinates with other governmental and non-governmental organizations and programs in the state and region;
- Major accomplishments and challenges during the review period;
- The state's response to the previous evaluation findings dated September 2005; and
- The partnership with the University of New Hampshire to implement the NERRS monitoring program.

## C. Site Visit to New Hampshire

Notification of the scheduled evaluation was sent to the NHFG and GBNERR. In addition, a notice of NOAA's "Intent to Evaluate" was published in the *Federal Register* on April 2, 2010; *Fosters Daily Democrat*, a regional newspaper on April 1, 2010; and it was published in the state's largest newspaper, the *Manchester Union Leader*, in April 2010.

The site visit to New Hampshire was conducted May 18-21, 2010. Carrie Hall, Evaluation Team Leader, OCRM National Policy and Evaluation Division; Cory Riley, GBNERR Program Specialist, OCRM Estuarine Reserves Division; and Paul Dest, Reserve Manager, Wells NERR, Maine formed the evaluation team.

During the site visit, the evaluation team interviewed GBNERR and New Hampshire Fish and Game staff, federal partners, University of New Hampshire researchers and staff, other state officials, and nongovernmental representatives. Appendix B lists persons and institutions contacted during this review.

As required by the CZMA, NOAA held an advertised public meeting during the evaluation on May 19, 2010, at 7 p.m., at the Hugh Gregg Coastal Conservation Center, 89 Depot Road, Greenland, New Hampshire. The public meeting is to give members of the general public the opportunity to express their opinions about the overall operation and management of GBNERR. Appendix C lists persons attending the public meeting.

The excellent support of GBNERR staff with the site visit's planning and logistics is gratefully acknowledged.

## III. RESERVE PROGRAM DESCRIPTION

NOAA's Office of Ocean and Coastal Resource Management designated the Great Bay Estuarine Research Reserve in 1989. The state lead agency is New Hampshire Fish and Game Department.

The Reserve incorporates selected key land and water areas covering approximately 10,235 acres and 48 miles of shoreline that are representative of the Acadian biogeographic region. The Great Bay estuary is a drowned river valley and is subject to high tidal energy and seasonal ice scour. The waters of the Reserve include all of Great Bay itself, the small channel from the Winnicut River, and larger channels from the Squamscott and Lamprey Rivers, which meet in the center of the Bay to form a main channel. The main channel connects to Little Bay at Adams Point. The Great Bay estuary also drains the Oyster, Bellemy, Cocheco, Salmon Falls, and Piscataqua Rivers. Although most of the Great Bay system is located in New Hampshire, one third of the estuary's total drainage of 930 square miles lies in Maine. The shoreline and upland holdings of the Reserve include rocky shores, salt marshes, tidal creeks, upland fields/woodlands, sheltered coves, and bluffs. These key land areas, constituting a mosaic of parcels ranging in size from one to 300 acres, have been incorporated into the Reserve by purchase or easement. Numerous waterfowl species and several rare birds are found in the area, including the bald eagle, common tern, and osprey, as well as rare plants.

The Great Bay has played a central role in the region's economy from the first European settlement. Historically, the Bay supported an active commercial fishery for oysters, lobsters, clams, and numerous finfish. The surrounding watershed provided timber for shipbuilding and other industries locally, as well as for export. With the Industrial Revolution, the region's economy began to shift to manufacturing, especially textiles. By the end of the 18th century, improvements in industrial practices and public sanitation were being sought to curb the threat of disease from organic wastes. Fisheries continued a decline that has been accelerated by pollution of all types. Not until a series of waste water treatment plans were built in towns surrounding the Bay in the 1960s did water quality begin to improve. Nevertheless, site-specific water quality problems persist. A profile of the Bay notes that while it is common to refer to the estuary as pristine, the Great Bay estuary exhibits warning signals of its fragility: shellfish closures, loss of eel grass habitat, and increasing shoreline and upland residential development.

Until recently much of the shoreline of Great Bay estuary had escaped the development pressures that have fundamentally altered estuarine systems throughout the United States. A number of factors have limited development pressures over the past 30 years. At low tide much of the Bay bottom is exposed as mudflats, making boating difficult. Great Bay is relatively removed from the Boston and Portland population centers. Further, the Bay is accessible at only a few points and is all but invisible from the area's roads. As a result, Great Bay has often been described as New Hampshire's hidden coast. Current uses of the Bay include limited commercial and recreational fin- and shell-fishing, boating, hunting, bird watching, and other passive pursuits.

## IV. REVIEW FINDINGS, ACCOMPLISHMENTS, AND RECOMMENDATIONS

### A. Operations and Management

The Reserve is administered through the Marine Fisheries Division of NHFG. Federal funds for the implementation of the Reserve's monitoring program and some special projects, such as the habitat mapping classification project, are managed by the University of New Hampshire and match is provided by the University.

GBNERR's administrative goal, as stated in the 2006-2010 Management Plan is to "Provide administrative leadership and resources necessary to fulfill the Reserve's mission as established in state and federal law, administrative rules and inter-agency agreements."

The objectives are:

- **Staffing:** Develop staff assessment tools and strategies for increasing staff effectiveness and efficiency.
- **Federal Relationship:** Strengthen the existing partnership between the Reserve, NHFG, State of New Hampshire and NOAA.

During the evaluation period, NHFG and GBNERR made significant improvements in operations and management including strengthened financial and administrative support of the Reserve; identification of four priority themes and coordinated work across sectors to effectively and efficiently address these themes; an expanded boundary approved by NOAA through the management plan approval process; expanded facilities; strengthened partnerships with other federal, state, local, and nonprofit agencies; and an increased visibility in the region.

#### 1. Reserve Administration

NHFG has considerably strengthened its support of the GBNERR and successfully addressed a necessary action of the previous evaluation that NHFG needed a "*dedicated or more stable nonfederal stream for the Reserve's general operation and management"* than volunteer match. At the current time, the Department is not relying on volunteer match and is matching federal cooperative agreement funds in its state fiscal year budgets at the required 70:30 federal/state ratio. By not relying on volunteer match, volunteer hours are now available to be counted as match for other grants that benefit the Reserve. NHFG has also enhanced its administrative support of the Reserve, particularly in the areas of grants management, public outreach and publication services, as well as property maintenance, operations, and enforcement. OCRM commends the Department for increasing its support of the Reserve which has enabled the Reserve to strengthen and improve its outreach, research, educational, and stewardship programming.

NHFG has also increased opportunities for private and non-profit support of the Reserve. For example, the Department developed and signed a Memorandum of Agreement with the Great Bay Stewards that allows them to collect program and building rental fees in support of the

Reserve. The funds have been used to support a number of maintenance projects such as the repair of the geothermal system at the Hugh Gregg Conservation Center. In addition, the state of New Hampshire established the Wildlife Heritage Foundation, a nonprofit organization, to support the NHFG. The Foundation is able to accept gifts from small businesses, corporations, other foundations, and individuals that are used to support projects and programs that support sustaining the traditions, lifestyle, and special places of New Hampshire. The Reserve recently successfully applied for a grant from the Foundation to support the construction of a new exhibit highlighting the area's local heritage and an outdoor viewing deck at the Conservation Center.

**Accomplishment: The New Hampshire Fish and Game Department has significantly strengthened its financial and administrative support of GBNERR.**

Although state financial and administrative support of the Reserve has improved, it remains difficult for the Reserve to accept additional funding that becomes available after the state's biennium budget is passed. New Hampshire operates under a biennium budget and once the budget is passed, agencies are not allowed to accept additional funds, except through a time consuming special approval process. Although the Reserve has been able to work with the University of New Hampshire to accept some additional OCRM funds to conduct projects, the Reserve has also missed opportunities to accept funds to enhance other programs such as education. During the evaluation site visit, the evaluation team discussed with Department staff possible mechanisms for accepting additional funds that might become available after a budget is passed. Mechanisms identified included adding additional federal funds into the two-year budget to allow the Reserve the flexibility to accept additional federal funds if they were to become available. Additionally the Reserve could expand their partnerships with other organizations such as the University of New Hampshire and/or Great Bay Stewards who could accept external funding for priority projects.

**Program Suggestion: OCRM encourages NHFG to explore and pursue mechanisms that will enable the Reserve to enhance and expand its programs with external funding sources.**

### 2. Staff

The Reserve is staffed by six full-time employees (manager, education coordinator, research coordinator, stewardship coordinator, coastal training program coordinator and assistant education coordinator) and five part-time employees (naturalist, park guide/program assistant, volunteer coordinator, maintenance mechanic/caretaker, and for four-six weeks in the summer a laborer). The Reserve staff's offices are located on site at the Great Bay Discovery Center in Greenland except for the Reserve manager and research coordinator whose primary office space is in the NHFG building in Durham. The education coordinator directly supervises staff located on-site at the Reserve.

Reserve staff are highly valued in the region for their expertise and ability to bring partners together to implement projects. During the evaluation period, Reserve staff have built and strengthened partnerships to address key issues and examples are highlighted throughout the findings. Reserve staff have also increased cross sector coordination through the identification

of four priority themes (biological assessment, water quality, climate change, and land use) and have worked together to develop and implement projects to address these priority areas. The evaluation team was impressed by the level of integration across sectors and the findings highlight a number of examples of how sector integration has enabled staff to maximize their on-the-ground impact.

The Reserve manager, who is well respected in the region and has led the Reserve since its inception, announced his planned retirement in mid-2011 before the evaluation site visit. The hiring of a new manager will be a significant change and transition for the Reserve. The evaluation team heard from numerous partners the importance of the long-term partnerships built by the reserve manager and their concerns regarding the transition. In the upcoming months, NHFG and GBNERR will have the opportunity to plan for the recruitment of a new manager and the transition process. NHFG and GBNERR will be developing the selection criteria and selection process for a new manager and may wish to consider if it would be beneficial to include partners in any part of the process. In addition, Reserve management and staff have time to prepare a plan for the transition that includes the key duties of the manager, developing a process to bring the new manager up-to-speed, and ensuring all necessary duties are covered through the hiring and training process. OCRM encourages the Department to develop recruitment and transition plans to ensure a smooth transition and timely hiring of a new reserve manager.

The NERRS requires that all Reserves have three core positions: reserve manager, education coordinator, and research coordinator and strongly encourages states to demonstrate their support for the program by funding the core positions. During the evaluation period, the research coordinator position has been funded in part with CICEET funding. The research coordinator has supported CICEET through developing materials and programs that demonstrate the utility of CICEET funded projects to other Reserves and potential users. The CICEET program is coming to a close and in August 2012 will no longer be able to provide support for the research coordinator position.

During the site visit, the evaluation team discussed with Department management the importance of having a stable funding source and state support for the research coordinator position. Research coordinators are expected to serve as a facilitator and coordinator between scientists and managers to encourage additional research on priority coastal management issues and support NERRS initiatives as well as conducting their own research on priority coastal issues. Due to the broad mandate of the research coordinator's role, it is important that research coordinators not rely on grant funding and implementation of specific projects to support their salaries. In addition, although the research coordinator support of CICEET has been valuable, this has meant the research coordinator has had less time to focus on the core activities of the position. During discussions with the evaluation team, Department management noted that the Department will have a new funding source, salt water license fees, beginning in 2011 and this funding could be used to support the research coordinator position. OCRM strongly encourages NHFG to assume full support of the research coordinator position.

**Necessary Action: A full-time research coordinator should be solely focused on implementing the Reserve's research program by January 2014.**

### 3. Management Plan and Boundary Expansion

Reserves are required by Federal regulation to have a current NOAA-approved management plan (15 C.F.R. sec. 921.13). The plans describe the reserves' goals, objectives, and management issues, as well as strategies for research, education and interpretation, public access, construction, acquisition, and resource preservation, and, if applicable, restoration and habitat manipulation. A management plan has four valuable functions (1) to provide a vision and framework to guide reserve activities during a five year period; (2) to enable the reserve and NOAA to track progress and realize opportunities for growth; (3) to present reserve goals, objectives, and strategies to constituents; and (4) to guide program evaluations. Regulations also require that a reserve's plan be updated every five years.

The Reserve's latest management plan was approved in September of 2007, successfully addressing a necessary action in the previous evaluation that the Reserve must complete an updated management plan. The 2006-2010 Management Plan included a major boundary expansion, extending the boundary of the Reserve to include Little Bay and tidal portions of the Bellamy, Oyster, Lamprey, Squamscott, and Winnicut rivers. The boundary expansion added 2,830 acres of open water and salt marsh as well as 1,052 acres of upland bringing the total acreage of the Reserve from 6,353 to 10,235 acres. The Reserve also has an approved acquisition zone comprising an additional 20,172 acres. The expansion of a Reserve's boundary is a comprehensive process that requires extensive effort and coordination with NOAA. OCRM commends the Reserve for successfully expanding its boundary, enabling the Reserve to better address land management issues within the region. The Reserve has also successfully partnered with the Great Bay Resource Protection Partnership to acquire and assume management responsibility of lands within its boundary during the evaluation period *(see Section E. Stewardship).*

**Accomplishment: GBNERR successfully expanded its boundary by almost 4,000 acres, worked with the Great Bay Resource Protection Partnership to protected additional lands within its boundary, and assumed management of additional lands where appropriate.**

During the upcoming evaluation period, the Reserve will revise and update the management plan. The Reserve has grown during the past five years with the addition of new facilities and lands to manage and will be hiring a new reserve manager in 2011. As the Reserve prepares for developing its new management plan, OCRM encourages the Reserve to reflect on its priorities, new opportunities brought about by change, and existing business practices to ensure the Reserve is addressing priority issues as efficiently and effectively as possible. With the 2005 plan, the Reserve doubled in size. With the expanded boundary came additional potential conflicting uses. The Reserve should also include more detail about the allowable uses and compatible activities within Reserve properties in the next management plan to ensure that the state has adequate control over key Reserve resources.

### 4. Facilities

The Reserve's facilities are essential for meeting the mission of the Reserve. The 2006-2010 Management Plan includes a goal to "Enhance the mission of the Reserve and its associated research, education, and stewardship programs through the maintenance and development of facilities necessary to support these efforts."

The objectives for this goal are:

- **Program and Exhibit Space:** Increase the amount of program and exhibit space with a special emphasis on providing additional meeting and classroom areas.
- **Trail and Public Access:** Provide appropriate increased trail and public access on properties added to the Reserve through the land acquisition efforts of the Great Bay Partnership.
- **Maintenance of Reserve Facilities:** Develop a comprehensive facilities and maintenance plan for the next five years to meet the future needs of the Reserve.

The Reserve greatly enhanced its facilities during the evaluation period allowing it to provide expanded and enhanced programming and public access. The Hugh Gregg Coastal Conservation Center opened in 2006 and provides a large conference room with audio visual capability, exhibits on the uplands of Great Bay, and a caterer's kitchen. The new facility allows the Coastal Training Program to host events on site and can be used to hold trainings for up to 100 participants. The building is also used extensively by the Reserve's education program. The new facility highlights green building techniques including a geothermal heating and cooling system and compostable toilets. In addition, a new parking lot that services both the Conservation Center and Great Bay Discovery Center was designed by the University of New Hampshire (UNH) Stormwater Center and features porous asphalt and pervious concrete sidewalks. The UNH Stormwater Center has partnered with the Coastal Training Program to provide trainings at the Conservation Center on low impact development (LID) techniques and the Conservation Center and parking area serve as a demonstration site. The new Conservation Center and parking lot have been landscaped with native and heritage plants and a children's garden, rain garden, and donated waterfall and stream feature have been installed. The Reserve also worked with multiple partners to develop and construct a 4.2 mile public trail *(see Section E. 4. Public Access)*.

**Accomplishment: OCRM commends the Reserve for facility improvements including (1) the construction of the Hugh Gregg Conservation Center, (2) installation of porous asphalt and sidewalks, (3) creation of a 4.2 mile trail, and (4) installation of native landscaping.**

The Reserve continues to maintain the Great Bay Discovery Center which provides office space for staff and features exhibits on the estuarine habitats of Great Bay, a touch tank, and a salt marsh tank. The Reserve also has a 1,700 foot boardwalk, enclosed pavilion, and ropes course that are used for educational programming.

The Reserve also successfully applied for a grant from the Wildlife Heritage Foundation of New Hampshire to develop a special collection room in the basement of the Conservation Center that will display and preserve antique hunting and fishing artifacts, publications, and audio records and to construct an outdoor viewing deck. The Reserve has received numerous donated artifacts over the years and this space will be designed to highlight these cultural artifacts and tell the history of the area.

### 5. Great Bay Stewards

The Great Bay Stewards are an all volunteer nonprofit whose mission is protect and preserve the vitality of the Great Bay estuarine system through education, land protection, research, and care of the Great Bay. The Stewards serve as the official friends group of the GBNERR through a Memorandum of Agreement with the NHFG and have approximately 300 members.

The Great Bay Steward volunteers provide exceptional support to the Reserve. The Stewards form the core and backbone of the volunteers at the Reserve and donate thousands of hours annually to support Reserve programs. Stewards participate in many activities including conducting educational and outreach programs, staffing the Discovery Center, serving as Community Land Stewards, constructing trails, participating in invasive plant control projects, and hosting a monthly speaker series on topics pertinent to the seacoast.

The Stewards also raise funds to support GBNERR through several smaller fund-raisers and two signature events, the Great Bay 5K Road Race & Fun Run and Art of Great Bay Show. The funds enable the Stewards to sponsor Reserve projects and other activities that promote their mission. For example, the Stewards initiated a graduate student research grant program in 2006 that provides up to $1,000 for two or more recipients to support research in or around Great Bay that furthers the Steward's mission. In addition, the Stewards initiated a high school scholarship program in 2007 and offer $1,000 to two or more recipients demonstrating an interest in conservation of the Great Bay estuarine system. OCRM commends the Great Bay Stewards for their extensive support of Reserve programs and for the creation of scholarship programs that engage and support high school and graduate students in research at the Reserve.

During the evaluation site visit, the evaluation team met with members of the Great Bay Stewards Board. The board members discussed how the Stewards are interested in raising additional funds and raising their profile to make a bigger impact in Great Bay. The Stewards have developed a well designed website, set up an on-line donation system, and initiated a monthly newsletter and Facebook page to better reach members and the public. The Stewards are also working with two consultants from the Executive Service Corps to determine their long term goals for growth and best approaches for moving forward. OCRM commends the Stewards for exploring how to grow their organization and encourages Reserve staff to continue to work with the Stewards to determine how best to advance the missions of both organizations as the Stewards grow and evolve as an organization.

## 6. Partnerships

The Reserve continues to maintain and build strong partnerships with other agencies and entities, enabling the Reserve to maximize cost effectiveness and better achieve its mission and goals with limited staff and financial resources. These partnerships are essential to the success of Reserve programs and specific examples are highlighted throughout the findings. OCRM commends the Reserve staff for fostering such productive partnerships. OCRM also acknowledges that the Reserve relies heavily on partners to implement required NERRS programs and encourages NHFG to continue to explore how to directly support these efforts in the future. Key partnerships include:

- The **Great Bay Resource Protection Partnership** has been a key partner in conserving Great Bay lands. The Partnership was formed in 1994 to further collective conservation goals and promote conservation actions in the Great Bay region. Principal partners include federal and state agencies and nonprofits. The Partnership has been very successful in obtaining federal grants and congressionally-directed funds through the NOAA budget to support land acquisition. Local governments have also contributed to land acquisition efforts. The Nature Conservancy serves as the lead acquisition agent. Many of the parcels acquired by the Partnership are ultimately transferred to NHFG and incorporated into the Reserve. Through the Partnership, habitat protection strategies and stewardship activities are also developed and implemented.

- The **Great Bay Stewards**, the official Friends Group of the Reserve, provide both volunteer hours and financial support of Reserve programs which is further discussed in *Section A.5 Great Bay Stewards.*

- The **Natural Resources Outreach Coalition** (NROC) is a multi-organizational initiative offering coordinated assistance to communities wishing to protect their natural resources while accommodating growth. NROC core partners are the GBNERR, New Hampshire Coastal Program, New Hampshire Department of Environmental Services, Piscataqua Region Estuaries Partnership, New Hampshire Sea Grant, Rockingham Planning Commission, Strafford Regional Planning Commission, and the University of New Hampshire Cooperative Extension. NROC has an annual application process and selects up to three communities to receive tailored assistance addressing the specific concerns and needs of the host community.

- The **New Hampshire Coastal Program** and Reserve collaborate to address a variety of coastal issues such as water quality and climate change and work together to provide assistance to local communities through NROC.

- The **Piscataqua Region Estuaries Partnership** (PREP), part of the Environmental Protection Agency's National Estuary Program, is a key partner in monitoring Great Bay. PREP provides additional monitoring stations and also uses the Reserve's SWMP data in its State of the Estuary reports and to further develop its management priorities.

- The Reserve also works with the **University of New Hampshire Sea Grant**. Sea Grant conducts a Marine Docent Training Program and many of these trained docents volunteer at the Reserve. Sea Grant also sponsors a number of research projects and helps to evaluate research projects supported by the Reserve.

- The **University of New Hampshire Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET)** and the **Stormwater Center** (an outgrowth of CICEET) have partnered to promote the protection of water resources through more effective stormwater management. The Coastal Training Program in particular has worked closely with the Stormwater Center to bring the latest knowledge in stormwater treatment and stormwater run-off reduction to local government officials and those involved in the construction industry. In addition, the research coordinator supports the work of CICEET and transfer of technologies to users within the Reserve and other communities.

- The **University of New Hampshire Marine Program** implements the Reserve's System-wide Monitoring Program (SWMP) and the biomonitioring and habitat mapping and change elements of SWMP.

At the national and regional level there is increasing support for and effort towards regional ocean and coastal management planning and governance. The Gulf of Maine Council, Northeast Regional Ocean Council, NOAA and others are engaged in regional planning and implementation efforts. OCRM encourages the Reserve to work with its partners to determine and further refine what the GBNERR's role is in regional planning efforts and any new initiatives.

### 7. Visibility

During the evaluation period, the Reserve has undertaken numerous steps to increase its visibility and that of the NERRS. The Reserve (1) changed its logo to the NERRS logo to better identity the program with NOAA (2) changed the name of the Discovery Center from Sandy Point to Great Bay to connect the name to the bay (3) redesigned the Reserve's magazine, *Great Bay Matters* and began to print it in full color (4) worked with the Great Bay Stewards to use new forms of communication such as Facebook and Constant Contact (an e-letter program) (5) is updating their website through the State Office of Information Technology, and (6) has increased signage on properties and has plans to install additional signage. In addition the Reserve also authored *Ecological Trends in the Great Bay Estuary* a report highlighting trends in human use, land use, water quality, biological communities, and the Reserve's role in addressing issues in the Great Bay.

## B. Research and Monitoring Program

The Reserve System's research and monitoring program provides a stable environment for research through long-term protection of Reserve resources; addresses coastal management

issues through coordinated estuarine research within the System; and collects and makes available information necessary for improved understanding and management of estuarine areas.

The goal of the GBNERR's research and monitoring program, as stated in the 2006–2010 Management Plan is to "improve the health of the Great Bay estuary and the watershed by conducting research and monitoring activities and providing information that promotes informed resource management."

The objectives are:

- **Research and Monitoring Information Database:** Develop a fundamental research and monitoring database to secure the necessary technology and resources to manage the information.
- **Monitoring Physical, Chemical, and Biological Processes:** Monitor physical, chemical, and biological processes that either impact or reflect the health of estuarine ecosystems.
- **Habitat Classification and Land Use Database:** Develop a database on major patterns of habitat classification and land uses within the Great Bay Reserve watersheds.
- **Accessing and Analyzing Ecological Features:** Access and analyze two fundamental ecological features of GBNERR (1) Basic community structure in major habitat types (e.g., uplands, emergent wetlands, benthos); and (2) Population trends of important "target species," including those of commercial, recreational, or conservation significance.
- **Restoration of Impacted Habitats:** Collaborate, assist in, and facilitate the restoration of impacted habitats in Great Bay.
- **Communication of Research and Monitoring Information:** Communicate research and monitoring information, including potential funding sources, to resource managers, scientists, educators, and the public.

The Reserve's research and monitoring program is staffed by a full-time research coordinator. The abiotic monitoring for the System-wide Monitoring Program (SWMP) is implemented through UNH Marine Program as are projects associated with the habitat mapping and change and biomonitoring elements of SWMP. Research conducted and facilitated by the Reserve includes a strong focus on the Reserve's four priority themes and the information needs of local coastal decision makers. A number of evaluation participants emphasized the value of having a research coordinator focused on watershed and ecosystem issues and the relevance of this research to coastal managers.

The Reserve has a Research Advisory Committee which was formed in 2002 that includes representatives from the NERRS Science Collaborative, UNH Marine Program/NH Sea Grant, Wells NERR, UNH Jackson Estuarine Lab, UNH Stormwater Center, PREP, and the Department of Environmental Services. The Research Advisory Committee meets annually and provides GBNERR with input on the research program direction and scope of the research coordinator's work.

## 1. Research Program

The research program has focused on conducting and facilitating research at an ecosystem level that supports the decision making needs of coastal managers. For example, the research coordinator has served as the New Hampshire lead for a multi-state Rainbow smelt recovery project. The Rainbow smelt population has been declining for 15 years and in 2004 was listed as a species of concern by NOAA National Marine Fisheries Service. The research coordinator worked with NH Marine Fisheries staff and staff from Maine and Massachusetts to secure NOAA Proactive Conservation Program funding for a five-year grant to document the status of smelt spawning populations, understand the factors affecting them, and develop an integrated conservation plan by 2012 to protect them.

The research and Coastal Training Program (CTP) coordinators have also taken a lead role in furthering understanding of the regional risks of climate change and encouraging local adaptation efforts. Through the educational efforts of the CTP and others *(see Section D. Coastal Training Program)* local decision-makers and regional planners began to request locally relevant information on flood risks in the context of climate change that they could use as a basis for guiding development and planning infrastructure investments. The research and CTP coordinators collaborated with UNH, Antioch University New England, and the Rockingham Planning Commission to successfully pursue a CICEET grant to understand how climate change and land use will affect local flood risks in the future. The project *Assessing the Risk of 100-year Freshwater Floods in the Lamprey River Watershed of New Hampshire Resulting from Changes in Climate and Land Use* was funded in 2009. The research coordinator serves as the collaborative lead on the project and will collaborate with a diverse group of local stakeholders to ensure that products produced will be relevant and suit local needs. The CTP coordinator will lead the knowledge dissemination component of the project including conducting training workshops.

The research coordinator has played a core role in promoting the acquisition of high-resolution elevation data using LiDAR for regional coastal areas and local parts of Great Bay. The research coordinator and two collaborators from the University of New Hampshire wrote a white paper explaining the need for LiDAR data for three coastal watersheds in Maine and New Hampshire and the data and processing specifications needed to address the decision making needs of coastal managers. The letter generated letters of support from 26 federal, state, and regional agencies or organizations and helped to shape a broader regional LiDAR project in response to a U.S. Geological Survey request for proposals. The research coordinator also contacted NOAA's National Geodetic Survey to inform them of the Reserve's LiDAR needs before they developed their 2010 flight plans for LiDAR and aerial imagery collection in New Hampshire.

**Accomplishment: GBNERR's research program facilitates and conducts research on priority issues that is informing coastal management in the New England region.**

The research coordinator also actively communicated the results of Reserve research and published numerous publications, presented results to the scientific and coastal management community, and participated in NERRS, state, and local workgroups. Papers published have

addressed topics such as *Protecting a threatened coastal fish species through collaborative regional and research planning, Effects of suspended solids on estuarine fish and shellfish: observations and implications in Great Bay, and Research and Monitoring components of the National Estuarine Research Reserve System.* In addition to publishing scientific papers the research coordinator has also written articles for *Great Bay Matters*, communicated research results to the general public and given presentations at conferences, national reserve meetings, GBNERR Coastal Training Program workshops and educational events, and on community radio.

The research coordinator has also served on local and state committees including (1) PREP Technical Advisory Committee which provides input into water quality monitoring, ecosystem indicators development and interpretation, and nutrient criteria development for Great Bay and (2) the New Hampshire Coastal Program Salt Marsh Restoration Technical Review Team, a group of coastal scientists and coastal managers who review the progress of salt marsh restoration plans and restoration efforts and provide technical guidance to increase the likelihood of success. Participation on local and state committees is a valuable mechanism for communicating Reserve research results and facilitating its incorporation into coastal management decision making.

The research coordinator has also supported national NERRS efforts through participation on several committees including the NERRS-CICEET Workgroup. The workgroup identified areas collaboration between CICEET and the NERRS culminating in a CICEET request for proposals whereby NERRS led proposals could be submitted to CICEET. The research coordinator was also a member of the NERRS Graduate Research Fellowship Program Follow-Up to Internal Review Workgroup which has focused on addressing the recommendations from a 2008 evaluation of the program.

### 2. System-wide Monitoring Program

The goal of the NERR System-wide Monitoring Program (SWMP) is to identify and track short-term variability and long-term changes in estuarine water quality, habitat, and land use in each reserve. The data gathered through SWMP provides standardized information about how estuaries function and change over time, enabling scientists to gain a better understanding of how human activities and natural events can change coastal ecosystems.

The SWMP continues to be administered by the UNH Marine Program and has benefited from having a long-term SWMP technician, ensuring consistency in monitoring techniques over time. The previous evaluation included a suggestion that the Reserve and UNH should communicate regularly and that the research coordinator should maintain active involvement and oversight of the program to ensure system-wide requirements are successfully met. During the evaluation period, this concern was successfully addressed and the research coordinator works closely the UNH to ensure compliance with national NERRS SWMP protocols through quarterly and as-needed meetings. In addition, a Memorandum of Agreement outlining UNH and Reserve responsibilities was signed as part of the development of the 2006-2010 Management Plan.

OCRM commends the Reserve and UNH for improving communication and implementation of SWMP during the evaluation period.

UNH provides for the operation and maintenance of the four SWMP stations which are located in the middle of Great Bay, Squamscott River, Lamprey River, and Oyster River where temperature, depth, salinity, turbidity, pH, and dissolved oxygen are measured every 15 minutes. A Campbell Scientific weather station provides 15-minute, hourly and daily data on air temperature, relative humidity, barometric pressure, rainfall, wind speed, and wind direction that are delivered to NERRS Centralized Data Management Office (CDMO). During the evaluation period, the weather station was moved from the roof of Jackson Estuarine Lab (JEL) on the shore of the estuary at Adams Point to an open cornfield in Greenland to better comply with specifications in the SWMP protocol. The four SWMP stations and weather station are telemetered and provide real-time water quality data which is available on CDMO's website at http://cdmo.baruch.sc.edu and at www.greatbaydata.org. In addition to the parameters required by SWMP, additional water quality and environmental parameters are also measured.

The collection of SWMP data and additional water quality and environmental data is valued and supported by Reserve partners. CICEET has used the Reserve as a test site and supported additional monitoring and telemetering for the program. In addition, PREP also supports some water quality monitoring in the Reserve and the UNH Marine Program has provided additional support to fill needed gaps. Through strategically implementing a monitoring program with partners like CICEET and PREP, the data collected by the Reserve has added value that it would not have if the Reserve's SWMP stations were deployed alone. With the sunset of the CICEET program, OCRM encourages the Reserve to work with NHFG, and other partners monitoring water quality in Great Bay, to ensure that the value of the data is not diminished as supplemental CICEET funding is no longer available.

The water quality and nutrient data collected through SWMP is being used by coastal decision makers and was noted by several participants as being instrumental in establishing nutrient criteria for the Great Bay estuary and the recent listing of the estuary as impaired due to nitrogen pollution under the Clean Water Act. The turbidity data from SWMP has been used as a basis for assessing potential threats posed by sedimentation to fish in the Oyster River. In addition, many university researchers and agency biologists have used the data in a variety of research projects, including eelgrass modeling, biological resource assessments, sediment transport studies, and microbial tracking.

During the evaluation period, the Reserve also initiated several biological monitoring efforts. In 2006 and 2007, the Reserve collaborated with a JEL scientist to conduct monitoring of a seagrass meadow in Great Bay to compare the usefulness of the SeagrassNet monitoring protocol (quarterly) and the NERRS biomonitoring protocol (mid-summer during peak biomass) in the same seagrass meadow. The study found that both monitoring protocols provided valuable baseline data on the *in situ* conditions of seagrass. The NERRS protocol showed a gradient in plant parameters from nearshore to the deep edge of the seagrass bed, while the SeagrassNet protocol enabled rapid detection of seagrass change at certain locations in the bed within a relatively short time period. Although the Reserve has not had the funding to continue using the

NERRS biomonitoring protocol, JEL has continued to map the extent of eelgrass and conduct SeagrassNet monitoring of the site. In 2010, the Reserve received NERRS funding to initiate Tier 2 biomonitoring in three marshes. The study will allow the Reserve to focus on determining (1) the spatial structure and temporal dynamics of emergent vegetation in Great Bay's salt marshes; (2) how these are related to physical factors such as water level and salinity; and (3) the spatial and temporal patterns of elevation and accretion, and relation to the distribution of vegetation communities. The study will lay the groundwork for understanding the future impacts of climate change on marshes.

In 2009, the Reserve published *Ecological Trends in the Great Bay Estuary*, a 20-year anniversary report. The report uses data collected by the Reserve and its partners to document major changes in the ecosystem and focuses on three Reserve priority themes—land use and habitat change, water quality and biological communities. The monitoring data is synthesized and interpreted and contextual information on relevant management issues and Reserve activities is provided.

**Accomplishment: GBNERR used Reserve and partner data to explore trends in land use and habitat change, water quality, and biological communities and to highlight Reserve activities in the report *Ecological Trends in the Great Bay Estuary*.**

### 3. Site Profile

NERRS implementing regulations require each reserve to develop a comprehensive site profile. A site profile is designed to (1) compile scientific datasets relating to the reserve, (2) characterize the physical and biotic components of the environment, (3) synthesize the known ecological relationships within the reserve and its watershed, (4) trace the impact of natural and human disturbances, and (5) explore the need for future research, education, and management initiatives.

GBNERR completed its site profile in 1992. In 2003, *A Synthesis of Research Needs for the Great Bay Estuary* was completed for the Reserve. The Reserve may find it beneficial to update recommendations for future research and monitoring and/or other sections of the site profile to encourage research that supports the Reserve. OCRM encourages the Reserve to provide the existing site profile on-line, once scanned by OCRM.

### 4. Graduate and Undergraduate Research Fellowships

The Reserve continues to be actively engaged in the education and training of both undergraduate and graduate students. During the evaluation period, the Reserve has sponsored five NERRS Graduate Research Fellows (GRFs) and one NOAA social science fellow. The NERRS GRF Program is a system-wide program that supports masters or doctoral students' management-related research projects that enhance scientific understanding of the reserve system, provide information needed by reserve managers and coastal decision-makers, and improve public awareness and understanding of estuarine ecosystems and management issues. . The research coordinator provides research support to GRF students and also works with

Reserve staff to integrate the fellows into Reserve activities including helping train education volunteers, working with high school teachers, and assisting with salt marsh habitat mapping.

NERRS GRF research projects include:

| Year | Fellow | Project Title |
|---|---|---|
| 2005 | M. Capone | *The effects of natural and restored oyster reefs on water quality* |
| 2006 | E. Westerman | *The effect of increasing primary production and artificial substrates on the success of invasive ascidians in the Great Bay Estuary, NH* |
| 2007 | W. Lee | *Engineering through disturbance: role of horseshoe crabs (Limulus polyphemus) on soft-sediment communities in Great Bay, NH* |
| 2007 | E. Washburn (NOAA social science fellow) | *Social landscape analysis of land use decision making in Great Bay's coastal watershed (see Section D. Coastal Training)* |
| 2008 | J. Nettleton | *Tracking environmental trends in the Great Bay Estuarine System through comparisons of historical and present-day green algal nutrient content and community structure* |
| 2009 | J. Mora | *Berm impacts on salt marsh dynamics in New England* |

The Reserve has also hosted other interns who have contributed to the Reserve. For example, in 2007, two undergraduate interns at UNH helped organize historical monitoring data on fish and phytoplankton in Great Bay and transcribed the data into electronic formats allowing it to easily be used for comparative studies of changes in estuarine species and communities. In 2008, the Reserve hosted a masters student from Antioch University New England who worked with the research and stewardship coordinators to test monitoring protocols and obtain preliminary data on the abundance and species composition of larval mosquitoes in three Great Bay salt marshes with different restoration histories.

## C. Education, Outreach, and Volunteer Program

National Estuarine Research Reserves are federally designated "to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation." The reserve system provides a range of educational programming to key audiences depending on watershed and community needs and the specific capacity of each reserve.

GBNERR's education program's goal, as described in the 2006–2010 Management Plan is to "design and implement a comprehensive program of education, outreach and interpretation based on solid scientific principles that strengthen understanding, appreciation and stewardship of estuaries, coastal habitats, and associated wetlands throughout the Great Bay watershed."

The objectives are:

- **Public Awareness:** Increase the awareness and understanding of the value of the Great Bay estuary and estuarine systems by the public living in the Great Bay watershed.
- **Clearinghouse for Information:** Serve as a clearinghouse for information about estuarine, coastal and Reserve management issues through the use of professional and accurate publications.
- **Educational Facilities:** Develop and maintain educational facilities consistent with national guidelines for sustainable design and conservation planning.
- **Coastal Decision Makers:** Develop and implement effective programs for coastal decision makers and other coastal partners about resource management issues that affect the sustainability of our estuaries and watersheds. *(See Section D. Coastal Training)*
- **Program Evaluation:** Continue to evaluate the effectiveness of Reserve sponsored programs on an ongoing basis.

The Reserve's education program is staffed by a full-time education coordinator and assistant education coordinator and part-time volunteer coordinator, naturalist, and park guide/program assistant and fifty plus volunteers who assist with the educational programming.

During the evaluation period, the education program continued to offer its two core and highly successful school programs for elementary students and additional programming for all ages; developed new exhibits for the Hugh Gregg Conservation Center emphasizing sustainable watersheds; developed and provided information about estuarine issues to the public; and continued to evaluate and refine its programming.

### 1. K-12 Education

The Reserve's formal education program focuses on providing spring and fall hands-on programming for elementary students that is aligned with the science and history curriculum standards of New Hampshire. The programs are tremendously popular and fill up within a few hours. Several teachers attended the public meeting and commended the Reserve for its excellent educational programming. One teacher emphasized that her students were able to recall facts learned on a field trip eight months later while another discussed how he brought high school students to the Reserve to learn about green building and their excitement over returning to the Reserve years later.

The education program has two flagship programs and has developed pre- and post-site activities for students. Teachers are able to check out trunks that house materials to complete additional activities that reinforce and complement what students learn on the field trips. The flagship programs are:

- **Spring Natural History School Programs** highlight the natural history of Great Bay. The Reserve ran 198 programs for 9,657 students in grades $1^{st}$ – $5^{th}$ from 2005–2009.

- **Fall Cultural History School Programs** highlight the area's cultural history as it relates to the natural resources of Great Bay. The Reserve offered 156 programs for 7,404 students in grades 1st – 5th from 2005–2009.

In addition to its two flagship programs the education program offers additional programs.

- **Summer Bayventure programs** are two hour programs with various themes that have included horseshoe crabs, geocaching, and tides. The Reserve offered 63 programs serving 767 children ages 7-11 from 2005–2009.
- **Bayventure Extreme Day Camp** was first held in 2009 for one week and included activities from the most popular Bayventure programs from the past 10 years.
- **Winter Bayventure programs** are four hour programs (except the overnight) that include outdoor and indoor activities. The programming varies and has focused on topics such as estuarine winter ecology, winter adaptations of animals, and ice fishing. During the overnight school vacation camp participants spend the night in a birch bark covered wigwam. The Reserve has offered 34 programs serving 391 children ages 7-12 from 2005–2009.
- **Once Upon an Estuary summer programs** offers hour long experiences for preschool aged children and their parents. The Reserve served 642 participants from 2005–2009.
- **Ambassador programs** are guided educational visits that do not fall into a K-12 audience and include groups of scouts, small schools, homeschoolers, summer camps, and senior citizens. The Reserve served 1,863 participants during 2005–2009.
- **Bay Views** are summer evening adult and family discussion series for the public and topics covered range from estuarine ecology, to climate change, to natural and cultural history. The Reserve has held 43 Bay Views programs for 2,247 participants during 2005–2009.
- **Interpretive Kayak programs** are held each summer on topics ranging from coastal birding to cultural history to coastal decision making A total of 385 people have participated in kayak trips for the years 2005–2009.

The education program develops much of its additional programming around themes that are carried through different programs. For example, the Once Upon an Estuary and Bayventure programs share weekly themes so that siblings can share with each other what they have learned about the same topic. The programs often include a focus on the Reserve's priority themes such as climate change and Reserve activities such as coastal decision making.

The education program solicits feedback from the teachers who participate in educational activities and staff and volunteers reflect and evaluate the success of each activity and program at the end of the season. Teacher feedback and staff and volunteer reflection is used to determine if improvements can and should be made or if an activity should be replaced. OCRM commends the education program for continually evaluating their performance and seeking ways to improve their programming.

**Accomplishment: The Reserve continues to strengthen and improve highly regarded and popular hands-on educational programming and is able to provide a large number of children with quality educational programming with the support of a dedicated group of volunteers.**

The NERRS has developed a K-12 Estuarine Education Program (KEEP) to help students learn about essential coastal and estuarine concepts, develop data literacy skills, and strengthen problem solving skills. The program combines experiential education, teacher education, and technology and web-base education. GBNERR's education program has a very strong and well respected experiential education program. OCRM encourages the Reserve to consider if expanding the Reserve's participation in other aspects of KEEP would be beneficial. The education program may also wish to explore a partnership with the Great Bay National Wildlife Refuge, as the Refuge grows their high school focused educational programs.

### 2. General Public

The education program provides the interested public with both educational programming, as discussed in the previous section, and drop-in opportunities for learning through onsite visits to the Hugh Gregg Coastal Conservation Center and Discovery Center. During the evaluation period, the education and stewardship programs led the development of exhibits for the Conservation Center which focus on land use change over time and impacts to wildlife in the region. The Conservation Center also highlights green design. The Reserve has also added a NERRS camp style post, featuring every Reserve in the NERRS, its direction and the distance in miles from GBNERR. When the contractor responsible for completing the exhibits dropped out, Reserve staff stepped up to assist with the completion of the exhibits. As of the evaluation site visit, some exhibits were still in the process of being completed. The Reserve also recently received a grant for the development of a new exhibit in the Conservation Center's basement highlighting the area's local heritage *(see Section A.4 Facilities).*

The informal education program also provides the public with information on estuarine and coastal issues through a professionally designed magazine, *Great Bay Matters*. The magazine is published three times yearly and two thousand copies are distributed to volunteers, partners, visitors and other targeted audiences and the magazine is also available on the Reserve's website. In addition, the education and stewardship programs developed the Passport to the Great Bay, a geocaching opportunity that highlights different Reserve properties *(see Section E. 4. Public Access).*

### 3. Volunteer Program

The Reserve's volunteer program plays a significant role in the accomplishment of the Reserve's mission. From 2005 to 2009 volunteers contributed 17,622 hours towards Reserve programs and projects. The Reserve's education program greatly benefits from the dedication of the Reserve's volunteers. Every year about 50 volunteers regularly participate in the education program and assist with conducting school field trips. Volunteers attend a one-day training event and shadow more experienced volunteers until they feel comfortable leading groups of children. The

volunteers then receive feedback on their instruction after leading a few classes. The volunteer coordinator also developed a volunteer manual and regularly schedules thank you events to support and encourage volunteers.

The Reserve has also cultivated a group of long-term volunteers (Community Land Stewards) who help monitor Reserve property and support the stewardship program. Land stewards adopt a property within the Reserve and are the "eyes and ears and protectors" and their responsibilities include picking up trash and noting activity on the land as well as answering visitor questions. Land stewards walk their properties at least four times a year, and complete monitoring forms. At the time of the site visit, 14 stewards were monitoring 11 of the Reserves properties. To support the land stewards, the Reserve provides a quarterly electronic newsletter and hosts thank you events specifically for the land stewards.

The Reserve also benefits from other individual volunteers and groups from local high schools, the University of New Hampshire, corporations and community groups who participate in a variety of one-day or short-term programs. Examples include a high school class geocaching to and removing known dump sites, involving students in the International Coastal Cleanup, creating a trail on an island within the Reserve, volunteer cleanup days, and invasive plant control days. In addition the Reserve has a Stewardship intern program for undergraduate and high school students which provides students with hands on experience managing public lands. Interns have developed volunteer training materials for the NERRS breeding marsh bird monitoring program and mapped rocky shore distribution. OCRM commends the Reserve for supporting a strong volunteer program that has allowed the Reserve to expand its educational programming and increase its stewardship and monitoring activities.

**Accomplishment: The GBNERR volunteer program has continued to maintain a strong cadre of long-term volunteers and partnerships with a variety of organizations that have enabled the Reserve to expand its hands-on educational experiences and enhance and maintain its properties through mapping, invasive removal, trash removal, and other activities.**

## D. Coastal Training Program

The Coastal Training Program (CTP) is designed to inform coastal decision-making, improve coastal stewardship at local and regional levels through the application of science-based knowledge, and increase dialogue and collaboration among decision-makers. Planning for the program includes establishing a training advisory committee, conducting a market survey of training providers and an audience needs assessment, developing a program strategy that outlines priority coastal issues to be addressed, prioritizing target audiences, and creating a marketing plan.

GBNERR's CTP was fully implemented in February 2005 and is staffed by a full-time CTP coordinator. The overall goal of the Reserve's CTP, taken from the 2004 Strategy, is "to advance the stewardship of coastal resources and the ecosystems that produce these resources in the New Hampshire Coastal Watershed and region." In 2009, the strategy was revised and the

overarching goal of the CTP is now "A sustainable Great Bay ecosystem that provides abundant coastal resources for society and nature."

The objectives of the CTP in the 2004 and updated 2009 strategy are that coastal decision makers will:

- Recognize the Great Bay National Estuarine Research Reserve as a leading source of scientific information pertaining to coastal resource management.
- Utilize the products and services provided through the Coastal Training Program to make decisions that will sustain estuarine ecosystems.
- Acknowledge that their management decisions have an impact on coastal resources.
- Understand the impacts that their management decisions have on coastal resources.
- Employ the best scientific information available in their decision making process regarding coastal resources.
- Form partnerships with stakeholder groups and service providers to address coastal issues.

The CTP's target audience is select boards and city councils, planning boards, conservation commissions, zoning boards of adjustments, planning departments, regional planning commissions, engineers, landscapers, and the construction community. The CTP 2004 Strategic Plan identified growth and associated issues (land use change, increased impervious cover, nutrient pollution, water pollution, and water resource problems) as the greatest challenges to a sustainable Great Bay ecosystem. From 1990 to 2004, New Hampshire's population grew by 17 percent and the fastest growing areas of the state were in the Great Bay watershed. In the 2009 Strategy, climate change was identified as a new priority.

During the evaluation period, the CTP coordinator has focused on building partnerships; established the CTP as trusted resource for bringing information to coastal decision-makers and the broader construction community; raised awareness and provided training on priority issues such as stormwater management and climate change; and led the development of the Coastal Adaptation Workgroup to better coordinate efforts to address climate change.

The completion of the Conservation Center has expanded opportunities to host CTP workshops on-site at the Reserve. The new Conservation Center can seat 100 participants and is equipped with audio visual equipment. The Reserve has filmed some of the training events and made them available on the NHFG website. The Reserve does not currently have access to technology for hosting large web based workshops or for taking full advantage of social media. OCRM encourages the Reserve in its efforts to expand access to its workshop and training opportunities through enhanced technology.

The CTP is primarily implemented via one-day workshops that have been developed for target audiences. The CTP has provided extensive programming during the evaluation period, a small sampling of recent workshops includes:

- Updates on the Department of Environmental Services alteration of terrain regulations and model stormwater management ordinances for municipalities
- Low impact development home tour
- New Hampshire Wildlife Action Plan workshop that focused on how to incorporate the plan into municipal planning documents and ordinances
- Salt marsh ecology and conservation field workshop
- Climate change impacts to the New Hampshire coast, wildlife and forests

The CTP also provides tailored workshops for communities that are selected through the NROC process. The workshops help communities address specific concern they have identified. For example, a *Stormwater Seminar* for the town of Hampton municipal board members and city staff explained the need for the rewrite of the stormwater ordinance.

The CTP coordinator has taken a regional leadership role in climate change and has moved from raising awareness of climate change and its possible impacts on municipal planning and infrastructure to offering assistance with adaptation planning efforts. The CTP coordinator began researching climate change science in 2006 and offering programs to build awareness in 2007. In 2008, the CTP and research program began bringing the science and scientists and relevant resources together to assist coastal decision makers with addressing the impacts of climate change. Interest in climate change was also heightened by local weather events including three 100-year flood events between 2006–2008 and three large rain events in the first four months of 2010.

In December of 2009, the Reserve helped organize the New Hampshire Coastal Adaptation Workgroup (CAW) comprised of state agencies, local governments, and nonprofits whose mission is to prepare coastal communities for natural hazards and climate change impacts. Since December, the group has been meeting monthly to assess the needs of coastal communities and review existing resources. In addition, the group is applying for grants for projects including a local climate assessment and is looking to develop a framework of adaptation options for local communities. The N.H. Coastal Program is also planning to support the CAW through the CZMA's Coastal Zone Enhancement Grants and in October of 2010, the Great Bay Stewards received a grant from the N.H. Charitable Foundation to support a detailed assessment of how climate has changed over the past century and how it may change over the next century and to conduct an outreach program to communicate the findings.

**Accomplishment: The CTP has taken a leadership role in climate change adaptation and the Reserve has been essential to raising awareness in the community; facilitating increased research into local impacts; and organizing scientists, state and local governments, and nonprofits to come together to share resources and develop adaptation plans.**

The CTP supports GBNERR and NERRS priority initiatives. The CTP works with the other sectors to address the Reserve's four key focus areas of water quality, land use change, climate change, and biological monitoring. For example, the CTP and research coordinators partnered to develop the January 2008 Seminar, *Anticipating Climate Change Impacts in Southern New Hampshire.* The seminar brought together 93 coastal decision makers and scientists (1) to provide coastal decision-makers with information on climate change impacts and (2) to bring researchers together to identify research needs. The seminar led to the formation of a research panel that was tasked with compiling currently available data, identifying current research needs, and finding funding to conduct necessary research.

The CTP has also built off the work of a NOAA Social Science Fellow who conducted a project "A Social Landscape Analysis of Land Use Decision Making in the Towns of the Lamprey River Watershed." The research project examined the potential for watershed-based land use decision making and looked at how local boards and commissions obtain information, if and how they communicate with each other, and how they made decisions. The CTP is incorporating this information into the development of workshops to assist an NROC recipient, the Lamprey River Watershed Association, develop a watershed coalition and support stewardship of the watershed. The CTP coordinator also regularly provided feedback to the research coordinator on research needs identified by coastal decision makers.

The CTP has also developed trainings in response to needs identified by the stewardship coordinator such as a workshop to train land managers on methods of identifying native and exotic *phragmites.* The workshop led to the publication of a report as part of the 2008 NERRS Research Technical Series Report. In addition, the CTP, stewardship, and research coordinator have plans to continue to partner on invasive species workshops through 2012. The CTP coordinator has also supported NERRS program planning and development efforts including chairing the CTP External Review Workgroup, and participating as a member of the Planning and Implementation Workgroup, Marketing Workgroup, and Climate Change Workgroup.

The CTP currently reaches a significant number of coastal decision makers but is looking to better serve hard to reach audiences such as volunteer board members with limited time. In order to better reach this audience, the CTP has identified and is pursuing new venues to bring science and information to them such as providing training at regularly scheduled meetings, partnering with other training providers to put on conferences versus creating new stand alone workshops, working one-on-one with coastal decision makers, developing new ways to get information out such as web based presentations, and working with other partners to facilitate information transfer. OCRM commends the CTP for considering and piloting new techniques for reaching coastal decision-makers and encourages NHFG to help the Reserve use technology to effectively reach new audiences.

The CTP routinely evaluates the effectiveness of trainings through post workshop evaluations and assessments. The information gathered from participants is used to refine training methods, identify new priority needs of coastal decision-makers, and contributes to the national NERRS CTP performance measurement system. The CTP regularly partners with different organizations to deliver trainings and these organizations track their own specific performance measures. The

CTP coordinator is working with training delivery partners to identify the best way to meet NERRS performance requirements and the performance measurement needs of partners while respecting the time of coastal decision-makers.

The CTP is growing and has taken on an increasingly larger role in the region. The Program is limited by having only one staff member, although other staff do assist with specific projects. OCRM encourages the Reserve to consider if additional support for the CTP would be beneficial and options for providing support such as the hiring of a part-time staff member, assistance from a long-term volunteer(s), development of an internship program with the University of New Hampshire, or other mechanisms. As the CTP continues to expand and become engaged in new valuable partnerships and projects such as CAW, the need for additional staffing support to ensure the Reserve maintains its core ability to provide coastal decision-makers with the knowledge and tools they need to address critical resource management issues through training and workshops has grown.

## D. Stewardship Program

Stewardship is a functional role at each reserve, involving aspects of research, monitoring, education, policy, and implementation of resource management actions. Stewardship provides long-term protection of natural resources within the system and serves to model responsible resource management practices to coastal communities.

The Reserve's stewardship and natural resource protection goals, as described in the 2006–2010 Management Plan, are to "maintain the ecological integrity of the Great Bay region by using a comprehensive stewardship approach to education, land acquisition, land management, and research and monitoring" and "provide for the long-term conservation and protection of the biodiversity of the Great Bay estuary and associated habitats" respectively.

The stewardship objectives are:

- **Stewardship Monitoring Programs:** Expand the land monitoring program and increase opportunities for volunteers to participate in these efforts.
- **Property Management Plans:** Develop and implement individual property management plans for the Reserve's protected properties based on a priority system developed by the Lands Committee and Marine Fisheries Division.
- **Restoration Projects:** Assess, identify and implement restoration.

The natural resource protection objectives are to:

- Support wetland restoration and management activities in the Great Bay estuary that promote biodiversity and conservation of critical habitats.
- Develop invasive species monitoring and control strategies.
- Develop and support activities that monitor, restore and protect identified species of concern.

- Actively participate in and support efforts to promote land conservation and land use regulations that are consistent with the Reserve's goals and policies.
- Promote the monitoring and improvement of water quality throughout the Great Bay estuary.

The Reserve's stewardship program is staffed by a full-time stewardship coordinator with the support of four-six weeks of assistance from a summer laborer. A care taker/maintenance mechanic also helps maintain Reserve facilities. During the evaluation period, the stewardship program coordinated the development of wildlife prescriptions for the Crommet Creek Conservation Area and developed "abstracts" to guide the management of Reserve lands; supported the creation and implementation activities of the New Hampshire Coastal Watershed Invasive Plant Partnership (CWIPP); enhanced public access facilities, conducted habitat mapping, and completed one of the first NERRS' Vertical Control Plans.

The stewardship program has a broad range of responsibilities which are growing as the Reserve expands. The stewardship program has been supported by both long-term volunteer interns and short-term volunteers. The stewardship coordinator has mentored interns who have mapped the Reserve's boundary and the location of invasive species. In addition, the Reserve has benefited from volunteers who have participated in one- or multi-day events to create trails, remove invasive species, and clean-up dump sites. The stewardship program has also benefited from additional grant funding to remove invasive species and conduct restoration activities.

Although the stewardship program has done an excellent job of taking advantage of opportunities to meet its goals and objectives, the stewardship program still needs to grow its land management capabilities and balance many competing priorities. Therefore, the stewardship program could possibly benefit the most from a strategic management plan planning process and the identification of priorities for the next five years. In addition, OCRM recognizes that NHFG also has limited resources, but encourages NHFG to consider opportunities for assisting with the stewardship and GIS needs of the Reserve such as providing additional summer labor; assistance with preparing permit applications; pursuing outside funding opportunities, or other applicable assistance. The additional need for creating a stable source of long-term funding for stewardship of properties is discussed below.

### 1. Land Acquisition and Management

The Great Bay watershed has been a focus of conservation efforts for over 20 years as an area critical for migrating birds and an estuary of local, regional, and national significance facing significant growth. The Reserve is a member of the Great Bay Resource Protection Partnership which was formed in 1994 to further collective conservation goals and promote conservation actions in the Great Bay region. The principal partners include federal and state agencies and nonprofits and The Nature Conservancy serves as the lead land acquisition agent for the partnership. The partnership has been very successful in obtaining federal and local government support of land acquisition projects. The NHFG and other partners have improved and streamlined the process for transferring properties from The Nature Conservancy to the managing partner since the previous evaluation. The partners now determine the land holding

agency before a piece of property is purchased and properties that are to be managed by the NHFG are transferred annually to the Department. Two NHFG land transfer agents manage the timely transfer of the properties.

The Partnership has been able to protect a significant amount of land in the Great Bay watershed and within the GBNERR boundary, 5,129 acres are conserved and the Reserve manages 3,740 acres distributed over 71 parcels. The Reserve has limited staff and equipment to develop management priorities and actively manage the lands. Although staff and resources are limited, the stewardship program has made significant progress during the evaluation period. The stewardship coordinator coordinated the development of wildlife prescriptions targeting wildlife species of concern for the Crommet Creek Conservation Area, an effort funded in part by a NOAA grant to The Nature Conservancy. Management plan "abstracts" were also developed for multiple properties within the Reserve. In addition, the stewardship program also received a multi-year $500,000 grant from the Natural Resources Conservation Service to conduct invasive removal activities and restoration.

NHFG and GBNERR's land management responsibilities will continue to be significant and important in the coming years. NHFG and GBNERR will need to identify long-term resources to manage these protected lands. Through the Partnership, NHFG and GBNERR have begun to consider and explore options for building long-term stewardship capacity. The Partnership is looking at setting up a nonprofit foundation that will be able to accept and distribute funds for regular maintenance and improvements on lands managed by partners. In addition, the Partnership is now encouraging land owners to contribute funding to support long term maintenance of the parcels that they sell or donate to the Partnership. OCRM encourages the NHFG and Reserve to continue work through the Partnership and with others to explore opportunities for developing long-term stable funding and staffing to ensure properties maintain their conservation values.

**Program Suggestion: OCRM encourages the NHFG and GBNERR to work with partners to develop a long-term stable funding source(s) to ensure conservation and management of Reserve lands in perpetuity.**

NHFG lands are primarily designated as Wildlife Management Areas (WMAs) including all lands within the Reserve boundary except for five acres that include and surround the educational facilities. Reserve staff must manage the Reserve's designated WMAs according to state regulations and in addition must meet the obligations of the federal-state NERRS partnership. GBNERR's designation as a Reserve adds an additional layer of management responsibilities and considerations as Reserve lands are to be managed for resource protection and as a platform for science and education. The evaluation team found that it was not easy for NHFG staff to quickly determine what parcels were designated as Reserve properties (the state currently relies on paper files) and when additional considerations might apply to proposed projects. The evaluation team discussed the issue with Reserve staff and staff suggested that by labeling Reserve parcels as "Great Bay NERR Wildlife Management Area" properties in both the state files and official signage, NHFG staff could quickly and easily determine what parcels are subject to additional considerations.

**Program Suggestion: OCRM encourages NHFG to pursue opportunities to label Reserve lands as being part of the NERRS to ensure that lands are managed in accordance with both the missions and regulations of NHFG and NERRS.**

### 2. Invasive Species

The Reserve along with other 10 other agencies and organizations partnered to create the New Hampshire Coastal Watershed Invasive Plant Partnership (CWIPP) in May of 2008. CWIPP's is committed to inventorying, monitoring and preventing the spread of invasive species. The partnership works with municipalities, private land owners, and state and federal land owners to control the spread of invasive species and restore native habitats.

The stewardship coordinator, with the support of interns, has mapped 4,100 stands of invasive plants in the Reserve and documented the location, size of plant stands, ecological characteristics, and proximity to other natural and manmade features. In addition, within the Crommet Creek sub-watershed, staff have worked closely with local land owners to document and map invasives and over 94 percent of the watershed has been mapped. The CTP has hosted workshops and demonstration projects that have taught homeowners how to identify invasive species and provided them with opportunities to practice techniques to remove them.

The stewardship coordinator developed and received a grant for an experimental design program to study options for the control and management of invasive species on NHFG lands. The program is a partnership with University of New Hampshire Cooperative Extension, community volunteers and commercial contractors and is using experimental designs and statistical comparisons to determine the effectiveness of removal methods for 14 invasive plant species.

**Accomplishment: The Reserve is addressing invasive species by improving state level coordination, mapping invasive species, researching control techniques, and educating homeowners on removal techniques.**

### 3. Habitat Mapping and Change

The stewardship program has a strong GIS component and is in the process of implementing the voluntary NERRS habitat mapping and change program. The NERRS habitat mapping and change program is part of SWMP and was established in order to determine long-term change related to local sea level change and human-caused stress in reserve watersheds. During the evaluation period, the stewardship program mapped the high and low salt marsh boundaries as an early vegetative indicator of sea level change and partnered with Complex Systems Research Center at the UNH to hand digitize all salt marsh, including small-sized fringing marsh throughout the Reserve and successional habitat. As noted previously, the location of invasive species throughout the Reserve have also been mapped. The stewardship coordinator also developed a Vertical Control Plan to enable increased understanding of habitat change in relationship to sea level rise. The Reserve has begun to implement the plan and, in partnership with NH Department of Transportation and NOAA's state geodetic advisor, five new GBNERR

benchmarks were established, three tied into the NOAA National Geodetic Survey's On-line Positioning User Service. OCRM commends the stewardship program for its implementation of the NERRS habitat mapping and change program.

The Reserve's GIS products are used to support management planning, decision making, and education. For example, maps have been developed to assist with prioritizing land acquisition projects and developing land management priorities for sub watersheds and Reserve management plan development. In addition, maps have also been developed for a variety of educational purposes including maps for publication in the *Ecological Trends in the Great Bay Estuary*; a land use change exhibit at the Hugh Gregg Coastal Conservation Center; and for the Great Bay Passport (*see Section 3.4 Public Access*). GIS has also been used to make land management decisions such as the location of the Cy and Bobbie Sweet Trail in which a co-occurrence model was used to determine the route of the trail and limit impacts on the environment.

The Reserve's GIS data layers have been requested and used by many partners, in particular data on invasives. The Reserve provides the information for free upon request but asks that credit be given to the Reserve. Reserve staff have noticed that their data is being attributed to other entities. In discussions with the evaluation team, the stewardship coordinator raised the possibility of developing a user agreement that requestors must sign before receiving the free data. The user agreement would require that the Reserve be credited as supplying the data and ensure that future users request the information directly from the Reserve. OCRM encourages the Reserve to develop and use a user agreement to ensure that data is properly credited and the Reserve knows who to contact regarding any data updates.

## 4. Public Access

The Reserve's public access goal, as described in the 2006–2010 Management Plan, is to **"**Provide appropriate public access to the Reserve's protected lands and waters, while protecting the inherent natural resource values of these lands and waters."

The objectives are:

- **Land Access Points:** Provide for appropriate access to Reserve properties that supports traditional recreational activities.
- **Public Awareness:** Develop access points for appropriate water-based activities at key locations throughout the Reserve.
- **Public Outreach:** Develop a wide range of outlets for distributing information about public access opportunities within the Reserve.

The Reserve has worked to encourage public access while minimizing impacts to habitat during the evaluation period. All Reserve lands, except for the educational facilities, are classified as Wildlife Management Areas (WMAs) and subject to state WMA rules and regulations. Reserve lands are multi-use and support a variety of recreational activities including boating, fishing, birding, walking/hiking, and hunting. Surveillance and enforcement of state regulations is conducted by the Department's Law Enforcement Division. Reserve staff work closely with the

Law Enforcement Division to monitor lands and determine how best to handle problems as they arise. In order to improve enforcement activities, the stewardship coordinator also keeps the Law Enforcement Division informed of new properties that have been acquired by the State and are managed by the Reserve.

During the evaluation period, the Reserve has planned and implemented projects to enhance public access. The Reserve, in partnership with the Great Bay Resource Protection Partnership, built the 4.2 mile Cy and Bobbie Sweet Trail to provide new and enhanced access to a variety of properties. The universally accessible trail traverses through two towns and property owned by three other property owners: the Town of Durham, the Society for the Protection of New Hampshire's Forest and The Nature Conservancy. A parking area was also constructed on Reserve lands and several interpretive exhibits and a wildlife platform were installed. The Great Bay Stewards funded the exhibits and a local family donated the material for the platform. The trail was carefully planned to minimize impacts to sensitive species and a counter was installed to track trail use. In addition, a wildlife viewing platform was also constructed at Chapman's Landing on the Squamscott River.

In addition, the stewardship and education programs developed the "Passport to Great Bay" to encourage public visitation at Reserve's properties that are ready for exploration. The "passport" has information sheets on each property that highlight the natural resources and/or history of the property along with directions, trail information, and geocaching coordinates. At each geocache there is a special hole punch and visitors who make it to all the sites receive a prize. During the past two years, over 600 people have visited and participated in geocaching at the Reserve.

## V. CONCLUSIONS

For the reasons stated herein, I find that the New Hampshire is adhering to the programmatic requirements of the National Estuarine Research Reserve System in the operation of its approved Great Bay National Estuarine Research Reserve.

NHFG and GBNERR have made notable progress in the following areas: strengthened financial and administrative support of GBNERR; conducting research on priority coastal management issues; publishing a 20-year anniversary report *Ecological Trends in the Great Bay Estuary;* continuing to provide and improve highly regarded educational programming; maintaining a strong cadre of long- and short-term volunteers who assist the education and stewardship programs; increasing coordination, outreach, and research around invasive species; and taking a leadership role in facilitating climate change adaptation.

The findings contain four recommendations in the form of one necessary action and three program suggestions. The state must address the necessary action regarding having a research coordinator who is able to focus full-time on implementing the Reserve's research program. The program suggestions should be addressed before the next regularly scheduled program evaluation, but they are not mandatory at this time. Summary tables of program accomplishments and recommendations are provided in the Appendix A.

This is a programmatic evaluation of GBNERR that may have implications regarding the state's financial assistance awards. However, it does not make any judgment on or replace any financial audits.

Donna Wieting

Donna Wieting, Acting Director
Office of Ocean and Coastal Resource Management

JAN 2 1 2011

Date

# VII. APPENDICES

## Appendix A. Summary of Accomplishments and Recommendations

**Accomplishments**

| Issue Area | Accomplishment |
|---|---|
| Administration | The New Hampshire Fish and Game Department has significantly strengthened its financial and administrative support of GBNERR. |
| Boundary expansion | GBNERR successfully expanded its boundary by almost 4,000 acres, worked with the Great Bay Resource Protection Partnership to protected additional lands within its boundary, and assumed management of additional lands where appropriate |
| Facilities | OCRM commends the Reserve for facility improvements including (1) the construction of the Hugh Gregg Conservation Center, (2) installation of porous asphalt and sidewalks, (3) creation of a 4.2 mile trail, and (4) installation of native landscaping. |
| Research | GBNERR's research program facilitates and conducts research on priority issues that is informing coastal management in the New England region. |
| Monitoring data/visibility | GBNERR used Reserve and partner data to explore trends in land use and habitat change, water quality, and biological communities and to highlight Reserve activities in the report *Ecological Trends in the Great Bay Estuary*. |
| Educational programming | The Reserve continues to strengthen and improve highly regarded and popular hands-on educational programming and is able to provide a large number of children with quality educational programming with the support of a dedicated group of volunteers. |
| Volunteer program | The GBNERR volunteer program has continued to maintain a strong cadre of long-term volunteers and partnerships with a variety of organizations that have enabled the Reserve to expand its hands-on educational experiences and enhance and maintain its properties through mapping, invasive removal, trash removal, and other activities. |
| Climate change | The CTP has taken a leadership role in climate change adaptation and the Reserve has been essential to raising awareness in the community; facilitating increased research into local impacts; and organizing scientists, state and local governments, and nonprofits to come together to share resources and develop adaptation plans. |
| Invasive species | The Reserve is addressing invasive species by improving state level coordination, mapping invasive species, researching control techniques, and educating homeowners on removal techniques. |

**Recommendations**

Recommendations are in the form of Necessary Actions (NA) or Program Suggestions (PS).

| Issue Area | Recommendation |
|---|---|
| Administration | PS: OCRM encourages NHFG to explore and pursue mechanisms that will enable the Reserve to enhance and expand its programs with external funding sources. |
| Staffing | NA: A full-time research coordinator should be solely focused on implementing the Reserve's research program by January 2014. |
| Stewardship | PS: OCRM encourages the NHFG and GBNERR to work with partners to develop a long-term stable funding source(s) to ensure conservation and management of Reserve lands in perpetuity. |
| Stewardship | PS: OCRM encourages NHFG to pursue opportunities to label Reserve lands as being part of the NERRS to ensure that lands are managed in accordance with both the missions and regulations of NHFG and NERRS. |

## Appendix B. Persons and Institutions Contacted

**Reserve Staff**

| NAME | Title |
|---|---|
| Peter Wellenberger | Manager |
| Kelle Loughlin | Education Coordinator |
| Steve Miller | CTP Coordinator |
| Beth Heckman | School Programs Director |
| Sheila Roberge | Volunteer Coordinator |
| Rachel Stevens | Stewardship Coordinator |
| Kristen Kwiecien | UNH Student Intern |

**Department of Fish and Game**

| NAME | Title |
|---|---|
| Glenn Normandeau | Director |
| Doug Grout | Chief of Marine Fisheries |
| Cheri Patterson | Supervisor of Marine Programs |
| Jessica Fischer | Marine Biologist |
| Randy Curtis | Federal Aid Coordinator |

**University of New Hampshire**

| NAME | Organization |
|---|---|
| Rich Langan | CICEET, Co-Director |
| Jon Pennock | UNH Marine Program and Sea Grant Director |
| Cameron Wake | UNH Climate Scientist with the Climate Change Research Center |

**State Partners**

| NAME | Agency |
|---|---|
| Ted Diers | New Hampshire Coastal Program Manager |

**Nonprofit Partners**

| NAME | Organization |
|---|---|
| Ray Konisky | TNC Restoration Partnership |
| Duane Hyde | TNC Project Manager for the Great Bay Partnership |
| Joanne Glode | TNC Stewardship Ecologist |
| Dea Brickner-Wood | Great Bay Partnership Coordinator |
| Nancy Cauvet | Great Bay Stewards Board of Directors, President |
| Peter Flynn | Great Bay Stewards Board of Directors, Board Member |
| Laura Flynn | Great Bay Stewards Board of Directors, Board Member |
| Jay Diener | Great Bay Stewards Board of Directors, Vice President |
| Karen North | Great Bay Stewards Board of Directors, Board Member |
| Cindy Blaney | Great Bay Stewards Board of Directors, Board Member |
| Joe Stiglitz | Great Bay Stewards Board of Directors, Secretary |

**Other**

| NAME | Organization |
|---|---|
| Dwight Trueblood | NOAA, CICEET Co-Director |
| Adrianne Harrison | NOAA Coastal Services Center |
| Graham Taylor | Great Bay Refuge Manager |

## Appendix C: Persons Attending the Public Meeting

| NAME | AFFILIATION |
|---|---|
| Lisa Freyenhagen | Epping Elementary School |
| Nancy Cauvet | Great Bay Stewards |
| Colin Lawson | Teacher |
| James Belanger | |
| Chuck Gilby | Rep. Carol Shea-Porter's Office |
| Denise Jundi | |
| Matt Leahy | Senator Gregg's Office |

## Appendix D: OCRM's Response to Written Comments

NOAA received five comments regarding the evaluation of the Great Bay NERR, New Hampshire.

**David Burdick, Ph.D.**
**Research Professor**
**UNH Department of Natural Resources**

**Comment:** Dr. Burdick stated he had an office and lab facilities at Jackson Estuarine Laboratory and has worked in the estuary for 20 years. He noted his concern with declining water quality and loss of productive habitat in the Bay. He stated that GBNERR has been a leader and partner in land acquisition, developing and supporting long term monitoring for water quality and habitat health and sharing scientific results with the public. He thinks that the Reserve has done very well in empowering local people to embrace the responsibility of stewardship for the special resources of the estuary. He stated that the Reserve's programs provide local residents and decision-makers with tools and information to make changes in daily activities and choices in how they develop and maintain the built environment in ways to minimize negative impacts to the estuary.

**OCRM Response:** OCRM concurs and thanks Dr. Burdick for his comments.

**Duncan Mellor**
**Citizen, Great Bay area**

Mr. Mellor noted that he had lived in the Great Bay Estuary for over 30 years and had worked in the area as a professional with an M.S. in Ocean Engineering from UNH. He provided comments on the following six areas:

(1) Public Perception: He stated that local residents know and hear about pollution problems which greatly discourage use of the bay. He stated that he and others wonder why it is a federal reserve and he believes it has to do with the proximity to UNH and the need for UNH researchers to find grant funding.

(2) Public Access: He stated that public access to the Great Bay is very poor, and in particular more and better boat ramps are needed and that Towns that restrict access and parking to town residents only should not receive federal funds directly or through state agencies.

(3) Land acquisition: Mr. Mellor raised concerns with the acquisition of a specific 25-acre parcel in Stratham that was acquired with NOAA funds through the Great Bay Resource Protection Partnership. He stated the land was 95 percent wetlands; not developable; and enrolled in Current Use, a designation under state law which provides owners with tax incentives to prohibit development with severe penalties for subsequent development. He stated that the property was purchased by a local developer after sitting on the market for a year and TNC and the developer co-applied for a subdivision approval which was largely denied (the existing house was

subdivided off the property), but used to value the land higher as theoretically buildable lots. He believes that the funding was channeled through TNC to avoid Federal Acquisition Laws and provides no improvement in buffer protection and reduced the town tax base.

(4) Winnicut River Dam Removal: He stated that the dam removal project, which is partially funded by NOAA, has become a local example of poor design and construction oversight.

(6) Eel Grass: Mr. Mellor stated that the eel grass beds in Great Bay were much larger in the 1970s when sewage treatment was virtually non-existent and nitrogen and phosphorous are not the culprits for eel grass die off. He stated that grant submissions from UNH should be independently peer reviewed as researchers are too focused on nitrogen and phosphorous from development and municipal outfalls as being the culprit for killing off eel grass. Mr. Mellor asks that OCRM look at a more complete picture including increases in bird populations which feed on the grass and contribute waste to the system; salinity and turbidity variations, especially during storms and floods; and impacts from ice.

He stated that he is a strong believer in environmental protection but that there are estuaries in the seacoast area which are more valuable and deserving of state and federal resources.

**OCRM Response:** OCRM thanks Mr. Mellor for his comments. OCRM believes there may be some confusion with regard to the role of the National Estuarine Research Reserve System (NERRS). NERRS is a network of 28 areas representing different biogeographic regions of the United States. Reserves are protected for long-term research, water-quality monitoring, education, and coastal stewardship. Reserve staff work with local communities and regional groups to address natural resource management issues, such as non-point source pollution, habitat restoration, and invasive species. Through integrated research and education, the reserves help communities develop strategies to deal successfully with coastal resource issues. Reserves provide adult audiences with training on estuarine issues of concern in their local communities. They offer field classes for K-12 students and many support teachers through professional development programs in marine education. Reserves also provide long-term water quality monitoring as well as opportunities for both scientists and graduate students to conduct research in a "living laboratory." The NERRS has a strong focus on research and GBNERR benefits from its proximity and partnerships with UNH. OCRM believes that the GBNERR is an excellent fit with the Reserve's mission of research, monitoring, education, and stewardship.

The Reserves do provide public access but this is not the primary mission of the GBNERR or the NERRS. The Reserve's Discovery Center is open to the general public Wednesday through Sunday from May to September and weekends in October. The Reserve provides extensive public education opportunities throughout the year for both K-12 and adult audiences that are open to the public and regularly hosts workshops at Reserve facilities for coastal decision-makers. The Reserve also worked with partners to develop and open the Cy and Bobbie Sweet trail during the evaluation period. Additional public access efforts are discussed in *Section E. 4. Public Access* and more information on public access can be found in the Reserve's 2006-2010 Management Plan which is available on-line at www.wildlife.state.nh.us/marine/GBNERR_mgt_plan_2006_2010.pdf. OCRM believes the

Reserve is successfully increasing public access while monitoring and ensuring impacts are minimized.

OCRM also manages federal grants with the Great Bay Resource Protection Partnership for acquiring land for conservation which is then managed by different entities including local towns and NHFG. Mr. Mellor raised concerned that some conservation lands are transferred to local governments that are unsupportive of public access by nonresidents. A review of Partnership grants is beyond the scope of this evaluation. Currently, NOAA does not consider a local government's general parking policies when awarding grants. OCRM is not aware of any parcels acquired with NOAA funds where parking on such parcels is restricted to residents. Although an assessment of these grants is beyond the scope of this evaluation, OCRM will consider if additional requirements specific to acquired parcels should be considered as part of the approval of any future grants.

Mr. Mellor also raised concerns with regards to a specific project that was funded through an OCRM grant to the Great Bay Resources Protection Partnership. Again, NOAA grants to the Partnership are outside the scope of this evaluation. However, when reviewing land acquisition projects NOAA reviews all required documentation including appraisals, contracts, and deeds to ensure that all federal land acquisition requirements are met.

NOAA has provided partial funding to the NHFG for the removal of the Winnicut Dam. The grant for this project is not under the purview of OCRM or the GBNERR and is outside the scope of this evaluation. However, the evaluation team did discuss the removal of the Winnicut Dam project with NHFG staff, including issues with the contractor not following contract requirements. NHFG staff affirmed their commitment to ensuring the project is completed and all issues are adequately addressed.

The Reserve is involved in various research and mapping efforts to look at and understand changes in the estuary and many are described in *Section B. Research* and *Section E.3. Habitat Change and Mapping.* The GBNERR also conducts extensive water quality monitoring as part of the NERRS System-wide Monitoring Program which is described in *Section B.2 System-wide Monitoring Program* and a synthesis of this information can be found in the Reserve's *Ecological Trends in the Estuary 20th Anniversary report* at www.wildlife.state.nh.us/marine/marine_PDFs/GBNERR_Anniv_Rpt_2009/GBNERR_20_Ann_Rpt.pdf. GBNERR provides logistical support to UNH researchers, a place to conduct research and the research coordinator has partnered with UNH researchers to conduct projects but GBNERR does not run competitive research grant programs. OCRM is unsure what grant submissions Mr. Mellor is referring to.

**Carolyn Matthews Raymond**
**Citizen, NH**

**Comment:** Ms. Raymond praised the CTP workshops as among the best in the area and for always being well organized, well advertised and timely, in particular the LID workshop and UNH stormwater workshop.

**OCRM Response:** OCRM concurs that the GBNERR provides well organized and valuable training for coastal decision-makers and thanks Ms. Raymond for her comments.

**Mary Jo Gregg and 2nd Grade Teachers**
**Main Street School, NH**

**Comment**: Ms. Gregg stated that living near the seacoast offers opportunity and responsibility to experience the shoreline and that she was grateful to Great Bay Discovery Center staff for engaging children in learning through informative and lively programs.

She noted that children will become the caretakers and decision-makers for the natural world and direct experience with the habitats surrounding their homes is an essential piece of young children's science education. She thanked staff for the consistently high quality instruction that Great Bay Discovery Center delivers. She noted that the school's nine 2nd grade classes have visited each spring over the last ten years, positively impacting the education of hundreds of Exeter students. During that time, the teachers watched the Center expand and continue to offer programs of the highest quality.

**OCRM Response:** OCRM concurs that the Reserve provides excellent educational programming and thanks Ms. Gregg and the 2nd grade teachers of Main Street School for their comments.

**Lisa Freyenhagen**
**Epping Elementary School, NH**

**Comment:** Ms. Freyenhagen provided a summary of student reflections on a fourth grade field trip to Great Bay Discovery Center. She stated the students overwhelmingly agreed that the trip was valuable and that other students should be able to continue to enjoy such field trips for years to come. Her students learned about the Bay and history before their trip to the Discovery Center and the trip cemented the pieces of information together and gave the children a context for all the information they had learned. The students enjoyed spending a day outdoors reliving life as it would have been experienced hundreds of years ago and learned many facts as they investigated their natural surroundings. Eight months after the trip, students were still able to accurately recall facts learned on the trip and spoke enthusiastically of their experience. She stated that as a teacher, she greatly appreciated the quality of programming and the professionalism of the staff at Great Bay Discovery Center.

OCRM Response: OCRM concurs that the Reserve provides excellent educational programming and thanks Ms. Freyenhagen for her comments.

## Appendix E: GBNERR's Response to 2005 Evaluation Findings

**Necessary Action: The Reserve and Department should develop a more stable non-federal stream of financial support.**

**Response:** The Department is matching NOAA annual operating funds in its state fiscal year budgets at the required 70/30 ratio. Volunteer match is now used on a limited basis only. The Department has also recently committed the required 70/30 match for a NOAA construction award to replace the roof on the Great Bay Discovery Center.

In addition to this financial commitment, the Department has worked closely with the Great Bay Stewards to generate private support for the Reserve. This includes authorizing the Stewards through a Memorandum of Agreement to collect program and building rental fees in support of the Reserve. These monies have been used for a number of maintenance projects, most recently the repair of the geothermal system at the Gregg Center ($5,200).

The Department also established the Fish and Game Wildlife Foundation to generate private dollars to support Department programs. The Reserve recently applied for and successfully received an award of $9,100 from the Foundation to support the construction of a new exhibit space (the Special Collections Room) and a new outdoor viewing deck at the Gregg Conservation Center.

**Necessary Action: The Reserve must complete and submit a final revised management plan to OCRM by March 2006.**

**Response:** A final revised management plan was submitted by the date due and final approval of the plan was received in September 2007. The eighteen month gap between submittal and approval was a period of negotiations between the Fish and Game Department and NOAA over the expanded Reserve boundary.

**Program Suggestion: NOAA encourages the Reserve and UNH to maintain and increase communication in the implementation of SWMP. The Research Coordinator should maintain active involvement in the program and strengthen his/her oversight role.**

**Response:** As part of the revised Management Plan, the Reserve and UNH Marine Program signed a Memorandum of Agreement allowing UNH to receive federal funds to administer SWMP and complete all of the required work tasks associated with this program.

The Reserve hired a new fulltime Research Coordinator in January 2007 (Kathy Mills). Since assuming this position, the RC and Reserve Manager meet quarterly with UNH Marine Program staff, including the Marine Program director and SWMP technician to review implementation of the program. In addition, the RC provides regular oversight of the program.

**Program Suggestion: The process for transferring properties acquired through the Great Bay Partnership to be incorporated into the Reserve should be completed in a timelier**

**manner. The State and the Fish and Game Department should devise and implement a mechanism to accomplish these transfers from The Nature Conservancy to the Department.**

**Response:** Working with TNC and the Great Bay Partnership, properties are now transferred on an annual basis (December) to the Department. The Coordinator of the Great Bay Partnership works with the Department's Land Resources Bureau to prepare the annual package of transfers for approval by the NH Governor and Council. This process has worked successfully for the past several years with support from the Lands Resources Bureau.

**Program Suggestion: The State and the Fish and Game Department should develop a plan to address the financial and staffing issues associated with the long-term management of lands acquired by the state and incorporated into the Great Bay Reserve. The Reserve's final management plan should address the issue of long-term land management for newly acquired properties.**

**Response:** The Reserve and the Department have implemented a number of steps to address the management of Reserve lands. The SC worked with other Reserve staff to create the Community Lands Stewards, a cadre of volunteers who each adopt a Reserve property. Their role is to monitor the property several times a year for illegal uses, public activity, storm damage, etc. There are currently over a dozen active volunteers. The SC has also worked with UNH to recruit student interns to help with management projects.

To increase coordination within Fish and Game, the Reserve's SC is now a member of the Department's Lands Team. They meet monthly to discuss land management issues. Since all Reserve lands are considered Wildlife Management Areas, participation in this policy-oriented group has led to more uniform enforcement of the rules and regulations that govern public use of Fish and Game properties. The SC also meets annually with the Conservation Officers who oversee lands within the Reserve boundary.

In order generate additional funding for land management, the Reserve successfully applied for and received an award from the Natural Resources Conservation Service (NRCS) for habitat improvements under the Wetlands Restoration Program. These funds are being used for a number of habitat improvement projects on Reserve lands and run through 2012.

## Appendix F: GBNERR's Accomplishments Report

Begins on next page.

# Great Bay National Estuarine Research Reserve

# Accomplishments Report

# May 2005 – April 2010

## Introduction

Over the past five years, the Great Bay NERR (Reserve) has made significant progress in expanding our programs and maturing as a site. Significant accomplishments included the dedication of a new facility, the Hugh Gregg Coastal Conservation Center (June 2006), the hiring of our first fulltime Research Coordinator (January 2007), and acceptance of the Reserve's revised Management Plan and boundary expansion (September 2007). The Reserve also celebrated its 20th anniversary during this time period (September 2009) and released a report on current environmental conditions, *Ecological Trends in the Great Bay Estuary* (December 2009).

All of these efforts and other contributions by staff have raised the profile of the program within Fish and Game, other state agencies, and the general public. The Reserve has also significantly strengthened its ties with local partners.

## Operation and Management

The Reserve's revised management plan for 2005-2010 was approved in September 2007. This was a long and difficult process, in part due to the large boundary expansion. The Reserve extended the boundary from Great Bay to include Little Bay and the tidal portions of the Bellamy, Oyster, Lamprey, Squamscott and Winnicut rivers.

The original boundary included 4,471 acres of open water and salt marsh in Great Bay proper and 1,882 acres of upland. The boundary expansion added 2,830 acres of open water and salt marsh as well as 1,052 acres of upland. This brings the total acreage of the Reserve to 10,235 acres with an approved acquisition zone comprising an additional 20,172 acres.

The plan also incorporates the Reserve's new facilities and implementation of several system-wide programs. Access to the plan is through the Department's web site under Marine Fisheries. There are no printed copies available.

## Facilities

The Hugh Gregg Coastal Conservation Center was opened in June 2006. This facility is adjacent to the Reserve's Great Bay Discovery Center. While the Discovery Center serves as office space for staff and features exhibits on the estuarine habitats of Great Bay, the Gregg Center provides much needed meeting space. The building includes a large conference room with full audio visual capability and a caterer's kitchen. There are also exhibits on the uplands of Great Bay.

The building includes a geothermal heating and cooling system and features composting toilets. A more recent addition is a Special Collections room in the basement (to be completed by June 2010). This space will be dedicated to cultural artifacts from the Seacoast. Over the years, the Reserve has received numerous donations of historical value and this space will allow us to put these items on display for the public.

The construction of the Gregg Center also involved a new parking lot that is available to both buildings. It was designed by the University of New Hampshire Stormwater Center and features porous asphalt with pervious concrete sidewalks. The site is used by the Stormwater Center for training purposes through our Coastal Training Program (CTP). Also added at the same time was a waterfall and stream feature that connects the two buildings. This was constructed entirely with donated funds from a local family. Finally, construction funds were used to install several outdoor exhibits on the grounds.

**Public Access**

All Reserve lands, minus the five acres for our educational facilities, are considered Wildlife Management Areas and subject to the rules and regulations as enforced by the Department. Public use is encouraged and all Reserve lands are multi-use and support a variety of recreational activities. We do not allow camping, fires or wheeled vehicles of any kind including bicycles. Snowmobiling is restricted to state-approved trails.

During the evaluation period, the Reserve has been actively planning to increase the number of access sites. Through the Great Bay Resource Protection Partnership, we completed construction of the Sweet Trail. This 4.2 mile hiking trail runs through two towns and involves three other property owners – The Town of Durham, the Society for the Protection of NH's Forest (SPNHF) and The Nature Conservancy (TNC). Reserve lands comprise a large part of the middle section of the trail and we maintain the only parking area outside of the two terminus points (Town of Durham and TNC).

In addition to the parking area (known as the Newsky site), we installed several interpretive exhibits and a wildlife viewing platform. The exhibits were funded by the Reserve's friends group, the Great Bay Stewards, and the materials for the platform were donated by a local family. A formal dedication of the site was held on April 24, 2010.

A wildlife viewing platform was also constructed at Chapman's Landing. Located on the Squamscott River, this site is the largest boat ramp within the Reserve boundary.

**State Partnership Relationship**

The Reserve-Fish and Game relationship has strengthened considerably in recent years with strong commitments from the agency director and business division chief. This enhanced relationship has resulted in more administrative and program support.

Specific examples of this increased support are in the areas of grants management, public outreach and publications as well as property management, maintenance and enforcement. Despite numerous state cutbacks, the Department has been able to provide much needed services to our program.

**Fiscal Management/State Budget**

The state operates under a biennium budget. We are currently in year one of the two-year cycle (July 2009 to June 2011). Planning for the biennium budget (2011-2013) will begin this summer. Once the budget is passed, you can only accept additional funds through a cumbersome and lengthy process. For example, for the coming year ERD offered each Reserve funding for biomonitoring and we could not accept these funds through the State in a timely manner (were processed through UNH instead).

Because of the complexity of the state budget process, a portion of the Reserve's federal funding for operations goes directly to UNH. This includes support for SWMP and other special projects (currently includes the Habitat Mapping Classification project). UNH is providing the required match for these funds.

The Department receives no general funds, but is a self-funded agency primarily through license revenue and grants. Matching state funds provided by the Department for our NOAA awards are generated through the sales of licenses and are matched on a straight 70-30 cost basis.

The majority of the funding for operations goes through the Department's Federal Aid Coordinator and Business Office. The Reserve currently supports six fulltime positions (Manager, EC, RC, SC, CTP Coordinator and Assistant Education Coordinator) and five part-time positions (Park Guide/Naturalist, Park Guide/Program Assistant, Volunteer Coordinator, Maintenance Mechanic/Caretaker, and Laborer; the latter position is for six weeks only in the summer).

Fulltime staff is eligible for benefits including full medical/dental insurance. Part-time staff receives limited benefits and in some cases are eligible for partial medical coverage (currently only the Park Guide/Naturalist is eligible for 80% coverage). All Reserve employees are union employees and fall under the collective bargaining agreement.

Recently, the State has moved to a centralized accounting system (Department of Administrative Services) and eliminated individual account categories. As a result, any costs associated with Reserve programs are placed in a single line item and cannot be tracked separately (i.e. CTP, research, education and stewardship).

**External Funding**

The Reserve received one construction award over the past five years. This was not a NERRS Land Acquisition and Construction award but part of a Congressional earmark that did not require non-federal match. It totaled $391,000 in federal funds.

These funds were used to complete the construction of the Hugh Gregg Coastal Conservation Center and included the following projects:

- Installation of a caterer's kitchen
- Landscaping
- Driveway and parking lot
- Landscaping and walkways
- Interior and exterior exhibits

Through the Great Bay Resource Protection Partnership, land acquisition funds for each of the last five years were received through the same earmark process. These awards were made directly to The Nature Conservancy (TNC) and many of the lands acquired are now part of the Reserve.

The Reserve is also supported by the Great Bay Stewards as described below.

## Partnerships

Partnerships are essential to the success and expansion of Reserve programs. Some of the Reserve's key partners include:

- Great Bay Resource Protection Partnership (TNC is the lead partner)
- NH Coastal Program (helps to provide local funding)
- UNH Sea Grant (provides marine education training to our volunteers)
- Piscataqua Region Estuaries Partnership (local NEP program)
- UNH Stormwater Center (outgrowth of CICEET)
- UNH Cooperative Extension (supports CTP)
- Great Bay Wildlife Refuge (located within Reserve boundary)

The Reserve's most important partner is the Great Bay Stewards. Serving as the Reserve's friends group, the Stewards were incorporated in 1997 as a 501(c)3. Based at the Great Bay Discovery Center, they manage the Discovery Center store and collect program fees (school programs and kayak program) on behalf of the Reserve. All of their activities are outlined in a MOA with the State of New Hampshire. This document was recently updated and approved.

## Visibility

The Reserve has gone to great lengths to increase its visibility. The Reserve logo was changed from a horseshoe crab to the NERRS logo to better identity the program with NOAA. The name of the Discovery Center was changed from Sandy Point to Great Bay in order to connect the name to the bay. These changes were made so the public would better associate the Reserve as part of a national system of protected sites (NERRS).

At the same time, the Reserve's magazine (Great Bay Matters) was redesigned and is now printed in full color. Circulation has been increased as well. The Reserve has worked with the

Stewards to use more electronic forms of communication such as Facebook and Constant Contact (an e-letter program). The Fish and Game Department also has a Facebook page that can be used to announce events. The Great Bay web page is in the process of being updated by the State Office of Information Technology.

**Management Issues**

In the revised Management Plan, six priority resources management issues were identified:

- Preventing land fragmentation and loss of wildlife habitat
- Protecting water quality
- Increasing shellfish populations
- Controlling invasive species
- Reversing the decline of key fish populations
- Ensuring the proper stewardship of Reserve lands

All of these remain significant challenges although significant progress has been made addressing each issue. The Great Bay Partnership continues to acquire and protect key parcels around the estuary. The success of this program has encouraged other conservation groups and the local communities to expand their land protection efforts.

The NH Coastal Program/Department of Environment and PREP have taken the lead in addressing water quality issues throughout the estuary. Nitrogen loading remains the primary concern and EPA is in the process of declaring Great Bay as impaired waters. This will have a significant impact on addressing pollution sources to the bay. The Reserve continues to provide important water quality data through SWMP.

The Nature Conservancy and the Jackson Estuarine Lab (JEL) at UNH have received grant funds to restore critical shellfish beds in the estuary. This work is being coordinated through the Marine Fisheries Division. The Reserve also is a member of the newly created Restoration Partnership (headed by TNC) to support all restoration efforts in Great Bay. Siltation is a major problem, which also impacts water quality.

The Reserve has taken a leadership role along with the NH Coastal Program in creating the NH Coastal Watershed Invasive Plant Partnership. This group is actively addressing ways to control invasive plants species in the Seacoast. The Reserve has developed an experimental design program to track the control and management of invasive species on Fish and Game lands. The woolly Adelgid insect is also a concern.

Rainbow smelt are a key fish species in the estuary and their numbers have been declining for the past fifteen years. The Reserve's RC worked with Marine Fisheries staff to secure NOAA funding from NMFS for a five-year project to restore smelt populations by improving their habitat and addressing water quality issues related to smelt reproduction. This is a joint project with the states of ME and MA. Winter ice fishing for smelt is an important winter recreational activity in the estuary.

The stewardship of Reserve lands is a top priority and will be a major issue over the next five years. Significant acreage has been added to the Reserve but there are limited resources to manage these lands both in terms of staff and equipment. Public use is increasing and it will be important to measure visitor impact. Other key land management issues include the spread of invasives, mosquito control and illegal dumping.

Climate Change has also become an important resource management issue. The driving factor has been the dramatic increase in storm events. The region experienced three 100- year flood events between May 2006 and November 2008. There have been three large rain events in the first four months of 2010. The major problem caused by these intense storm events is freshwater flooding and inputs to the estuary as well as increased siltation.

The Reserve has been active in Climate Change issues and help to organize the Climate Adaptation Workgroup (CAW). The Reserve's CTP Coordinator is chair of this group comprised of state agencies and non-profits. Their mission is to work with local communities in planning for sea level rise and other impacts associated with Climate Change.

Other resource management issues that have emerged more recently are managing Fish and Game lands to restore habitat for the New England Cottontail. This species is likely to be listed as a Federally Endangered Species. The Reserve has already approved through NOAA two habitat manipulation projects on Reserve lands to promote cottontail habitat. A third proposal has been submitted to NOAA for review (this latter property was purchased with NOAA funds but is located outside of the boundary).

There is also pressure to increase the number of oyster aquaculture projects located within the Reserve boundary, especially Little Bay. These proposals are likely to be commercial efforts rather than research projects. There is growing interest in using oysters to help improve water quality. All such projects are permitted by Fish and Game and must be approved by the Marine Fisheries Division.

# EDUCATION PROGRAM DESCRIPTION AND ACCOMPLISHMENTS

**Education Sector Accomplishments 2005-2009**

## K-12 Education- School Exploration Programs

The Reserve's K-12 School Exploration Programs are the flagship programs of the Education Sector. Programs are held in the spring and fall and undergo rigorous evaluation, integrating teacher, staff and volunteer input each season. The programs are so popular within the education community that they fill up in less than a day. Programs are aligned with the science and history curriculum standards for the State of New Hampshire.

A sample of teacher evaluation comments are listed below.

***"I've been teaching over 30 years and this is one of the best field trips I've ever been on. My only suggestion is to find a way that more schools could participate!"***

***"This is one of the best prepared and presented education field trips anywhere!"***

***"Children got to hold and observe such a variety of sea life at close range! The guided touch tank experience was far more educational and safer for the animals than a free exploration touch tank."***

***"All parts of the program meet the needs of our estuary unit."***

***"Each of the activities could be tied into our curriculum goals."***

***"I have been to Sandy Point for primary or 4th grade trips each year they have been offered and have participated in a professional development seminar. I have a copy of your curriculum. I truly believe you have done an excellent job creating a curriculum for this important local habitat."***

## Program Descriptions

### Spring Natural History School Programs – April, May & June

Students participate in on-site staff and volunteer-led activities that highlight the natural history of the Great Bay Estuary including an interactive horseshoe crab activity with costume, a habitat discovery walk on a boardwalk which involves stops to learn about osprey, salt marsh ecology, upland forests and vernal pools, a waterfront exploration, a hands-on discovery tank visit with estuarine animals and a simulated cooking class where the students make "estuary soup".

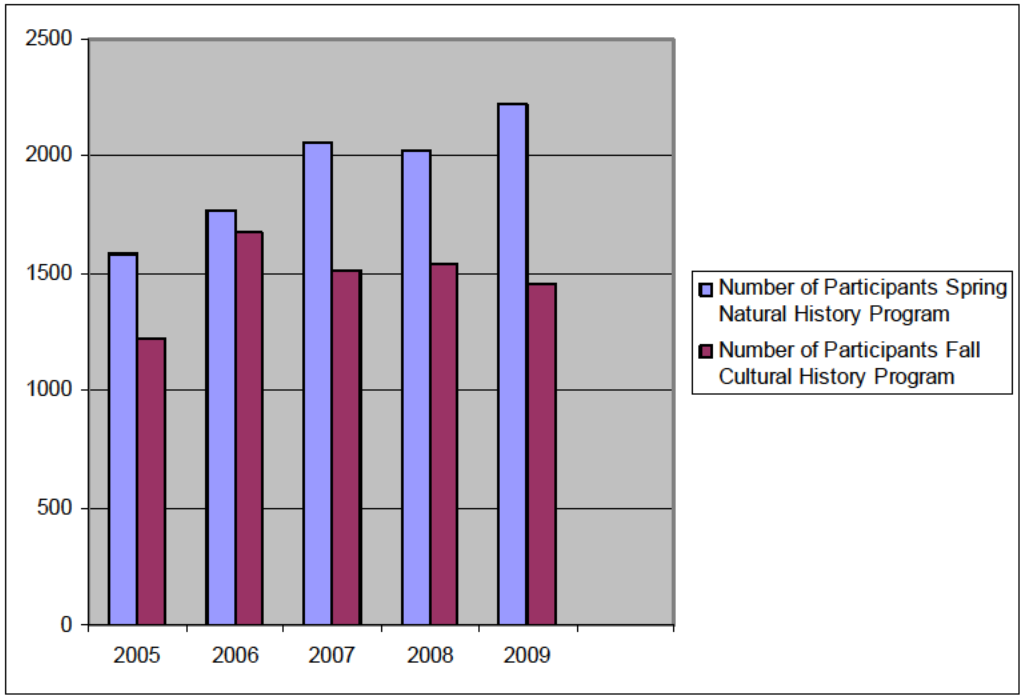
**A total of 198 programs with 9,657 students in grades 1-5 from New Hampshire and Massachusetts schools attended Spring Natural History Programs from 2005-2009. A training day is held each year for approximately 40 volunteers to teach them how to lead these programs.**

### Fall Cultural History School Programs- September & October

Students participate in on-site staff and volunteer-led activities that highlight the cultural history as it relates to the natural resources of the Great Bay Estuary. Activities include a salt marsh haying interactive story, a mini hands-on archaeological dig, a visit to our "Landing" where students trade goods that would have been carried on board gundalows in the 1700's and 1800's.

They then climb aboard the last Piscataqua River gundalow boat replica to participate in deckhand activities. The field trip is complete with a walk on The Trail of the Arrowhead which includes a visit to a "fishing encampment" and an interpretive talk inside our birch bark covered wigwam featuring replica artifacts of the
Squamscot Indians.

**A total of 156 programs with 7,404 students in grades 1-5 from New Hampshire and Massachusetts schools, attended Fall Cultural History Programs from 2005-2009. A training day is held each year for approximately 40 volunteers to teach them how to lead these programs.**




**K-12 School Programs – 2005-2009**

## Community Education

### Summer Bayventure Programs-July & August

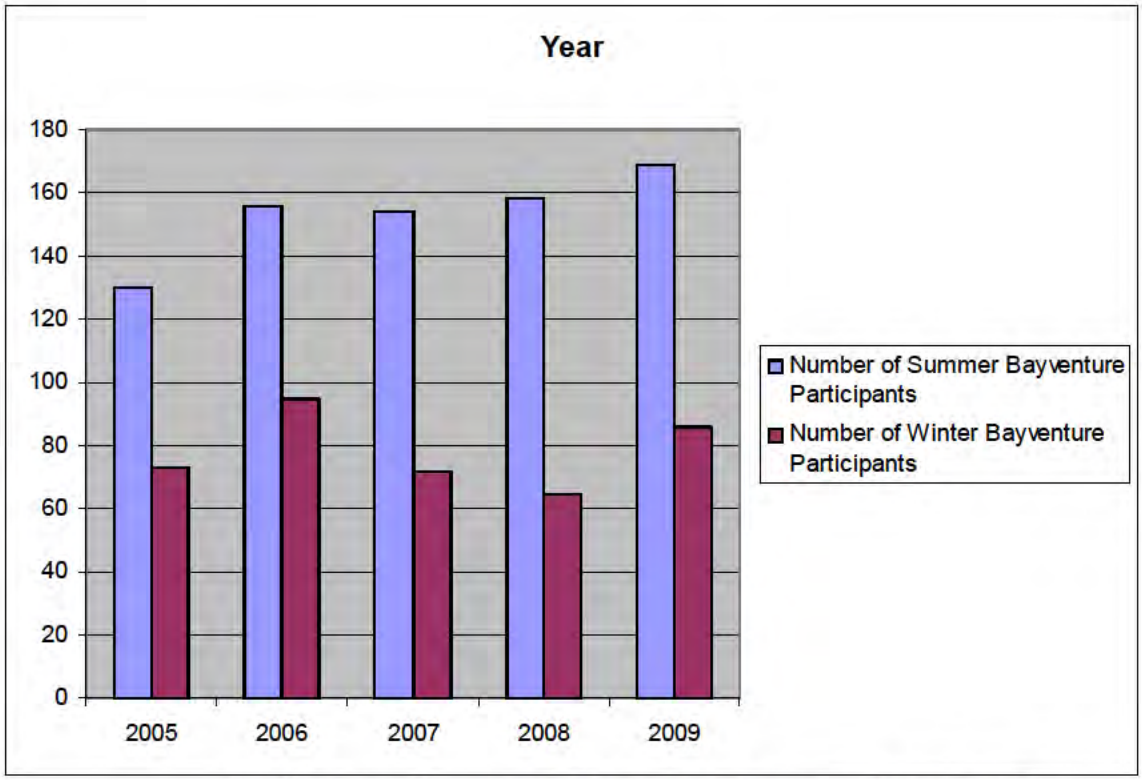
During the summer, the Reserve conducts Bayventure Programs, a 2 hour program held primarily on the grounds of the Great Bay Discovery Center. Program themes have included horseshoe crabs, mudflats, aquaculture, Geocaching, reptiles and amphibians, fish, mammals, tides etc. Bayventure Extreme Day Camp was new for 2009 and was held for one week in August. The camp was 6 hours each day and included activities from our most popular Bayventure programs from the last 10 years.

**Sixty-three Bayventure programs served 767 children ages 7-11 from surrounding communities for the years 2005-2009.**

## Winter Bayventure Programs- January, February & March

Each Winter Bayventure Program (except the overnight) is 4 hours in length and includes outdoor and indoor activities. Program titles have included Project Feederwatch, an International Citizen Science Program for counting birds at feeders, ice fishing, Geocaching, estuarine winter ecology, raptors, tracking and winter adaptations of animals, etc. The Reserve also offers a school vacation camp called Surviving and Thriving in Winter Overnight, where participants spend the night in a birch bark covered wigwam.

**A total of 34 programs served 391 children ages 7-12 from surrounding communities for the years 2005-2009.**




**Bay Ventures Community Education Programs 20005-2009**

**Once Upon an Estuary Summer Programs**

During the summer, the Once Upon an Estuary Program offers an hour long experience for preschool aged children with their parents. Each week, the program is designed to offer a similar topic as the Bayventures program so that siblings, who attend either, might share what they have learned**.**

**A total of 642 participants attended OUE programs for the years 2005-2009.**

**Ambassador Programs**

These programs are designed to meet the needs of groups that would like to have a guided educational visit but do not fall into a K-12 audience. These groups can include, but are not limited to scouts, small schools, homeschoolers, summer camps, and senior citizen groups. These programs are at least an hour long and are available during our open season, May through October.

**A total of 1,863 participants attended Ambassador Programs for the years 2005-2009.**

**Bay Views**

These summer evening adult and family discussion series attract a general public audience and cover topics ranging from estuarine ecology, natural and cultural history, climate change, sustainability and fish and wildlife management**.**

**A total of 43 Bay Views programs were held with 2,247 participants for the years 2005-2009.**

**Interpretive Kayak Program**

During the summer, GBNERR offers interpretive guided kayak trips in the Estuary. A variety of trips are held each summer on topics ranging from Coastal Birding, Salt marsh Ecology, Saltwater Angling, Cultural History, Research, Stewardship and Coastal Decision Making. The Reserve operates the trips using its own fleet of kayaks, and/or participants join the trips using their own boats. Several staff members are trained in kayak safety and rescue and lead both the naturalist and safety portions of the trips. We have found these trips to be an excellent way to attract a "non-choir" audience to our programs. Evaluations of the trips have been excellent. Other kayak companies locally have contacted the Reserve to provide naturalist for their trips.

**A total of 385 people have participated in kayak trips for the years 2005-2009.**

## Volunteer Community

If one were to ask what the Reserve's most valuable commodity is, we would all agree; our volunteers. Each year volunteers contribute over three thousand hours to Reserve programs. Our education programs receive the most volunteer support; however we also benefit from their assistance with our grounds and gardens and within our Stewardship Program. A full description of our volunteer opportunities can be found in our "Great Bay Discovery Center Volunteer Handbook."

In the period between 2005 and 2009, volunteers contributed 17,622 hours toward Reserve programs and projects.

## Publications

Two thousand copies of our Reserve magazine, *Great Bay Matters*, are distributed three times yearly to volunteers, partners, visitors and other targeted audiences.

In the last five years several new publications have been developed:

*Passport to Great Bay*: The Passport is a publication that features a dozen Reserve Properties available for public visitation. In the Passport pages, special property characteristics are interpreted, along with directions, unique natural and cultural attractions and a Geocache coordinate leading to a special Reserve cache hidden at each site. Individuals who complete the entire Geocache trail are eligible to receive a GBNERR water bottle with "I punched my way around Great Bay" printed on it.

*Great Bay Discovery Center Brochure*: A new, full color brochure was developed to inform visitors about the Center and its programs.

*School Exploration Programs Brochure*: Compatible with the Discovery Center Brochure, this new brochure features full color highlights of our K-12 Education Programs.

## Facilities and Exhibits

Within the last five years the Hugh Gregg Coastal Conservation Center was completed. This 40x60 New England Style Post and Beam Barn features Geo-thermal heating and cooling, composting toilets and other green design features. Exhibits in the Gregg Center feature the uplands of Great Bay, with a focus on land use change over time and its impacts to wildlife of the region. Together with the exhibits in the Discovery Center, a watershed approach to interpreting Great Bay is achieved. A special design feature created by private donations is a

man made stream that runs off the excess water from the Geo-thermal well. Other outdoor exhibits have been developed including a new "NERRS" Post, featuring every Reserve in the System, its direction from us and the distance in miles from GBNERR.

**From 2006-2010, 12,323 people have attended public events, workshops and trainings in the Hugh Gregg Coastal Conservation Center.**

**Friends Group Integration/Funding**

The Great Bay Stewards are the friends group of the Reserve. Each year the Stewards hold a number of fund-raisers to support Reserve programs and facilities. One in particular is the Great Bay 5K Road Race. This race has been a popular event for over ten years, and is now maxed out at a cap of 1,000 runners. In the period from 2005 to 2009, 3750 individuals have run the Great Bay 5k.

The Stewards also host the Art of Great Bay show in the Hugh Gregg Center as well as several other smaller funder-raisers. The Stewards assist in taking in grants and providing additional funding to support programs and initiatives beyond what the general grant can pay for. The Stewards operate the store within the Discovery Center, and collect program fees for our K-12, community education and kayak programs.

## Coastal Training Program Great Bay National Estuarine Research Reserve

**Introduction and Program Context**

The Great Bay National Estuarine Research Reserve (GBNERR) submitted all documents to establish the GBNERR Coastal Training Program (CTP) in the fall of 2004, with ERD approval in February 2005, completing the planning requirements to officially establish the CTP.

New Hampshire has 18 miles of oceanic coast with an additional 131 miles of tidally influenced river and estuarine coast of which Great Bay is a central feature. Due to the large tidal expression in the Gulf of Maine, the center of Great Bay is 15 miles inland from the ocean. The resulting coastal watershed of 1087 square miles of land is under the jurisdiction of 43 New Hampshire and 10 Maine municipalities. With strong local control, these municipalities address natural resource issues with a variety of strategies implemented through their predominately citizen volunteer land use boards (Primary CTP Audience). Some of the fastest growing areas of New England are in coastal NH. From 1990 to 2004, NH's population grew by 17.2%, and a 28% growth rate is projected between the years 2000 to 2025. The coastal and southern counties of NH, which cover almost the entire Great Bay watershed, are by far the fastest growing areas in the state. Development and growth continue to be the primary drivers behind CTP strategy.

The GBNERR CTP has grown and evolved through experience, evaluation, and planning. While the GBNERR CTP operates in the coastal state with the smallest coastline in the nation, this situation offers valuable and perhaps unique partnership opportunities. The GBNERR CTP

strategy has focused on partnership building and has established the CTP as a program that brings value to existing programs, contributes to coastal decision maker (CDM) training, and brings new resources to bear on the issues faced by CDMs. CTP continues to refine its niche, strengthen its role in our training market, and continue to find ways to address and meet the needs of coastal decision makers in the most resource effective way possible. The CTP strategy is informed by analysis of the evaluations completed after every training event, engagement with partners, almost daily contact with the target audience members, the CTP Coordinator's (CTPC) role as a local decision maker (the CTPC is Chair of a municipal conservation commission), assessments of emerging issues, and information gathered from partner organization strategies, as well as the input from the CTP Advisory Committee (CTPAC).

**Coastal Training Program Goals**

The mission of the Great Bay National Estuarine Research Reserve is to promote informed management of the Great Bay Estuary and estuarine habitats through the linked programs of stewardship, education, and scientific understanding. The mission of the GBNERR Coastal Training Program is to augment informed decision making by transferring technical information and science based training to target audiences. The overarching goal of the CTP is a sustainable Great Bay (GB) ecosystem that provides abundant coastal resources for society and nature. The CTP contributes to the goals and objectives of the GBNERR in the following ways.

The primary GBNERR goal that involves CTP is education. This goal is: *Design and implement a comprehensive program of education, outreach and interpretation based on solid scientific principles that strengthen understanding, appreciation and stewardship of estuaries, coastal habitats, and associated wetlands throughout the GB watershed.* This goal has several objectives including: *Develop and implement effective programs for coastal decision makers and other coastal partners about resource management issues that affect the sustainability of our estuaries and watersheds.* This is the main focus of all CTP activities.

Another GBNERR goal that involves CTP and integration with other Reserve sectors (Research and Stewardship) is: *Improve the health of Great Bay estuary and the watershed by conducting research and monitoring activities and providing information that promotes informed resources management.* To meet this goal, CTP provides identification of research needs to our RC from CTP program evaluations and interaction with coastal decision makers. CTP activities include providing technical assistance to organizations and municipalities conducting research and monitoring activities.

The GBNERR in a recent strategic planning process identified four key areas of focus. These are Water Quality, Land Use Change, Climate Change, and Biological Monitoring. All of these areas will allow for continued and improved integration within Reserve Sectors, as well as provide training opportunities for CTP that are a near perfect match of CTP Priorities as identified in the 2004 Needs Assessment and as identified in analysis of training evaluations since 2004. Two current examples of how CTP meets the goals of integration with other sectors within the GBNERR are with climate change and invasive species work, descriptions of these programs can be found in Appendix One.

**Partnerships**
A needs assessment completed by GBNERR in 1998 was instrumental in the strategic planning and organization of the collaborative CDM service provider group now known as the Natural Resource Outreach Coalition (NROC). NROC is an effective training provider to coastal decision makers in New Hampshire. GBNERR has been working directly with NROC through the CTP since March 2002 and with leadership and support resources for years prior to 2002. NROC core partners are the GBNERR, New Hampshire Coastal Program, New Hampshire Department of Environmental Services, New Hampshire Estuaries Project, New Hampshire Sea Grant, Rockingham Planning Commission, Strafford Regional Planning Commission, and the University of New Hampshire Cooperative Extension. Coalition members are skilled and experienced at providing training resources to coastal decision makers and will continue to be some of the CTP's strongest partners.

Other noted partners are the NH Association of Conservation Commissioners, NH Fish and Game Department, the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), the UNH Stormwater Center, and the UNH Jackson Estuarine Laboratory. The CTP continues to developed new partnerships with local engineering, development, and landscaping professional sectors. CTP has established effective partnerships with several towns and municipalities in the watershed, this effort will continue. The CTP continues to monitor the training market and develop partnerships that address both coastal decision maker needs and critical training opportunities that arise. Partners are a key component of the CTP and are utilized whenever practical to meet the goals of CTP and to meet the programmatic needs of CTP.

**Programmatic Issues**
As the primary issues challenging a sustainable Great Bay ecosystem continue to be development and population growth, the main areas of focus for CTP are land use change, increase in impervious cover, nutrient pollution (including sewage), stormwater management, and climate change. This will involve supporting land conservation (through NROC and GBNERR), promoting natural resource based planning (NROC), advancing decision-making based on scientific knowledge in all the areas of focus (workshops/trainings), and in facilitating the implementation of Low Impact Development (LID) (workshops/trainings). GBNERR's four priority areas of focus correspond to CTP programmatic issues as follows. Water Quality includes stormwater and non-point source pollution, buffers and land use. Land Use Change includes land conservation management, restoration, LID, and watershed management. Climate change includes how changes in precipitation will affect municipal stormwater infrastructure and water conservation efforts, sea level rise, coastal resilience issues, and habitat change. Biological Monitoring includes biodiversity and habitat.

One area of focus for the CTP is climate change which until recently was not being addressed by the training market. CTP began researching climate change science in 2006. In 2007 CTP began offering programs on climate change to CDMs. The programmatic focus shifted in 2008 from one of awareness building to actual impacts that affect municipal planning, infrastructure, and resource allocation. CTP is a leader in offering climate change trainings that bring new science and resources relevant to municipal needs to CDMs.

**Audiences**
The CTP serves the general target audience of coastal decision makers. The primary coastal decision makers in the New Hampshire Coastal Watershed are select boards and city councils, planning boards, conservation commissions, zoning boards of adjustments, planning departments and regional planning commissions. Other CTP Primary Audiences are developers, engineers, landscapers, and the construction community. These additions to the primary audience of CTP are based on CTP assessments during the past strategic period. It is clear to the CTPC that all parties involved in development and the municipal review/approval process of development need to be on the same page (or close to the same page) regarding LID and stormwater management to see improvement in the environmental design of developments and a reduction of the impacts of development.

**Training Delivery**
The training methods employed by the CTP are, by order of preference from most to least preferred, workshops with facilitated discussion and hands-on training, lecture and field trips, conferences, publications, information manual, internet, short lectures, and demonstrations. The best incentives for CDMs to attend a workshop remain to be having expert speakers/presenters, with workshops held at a central location, and to supply support materials. These methods have served the CTP well and continue to be the basis of most CTP training events.

The CTP continues to routinely evaluate effectiveness of training methods and employ the most effective training methods based on analysis of evaluations. A major challenge to the CTP is to engage those CDMs who generally do not participate in training opportunities. The key to meeting this challenge is accommodating the time limitations of the NH citizen volunteer CDM and finding ways to bring information directly to them at the local level. This can be accomplished by providing training at their regular scheduled meetings, partnering with other training providers to put on conferences versus creating new stand alone workshops, working one-on-one with coastal decision makers, developing new ways to get information out such as web based presentations, and working with our partners to facilitate information transfer.

In 2008 Technical Assistance made up about 15% of the CTPC's effort as measured in our NERRS CTP Performance Monitoring System. This percentage will increase slightly CTP moves forward in its efforts with watershed organizations. The main focus of CTP efforts will continue to be workshops and trainings that bring the best science available to the issues at hand. Routinely the professional outreach peers from GBNERR CTP partners attend CTP workshops to stay current on the science/solutions.

**Evaluation**
The CTP evaluates all activities as per the NERRS Performance Measures Handbook and system wide CTP requirements. CTP is evaluated for effectiveness in accomplishing the goals and objectives as identified in this document through post workshop/training evaluations and assessments, the GBNERR CTPAC regular meetings with supervisors, and near constant reflection on performance of the program and individual trainings. This information is utilized to improve training delivery and to develop the new trainings requested by CDMs.

Evaluation techniques are being refined for the one-on-one CTP work, as well as training efforts with CTP partners. Working with partners presents challenges with evaluation specifics, as each organization tracks different performance measures. CTP will continue to work with partners and find ways to complete NERRS requirements while meeting the needs of partners and the demands of CDMs to respect their time. Evaluation and performance measures are an essential part of the CTP's evolution and effectiveness. The CTP Advisory Committee serves as an important role in the evaluation and evolution of CTP.

**Staffing**
The GBNERR Coastal Training Program Coordinator is a single full time equivalent position and is the only CTP staff.

**Resources**
Primary infrastructure resources for GBNERR's CTP include office space and equipment, and the Hugh Gregg Coastal Conservation Center (HGCCC). The HGCCC is a key infrastructure component of the CTP as it provides a near perfect venue for most training, can seat 100 participants, and is equipped with AV. The HGCCC will soon be wired for Internet access and plans are being developed to find ways to increase the technology-based opportunities for training. A major challenge is to find the technology support needed for these technology-based tools. A majority of the coastal decision makers that participate in training are willing to travel up to 50 miles for training and the HGCCC is within 45 miles of all towns in the watershed. As an online resource, an independent CTP web page has been developed to assist the marketing and administration of CTP trainings.

Coastal NH has a well-developed and experienced network of coastal management training providers and it has a diversity of other resources that benefit the CTP. The University of New Hampshire houses excellent marine and coastal science departments and includes the UNH Jackson Estuarine Laboratory, CICEET, UNH Cooperative Extension, UNH Sea Grant, and the NH Estuaries Project now the Piscataqua Regional Estuaries Partnership (PREP). The CTP has a wealth of training resources represented in the partners and potential partners outlined earlier in this document. A key resource for the CTP is the very active and integrated network of service training providers that exist in coastal NH.

The following sections are listings of CTP activities for each six month ERD reporting period from 2009 to 2005. Each brief event description includes priority areas of focus, target audience information, and results. Often these activities are linked to past events and may represent follow up activities or activities that are part of a larger long term effort.

**Broad topic areas covered by trainings 2009-2005.**

| General Topic Area | Number of Trainings (n151) | Percentage of Total |
|---|---|---|
| Stormwater Management | 52 | .344% |
| Land Use Change | 41 | .271% |
| Estuarine Ecosystem | 21 | .139% |

| | | |
|---|---|---|
| Science | | |
| Watershed Management | 18 | .119% |
| Climate Change | 17 | .112% |
| Nutrients | 2 | .013% |

# RESEARCH PROGRAM DESCRIPTION AND ACCOMPLISHMENTS

## Description of research and monitoring projects

### *System-Wide Monitoring Program*

*Phase I: Abiotic Characteristics.*

All SWMP activities at the Great Bay NERR are currently administered directly by the University of New Hampshire through the Jackson Estuarine Lab. Jonathan Pennock, UNH Marine Program Director, has acted as the lead investigator since 2003. The research coordinator works closely with Dr. Pennock and the UNH SWMP team to ensure compliance with NERRS SWMP protocols. This coordination occurs through quarterly meetings and communication on an as-needed basis.

The Great Bay NERR established its first SWMP water quality monitoring station in the middle of Great Bay in 1995. Since that time, stations have been added in the Squamscott River (1997), Lamprey River (1998), and Oyster River (2002). At each station, a YSI 6600 non-vented multi-parameter datasonde measures temperature, depth, salinity, turbidity, pH, and dissolved oxygen every 15 minutes. All sites are telemetered to provide real-time data. The Oyster River station transmits data to the NOAA GOES satellite and then to the CDMO, while data from all four stations are delivered to UNH's Jackson Estuarine Lab and made publically available at www.greatbaydata.org.

In addition to the physical and chemical parameters monitored by the datasondes, water samples have been collected monthly at each site since 2002 for analyses of dissolved inorganic nutrients, particulate organic matter, suspended sediments, and chlorophyll. All grab samples from these stations were collected on ebbing tides within 2 hours of low tide in the same 24-hour period. All parameters required for SWMP (*) are measured, as are a number of additional water quality and environmental parameters:

| | |
|---|---|
| Nitrogen species: | $NH_4$*, $NO_2$*, $NO_3$*, TDN, PON, DIN, DON |
| Phosphorus species: | $PO_4$* |
| Other: | POC, $SiO_4$, TSS, CHLA*, PHEA |
| Environmental variables: | Water Temperature, Salinity, Dissolved Oxygen, Dissolved Oxygen Saturation, Total Water Depth, Light Attenuation, Cloud Cover, Precipitation, Tidal Stage, Wave Height, Wind Direction, Wind Speed |

To complement the monthly samples, high-frequency water samples are collected over a full lunar cycle at the Lamprey River location to track the tidally-driven temporal variability in nutrient concentrations. (Prior to April 2005, the diel samples were collected in the Oyster River, but the Lamprey site provides deeper water at low tide and eliminates problems such as clogged intake tubes and poor replication between samples.) Prior to June 2009, two 850 mL water samples were collected one minute apart every 2.5 hours, resulting in 12 samples for every 24 hour period. In June 2009, the sampling interval was shortened to ensure that samples covered a full lunar cycle.

Meteorological data are collected to aid interpretation of water quality data as well as to document extreme weather events and develop a database of historical weather conditions in the Great Bay NERR. A Campbell Scientific weather station samples every five seconds throughout the year, and these data are used to compile 15-minute, hourly, and daily data on air temperature, relative humidity, barometric pressure, rainfall, wind speed, and wind direction. Prior to October 13, 2005, the weather station was located on the roof of UNH's Jackson Estuarine Lab on the shore of the estuary at Adams Point. Following this date, the weather station was relocated to an open cornfield in Greenland, NH, to better comply with specifications in the SWMP protocols. In 2006 a GOES satellite transmitter was installed to provide real-time access to the weather data.

Data from Phase I of SWMP have been applied for a variety of purposes in Great Bay. The NH Department of Environmental Services has relied on SWMP water quality and nutrient data to establish nutrient criteria for the Great Bay Estuary. Turbidity data were used as a basis for assessing potential threats posed by sedimentation to fish in the Oyster River. In addition, many university researchers and agency biologists have used the data in a variety of research projects, including eelgrass modeling, biological resource assessments, sediment transport studies, and microbial tracking.

*Phase 2: Biological Monitoring.*

In 2006 and 2007, the Great Bay NERR collaborated with Dr. Fred Short of the UNH Jackson Estuarine Lab to conduct Tier 2 monitoring of seagrass in Great Bay. This project applied both the SeagrassNet monitoring protocol (quarterly) and the NERRS biomonitoring protocol (mid-summer during peak biomass) in the same seagrass meadow to enable comparison of the protocols. In addition, both protocols provided valuable baseline data on the *in situ* condition of seagrass in Great Bay. The NERRS protocol showed a gradient in plant parameters from nearshore to the deep edge of the seagrass bed, while quarterly repeated measures sampling using the SeagrassNet protocol enabled rapid detection of seagrass change at certain locations in the bed within a relatively short time period.

Results from the pilot seagrass biomonitoring project were presented at the 2007 NERRS Annual Meeting and at the 2008 New England Estuarine Research Society meeting. Application of the NERRS biomonitoring protocol for seagrass has not continued in Great Bay due to a lack of sustained funding. However, Dr. Short has been able to continue mapping the extent of eelgrass

and SeagrassNet monitoring of the Great Bay site, both of which provide valuable information on this important habitat.

In 2010, the Great Bay NERR submitted a successful work plan to initiate Tier 2 biomonitoring in three marshes around the bay using the NERRS protocols. This work will be conducted in collaboration with Dr. David Burdick at the UNH Jackson Estuarine Lab, who will help establish plots and train GBNERR staff in field monitoring methods. In the short term, this project will enable us to address two scientific questions:

- What are the spatial structure and temporal dynamics of emergent vegetation in Great Bay's salt marshes, and how are these related to physical factors (e.g., water level, salinity)?
- What are the spatial and temporal patterns of elevation and accretion, and how are these related to the distribution of vegetation communities?

Continuation of this monitoring program over the longer-term will enable us to understand (1) the extent to which changes in biological and physical features are related to climate change drivers and (2) how the study sites may respond as a whole to climate change. This type of local monitoring is critical for building understanding and guiding management decisions that will support the long-term maintenance and adaptation of marshes to climate change. Following the initial 18 months of funding, we hope to be able to continue this biomonitoring effort pending some level of sustained funding from the NERRS.

*Phase 3: Land Use and Habitat Mapping.* The Great Bay NERR has initiated the development of baseline maps of habitats within the Reserve boundary. This effort is being led by Rachel Stevens, our stewardship coordinator, and will be described in detail in the stewardship section of this report.

**Externally-funded research projects**

*Multi-State Collaborative to Develop and Implement a Conservation Program for Rainbow Smelt in the Gulf of Maine.*

Rainbow smelt populations have declined throughout their range, and southern populations between Chesapeake Bay and Long Island appear to have been extirpated in recent years. As a result, rainbow smelt was listed as a species of concern by the National Marine Fisheries Service in 2004. Since 2007, the states of Maine, New Hampshire, and Massachusetts have been working together regionally with funding from a five-year grant under NMFS's Proactive Conservation Program to document the status of smelt spawning populations, understand factors affecting them, and develop an integrated conservation plan to protect them.

The research coordinator manages and participates in this project as the lead representative for the state of New Hampshire. Field surveys are documenting smelt spawning use of rivers in Great Bay, including the creation of abundance indices in three local rivers. In addition, sex ratios, length:weight ratios, length distributions, age distributions, and mortality estimates are computed for each river and compared across the Gulf of Maine region. The genetic distinctness of populations and the contaminant and pathogen loads in body tissue are also being evaluated.

In addition to collecting biological data on the smelt themselves, an important emphasis of this project focuses on habitat quality that may affect the spawning success of smelt. Habitat conditions are assessed by monitoring water quality, measuring periphyton growth rates, and documenting in-stream habitat conditions. Datasondes are deployed to track water quality parameters, including temperature, salinity, dissolved oxygen, turbidity, and pH. Water samples are collected on a weekly basis to determine nutrient levels (i.e., total nitrogen and total phosphorus). For 2007-2009, tiles have been placed in two rivers (Winnicut and Squamscott) to track periphyton growth rates and composition. Additional in-stream habitat conditions such as channel width, substrate type, flow velocity, light intensity, and canopy cover are documented as potential correlates with periphyton growth and smelt spawning habitat selection.

Finally, the focused field work associated with this project will be scaled to a regional perspective through the development of a predictive GIS model. Watershed characteristics will be related to smelt abundance, biological parameters, and habitat conditions for those sites in which intense field work has been focused. The model that best characterizes these relationships will be used to predict smelt spawning use of other rivers in the Gulf of Maine region, and predictions will be validated through qualitative field assessments.

Ultimately, this project links biological features with in-stream habitat conditions and watershed features to understand smelt spawning habitat selection in the Gulf of Maine. These findings will be applied to develop conservation and restoration strategies to protect spawning populations of smelt in this region, culminating in a region-wide conservation plan. This plan will be drafted and put out for public review in 2011, with the three participating states seeking to begin its implementation in 2012.

*Assessing the Risk of 100-year Freshwater Floods in the Lamprey River Watershed of New Hampshire Resulting from Changes in Climate and Land Use.*

Funded in 2009 by CICEET, the Great Bay NERR is working with collaborators from the University of New Hampshire (Lead PI: Cameron Wake), Antioch University New England, and the Rockingham Planning Commission to understand how climate change and land use will affect local flood risks. This project was initiated in response to requests from local decision-makers and regional planners for locally-relevant and sound scientific information regarding flood risk in the context of climate change that could be used as a basis for guiding development and planning infrastructure investments.

This project will use technical methods consistent with FEMA flood studies to evaluate potential changes in the spatial extent of the 100-year floodplain based on projected changes in land use and climate for present conditions, two climate change scenarios, and four land use scenarios. A collection of map products displaying a select subset of scenarios will be generated for distribution to local decision-makers. The content and format of these products will be guided by collaboration with stakeholders and end-users through an advisory committee and focus groups; the research coordinator serves as the collaborative lead for this project. Intermediate and final products as well as information to support their use will be disseminated through training workshops, targeted mailings, and the NH GIS clearinghouse (GRANIT website); the CTP

coordinator leads this knowledge dissemination component of the project. Formative and summative evaluations will be used to ensure that the project fits the needs and capacities of end-users and meets its ultimate objectives. The technical methods and collaborative approach employed for this project may serve as models that can be adapted for use by other NERR sites.

**Other supportive research initiatives**

*Regional and local LiDAR collection.*
The research coordinator has played a core role—along with others from the UNH Complex Systems Research Center and Center for Coastal and Ocean Mapping/NOAA Joint Hydrographic Center—in promoting the acquisition of high-resolution elevation data using LiDAR for regional coastal areas and local parts of Great Bay. At a regional level, the research coordinator and two collaborators from UNH developed a white paper that explained the rationale for a large-scale collection of LiDAR data for three coastal watersheds in Maine and New Hampshire. The white paper also identified data and processing specifications that should be met in order to be able to address current questions related to inundation associated with coastal storms and sea level rise as well as a variety of other management-relevant needs. Letters of support from 26 federal, state, and regional agencies or organizations were submitted in response to circulation of this white paper. The rationale and specifications, although not fully adopted, helped to shape a broader regional LiDAR proposal in response to a USGS RFP.

On a local level, the research coordinator has also been in touch with the LiDAR operations group at the National Geodetic Survey to make them aware of the Reserve's LiDAR needs in areas near the bay's shoreline. It would be helpful if NGS could fly LiDAR and aerial photoimagery for a landward buffer and certain key properties around Great Bay when they fly the area for shoreline mapping and navigational charting purposes. NGS will be flying LiDAR and aerial imagery in New Hampshire during the summer of 2010, but its flight plans are still being developed and will be contingent upon aircraft availability and funding. It appears that the 2010 flights will focus on the NH coast. We will continue the dialogue with NGS to attempt to expand their flight coverage around Great Bay either this year or in future years. Such high resolution elevation data, coupled with our biomonitoring plans and other vertical control efforts (described in stewardship section), would have powerful applications for addressing research questions related to habitat change and climate change impacts.

**Great Bay NERR Research Prioritization**

Research endeavors in the Great Bay NERR are prioritized by assessing the extent to which they satisfy objectives of the GBNERR management plan, address the Reserve's focus themes, meet local management and decision-making information needs, and are supported by input from the GBNERR Research Advisory Committee.

The Research Advisory Committee was formed in 2002 to assist the research coordinator in developing a research program that complements current efforts and needs in Great Bay. Membership of the committee currently includes Dwight Trueblood (NOAA/NERRS Science Collaborative), Rich Langan (UNH/NERRS Science Collaborative), Jonathan Pennock (UNH

Marine Program/NH Sea Grant), Michele Dionne (Wells NERR), Fred Short (UNH Jackson Estuarine Lab), Art Matheison (UNH Jackson Estuarine Lab), Tom Ballestero (UNH Stormwater Center), and Phil Trowbridge (Piscataqua Region Estuaries Partnership/NH Dept. of Environmental Services).

**Graduate Research Fellowships**

The Great Bay NERR has funded 13 GRF positions since 1997 and has hosted one NOAA social science fellow. Since 2005, graduate fellows have included the following students and projects:

| Year | Fellow | Project Title |
|---|---|---|
| 2005 | Mark Capone | The effects of natural and restored oyster reefs on water quality |
| 2006 | Erica Westerman | The effect of increasing primary production and artificial substrates on the success of invasive ascidians in the Great Bay Estuary, NH |
| 2007 | Wan-Jean Lee | Engineering through disturbance: role of horseshoe crabs (*Limulus polyphemus*) on soft-sediment communities in Great Bay, NH |
| 2007 | Erika Washburn (NOAA social science fellow) | Social landscape analysis of land use decision making in Great Bay's coastal watershed |
| 2008 | Jeremy Nettleton | Tracking environmental trends in the Great Bay Estuarine System through comparisons of historical and present-day green algal nutrient content and community structure |
| 2009 | Jordan Mora | Berm impacts on salt marsh dynamics in New England |

For 2010, six strong applicants competed for the available GRF slot at the Great Bay NERR. Iulia Barbu received the fellowship and will begin her research on low impact development approaches for mitigating the impacts of urbanization and climate change on water resources in June.

The research coordinator typically meets with all GRF students at the beginning of their fellowships and on a semi-annual basis thereafter. These meetings provide opportunities to check in on student progress and address any project-related or administrative questions. In addition, the RC works with other staff to integrate the fellows into Reserve activities. Some activities undertaken by recent fellows include helping train education volunteers, working with high school teachers, and assisting with salt marsh habitat mapping.

**Interns and visiting researchers**

The Great Bay NERR research program has benefited from the efforts of several interns, who have worked under the guidance of core staff members. In 2007, Delia Hobbins and Eric Morrison—both undergraduates at UNH—helped to organize historical monitoring data on fish

and phytoplankton in Great Bay. They reviewed paper documents and then organized and transcribed data into electronic formats so that it can more easily be used for comparative studies of changes in estuarine species and communities over a number of decades.

In 2008, a masters student at Antioch University New England—Colin Lawson—worked with the research and stewardship coordinators to test monitoring protocols and obtain preliminary data on the abundance and species composition of larval mosquitoes in three Great Bay salt marshes with different restoration histories. In addition to providing some preliminary information about the relative abundance and habitat hot spots for larval mosquitoes, the data collected will help refine monitoring designs and sample sizes for future research efforts.

The research coordinator has also provided guidance and logistical support to a number of visiting researchers who were conducting studies in Great Bay. In recent years, these visiting researchers have included an Elkhorn Slough GRF student studying green crabs, a graduate student working on a CICEET-funded project to culture seagrass, a graduate and undergraduate student studying geographic variation in salt marsh food web structure, and a professor and graduate student studying anthropogenic perturbations to salt marsh food webs. In addition to assisting these researchers with site selection advice and permitting requirements, the research coordinator routinely addresses inquiries regarding the suitability of Great Bay as a study site for a variety of research endeavors.

**Publications and presentations**

***Publications***

Mills, K. E., C. Enterline, and B. Chase. 2010. Protecting a threatened coastal fish species through collaborative regional research and planning. *In press,* Proceedings of The Coastal Society's 22nd Biannual Conference, Wilmington, NC.

Great Bay National Estuarine Research Reserve. 2009. Ecological trends in the Great Bay Estuary: 20 year anniversary report. Great Bay National Estuarine Research Reserve, Durham, NH.

Short, F. T., G. E. Moore, and K. Mills. 2009. Biological monitoring of seagrass in Great Bay Estuary, New Hampshire, USA. National Oceanic and Atmospheric Administration, Office of Coastal Zone Management, Estuarine Reserves Division.

Mills, K., F. Rubin, and C. Wake. 2009. Rationale for the collection of regional LiDAR data in New Hampshire and Maine [White paper]. Great Bay National Estuarine Research Reserve, Durham, NH.

Mills, K. E. and J. Fischer. 2008. Effects of suspended solids on estuarine fish and shellfish: observations and implications in Great Bay. Prepared for Great Bay Siltation Commission. Great Bay National Estuarine Research Reserve, Durham, NH.

Mills, K. E., M. J. Kennish, and K. A. Moore. 2008. Research and monitoring components of the National Estuarine Research Reserve System. Journal of Coastal Research 55(1): 1-8.

Mills, K. E. Articles for *Great Bay Matters*, tri-annual magazine newsletter of Great Bay National Estuarine Research Reserve:

- Spr/Sum 2010: Tracking *Vibrio* bacteria in Great Bay
- Winter 2010: New flood risk information for the Lamprey watershed
- Fall 2009. Advancing ecosystem understanding through research
- Spr/Sum 2009. Lee, Wan-Jean and K. Mills. Living fossils stirring under Great Bay waters
- Winter 2009. Eye on graduate research in Great Bay
- Fall 2008. Optimism for oysters?
- Spr/Sum 2008. Is the Great Bay ecosystem reaching a "tipping point"?
- Winter 2008. Nutrients in estuaries: sources of life and signals of stress
- Spr/Sum 2007. Balancing costs and benefits of life in an estuary

***Presentations***

Chase, B.C., C. Enterline, K. Mills, M. Ayer, S. Elzey, J. Fischer. 2010. The role of water quality and spawning habitat assessment in the restoration of anadromous fish populations in New England. *Pending*, Restore America's Estuaries 5th National Conference, Galveston, TX. November 2010.

Mills, K. E., C. Enterline, and B. Chase. 2010. Protecting a threatened coastal fish species through collaborative regional research and planning. *Pending,* The Coastal Society's 22nd Biannual Conference, Wilmington, NC. June 2010.

Kellam, D. and K. Mills. 2010. Status of biological communities in the Great Bay Estuary. Portsmouth Community Radio, Environment Show, Portsmouth, NH. February 2, 2010.

Mills, K. and R. Stevens. 2009. Ecological changes and conservation actions to protect the Great Bay Estuary. Great Bay Stewards Annual Meeting, Greenland, NH. October 28, 2009.

Mills, K. and C. Enterline. 2009. A multi-state collaborative to develop and implement a conservation program for rainbow smelt. State of the Estuaries 2009, Piscataqua Region Estuaries Partnership, Somersworth, NH. October 16, 2009.

Mills, K. and R. Stevens. 2009. Ecological trends and Reserve accomplishments in the Great Bay Estuary: 20 year review. Great Bay National Estuarine Research Reserve, Greenland, NH. September 26, 2009.

Mills, K. E. 2009. Fish in the Great Bay Estuary and its ecosystem. Bay Views seminar series, Great Bay National Estuarine Research Reserve, Greenland, NH. July 29, 2009.

Mills, K. E., F. Rubin, and C. Wake. 2009. Rationale for the collection of regional LiDAR data. Northeast Regional Ocean Council, Gloucester, MA. April 8, 2009.

Mills, K. E. 2009. Ecosystem-based management in the Gulf of Maine: from ecosystem science to governance. National Estuarine Research Reserve System, Research Coordinators' Annual Meeting, St. Augustine, FL. January 27, 2009.

Wake, C. and K. E. Mills. 2008. Assessing changes in 100-year floodplains in the context of climate change. New England Interstate Water Pollution Control Commission Climate Change Workgroup, Lowell, MA. June 26, 2008.

Mills, K. E. 2008. Strengths and limitations of statistical approaches for detecting ecosystem tipping points. New England Estuarine Research Society Spring Meeting, Greenland, NH. May 1, 2008.

Sarrette, N., K. Mills, and F. Short. 2008. Comparing monitoring methods to detect eelgrass change in Great Bay, NH. New England Estuarine Research Society Spring Meeting, Greenland, NH. May 1, 2008.

Mills, K. E. 2007. Use of indicators for coastal ecosystem planning and management. Estuarine Research Federation Annual Meeting, Providence, RI. November 5, 2007.

Short, F. T., K. E. Mills, and G. E. Moore. 2007. Seagrass monitoring in Great Bay, NH. National Estuarine Research Reserve System Annual Meeting, Shepherdstown, WV. October 26, 2007.

Mills, K., S. Miller, S. Rumrill, J. Bragg, M. Kennish, and L. Auermuller. 2007. Assessing and adapting to climate change impacts in coastal zones: stakeholder and scientific needs and capacities in three estuaries. National Estuarine Research Reserve System Annual Meeting, Shepherdstown, WV. October 25, 2007.

Mills, K. E. 2007. A kayak tour of research in the Great Bay Estuary: an introduction to water quality, habitat, and oyster research projects. Great Bay National Estuarine Research Reserve, Greenland, NH. August 2007.

Mills, K. E. and S. Miller. 2007. Introduction to Great Bay's salt marshes and their ecological value. Great Bay National Estuarine Research Reserve Coastal Training Workshop, Greenland, NH. August 2007.

Mills, K. E. 2007. The Gulf of Maine ecosystem: its ecology, importance, and management. Great Bay National Estuarine Research Reserve, Greenland, NH. February 2007.

**Participation on committees**

The Research Coordinator serves on several local, state and NERR committees. These activities help make other groups aware of the GBNERR's programs and provide mechanisms for

GBNERR to influence research activities and coastal management policy statewide and system-wide. Key committees are identified below.

- **New Hampshire Sea Grant Policy Advisory Committee:** The Research Coordinator has served as an advisory committee member for New Hampshire Sea Grant since 2008. This committee supports NH Sea Grant's interactions with its stakeholder community and guides its research and extension efforts to ensure they are consistent with high-priority needs of the state and region.

- **Piscataqua Region Estuaries Partnership Technical Advisory Committee:** The Research Coordinator has served as a member of the technical advisory committee for the Piscataqua Region Estuaries Partnership (PREP) since 2007. This committee provides input regarding PREP's water quality monitoring program, ecosystem indicator development and interpretation, and nutrient criteria development for the Great Bay Estuary.

- **Species of Concern Technical Advisory Committee:** This committee steers a tri-state (Maine, New Hampshire, Massachusetts) project focused on two anadromous species of concern—rainbow smelt and Atlantic sturgeon. The committee guides population monitoring efforts, research elements, and the development of a conservation plan for these species. The Research Coordinator has served as a committee member since 2007.

- **New Hampshire Coastal Program Salt Marsh Restoration Technical Review Team:** This group of coastal scientists and management professionals reviews progress of past salt marsh restoration efforts and plans for future restorations in the coastal waters of New Hampshire. The team seeks to draw lessons from past restoration experiences, provide technical guidance to increase the likelihood of success for pending projects, and identify areas in need of future restoration attention. The Research Coordinator has served on this team since 2007.

- **COMPASS New England Ecosystem-Based Management Workgroups:** Following a regional conference in 2007, the Research Coordinator participated in several follow-up workgroups to help identify ways of moving coastal and marine ecosystem-based management forward in the region. These groups focused on developing a regional vision for EBM; enhancing data access, coordination, and dissemination; identifying needs for decision-support tools that would be useful to coastal and fisheries managers; and enhancing the public communication skills and professional mentoring opportunities for young scientists.

- **NERRS-CICEET Workgroup:** The Research Coordinator served as a member of this workgroup in from 2008. This workgroup broadly functioned to identify areas of interaction and collaboration between CICEET and the NERRS, resulting in a 2009 RFP by which NERRS-led proposals could be submitted to CICEET for funding.

- **NERRS Graduate Research Fellowship Program Follow-Up to Internal Review Workgroup:** This workgroup was formed to develop an approach for addressing recommendations that were put forward as part of the 2008 GRF internal review. To date, the workgroup's efforts have focused on identifying and sharing ideas for better integrating the GRFs with their host reserves, fostering a sense of community among current GRFs and alumni, and clarifying reporting requirements and procedures. The Research Coordinator has participated in this workgroup since 2009.

- **UNH Earth Systems Data Collaborative Advisory Board:** During 2007, the research coordinator served as a member of the advisory board for a NOAA-funded initiative at UNH, the Earth Systems Data Collaborative. This initiative sought to develop web-based visualization and integration tools to united environmental data providers with information consumers within the Gulf of Maine region. Input from the advisory board was sought to guide the selection of specific applications for demonstrating the tools and to aid the project team in engaging end-users and decision-makers.

- **UNH Community-Based Outreach/Research Program:** During 2007, the research coordinator served as a cooperator in this UNH initiative to engage undergraduate students in an interdisciplinary course focused on "outreach scholarship." The Great Bay NERR served as one partner in this course by presenting a profile of the Reserve to the class. In addition, the research and CTP coordinators worked with students to make them aware of how scientific research can be designed to benefit their local communities and the importance of outreach to disseminate this knowledge for broader societal purposes.

# STEWARDSHIP DESCRIPTION AND ACCOMPLISHMENTS REPORT

## 1. Land Acquisition and Habitat Protection

Within the Great Bay NERR, 5,129 acres are conserved. Of this total, the Reserve has a management interest in 3,740 acres distributed over 71 parcels. In the upland areas of the Reserve, the protected lands include wetland and early successional habitats set in a matrix of Appalachian oak-pine forest. Other protected parcels encompass intertidal habitats, including mudflats, rocky shores, and salt marshes. Land acquisition priorities have focused on protecting salt marshes and the upland buffer; these habitats support key species such as beaver and osprey, as well as species of concern such as the Blanding's and spotted turtle. The Great Bay NERR actively stewards these lands to protect natural plant and animal communities as well as provide public recreational opportunities.

The Reserve works closely with other partners through the Great Bay Resource Protection Partnership to advance land protection initiatives. The Nature Conservancy of NH serves as the lead acquisition organization for the Partnership, and other key partners in this effort include:

Ducks Unlimited, Inc.
New Hampshire Audubon
New Hampshire Fish and Game Department

Society for the Protection of New Hampshire Forests
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service, Great Bay National Wildlife Refuge
U.S. Department of Agriculture, Natural Resources Conservation Service

## 2. Natural Resource Management

### Species and Habitats of Concern

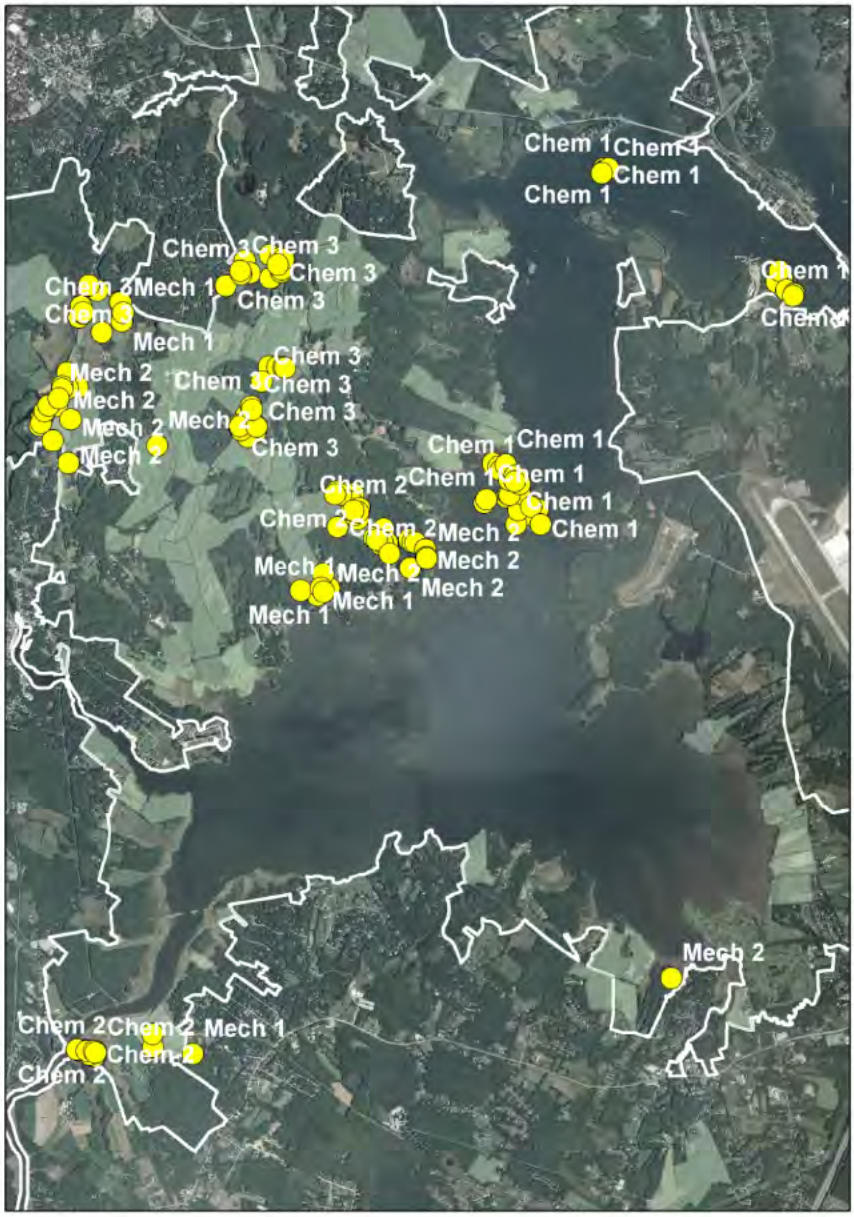
The Reserve stewards several species and habitats of concern. Example activities include; GPS mapping of vernal pools, surveying for Blanding's and spotted turtles, monitoring winter eagle use, and salt marsh mapping.

### Restoration Projects

*Invasive Plants*
The Great Bay NERR is a key partner in the New Hampshire Coastal Watershed Invasive Plant Partnership (NH CWIPP), which brings together eleven agencies and organizations to assess the extent and control the spread of invasive species in New Hampshire's coastal watershed. Partners in the NH CWIPP work collaboratively to inventory, monitor, and prevent the spread of invasive plants across jurisdictional boundaries. It also works with municipalities, private landowners, and state and federal land managers to control native species and restore native habitats.
As part of a NH CWIPP shared database project, the Great Bay NERR staff has mapped more than 4,100 stands of invasive plant within the Reserve boundary. In addition to documenting the location and size of invasive plant stands, the mapping effort documents ecological characteristics of each stand and the proximity to other natural and manmade features.

Within the Crommet Creek sub-watershed watershed, Great Bay NERR has worked closely with local landowners to document invasive species and build awareness of control options. Ninety four percent of the watershed was successfully mapped. Through hands-on workshops and demonstration projects, homeowners have learned to identify invasive species and practiced effective ways of removing them.

As the Great Bay NERR's efforts to control invasive species proceed, treatments are being applied using experimental designs that will allow for statistical comparisons of the effectiveness of different control options. By rigorously evaluating the effectiveness of control techniques and tracking conditions that may influence treatment outcomes, efforts by the Great Bay NERR to control invasive species on Reserve properties will provide lessons that are useful beyond its boundary.




Spatial design for testing two commonly used chemical, and one manual, control technique on populations of invasive bush honeysuckle around Great Bay. The Research Reserve is completing this quantitative evaluation of control success for 14 invasive plant species in partnership with UNH Cooperative Extension, community volunteers and a commercial contractor.

Ultimately, these experiences will be shared with landowners, conservation commissions, and management agencies to guide their future decisions about controlling invasive species on private and public lands.

*Wetland restoration design*

A wetland restoration was designed to enhance habitat conditions for resident and migratory waterfowl, for amphibian and turtle species, to increase wetland plant species diversity and extent, while at the same time trying to control the spread of invasive wetland plant species, particularly *Phragmites*, purple loosestrife and glossy buckthorn. The restoration project was set

up to be monitored quantitatively by UNH wildlife students. For several years they completed a semester long wetland restoration pre-monitoring project.

**3. Management Plans**

The stewardship program is involved in multiple management planning efforts. We have coordinated development of the wildlife prescriptions Crommet Creek Conservation Area. Using guidelines developed in conjunction with the Great Bay Resource Protection Partnership, wildlife management prescriptions were drafted for all lands within the conservation area irrespective of underlying ownership. This effort includes landscape scale prescriptions for targeted wildlife species that are outlined in the Department's Wildlife Action Plan (WAP). In addition, management plan "abstracts" have been developed for multiple properties within the Reserve and wildlife habitat management recommendations have been made for several conservation easement stewardship plans.

**4. Public Access**

All Reserve properties are open to the public for passive recreational activities such as wildlife viewing and hiking. Three "destination points" have been identified and are being equipped with infrastructure to make them accessible to people with as wide a range of mobility types as possible. The design of this infrastructure has been done with advice from UNH's Northeast Passage. The first of these "destination point" properties has had a parking lot constructed and out door exhibits have begun to be installed. A "backyard wildlife garden" demonstration area has been designed at another of these destination areas.

Working with our education staff, we developed a publication, the "Passport to Great Bay". This series highlights several Reserve properties that are ready for exploration. Each property has a theme, or chapter, that together tell the story of Great Bay's natural and cultural history. On each "passport" property we maintain a geocache that includes a hole punch in a shape that represents the theme of the property. Deployed for two years now, hundreds of people have found their way to our geocache sites.

**Visitor Use Impacts**

We have installed an infrared trail counter to monitor the regional "Sweet trail". Numbers of visitors are monitored monthly by a Community Land Steward. This information is complemented by an annual UNH student study that assesses abundance of key wildlife species including heron, turtle and neotropical migrant birds. Over time we can link this data with any potential visitor impacts on wildlife species and hopefully address any issues at their earliest stage.

With the Great Bay Resource Protection Partnership, Great Bay NERR worked to develop a regional hiking trail from downtown Durham to Great Bay's shores in Newmarket. This is called the "Sweet Trail". Infrastructure was installed to minimize any visitor use impacts.

**Coastal Cleanup, Trash Removal and Monitoring**

Maintaining the Reserve's protected lands by removing trash is achieved in a myriad of ways. We have a high school class "geo-caching" to, and removing, known dump sites. Other students participate in the International Coastal Cleanup, and the backbone of our effort is our network of Community Land Stewards.

In an attempt to not only clean up, but start to prevent some of the dumping taking place, we have developed a standardized database to record the type of trash removed from Reserve properties. As this data complies, we hope to document our major dumping issues and work with communities to address the real reasons behind them.

## 5. Infrastructure and other Stewardship

The majority of the Reserve's fee owned property boundaries have been posted with tin identification signs every 50 feet and allowable use signs at access points. A survey quality GPS unit is used to develop a digitized boundary and develop a baseline "stewardship map" noting interesting features such as vernal pools or stewardship concerns such as dumping sites. This information compliments the feedback we get from Land Stewards and the hope is to be able to address these concerns over time.

The stewardship program is responsible for acquiring all state and federal permits for infrastructure and invasive species control projects. This includes wetland and trail permits and review by the Division of Historic Resources. Recently, Fish and Game personnel have assisted with some of the infrastructure permits needed for a Natural Resource Conservation Service Wetlands Reserve Program grant that was originally awarded at $500,000. The stewardship program is also responsible for authoring State Lands Committee Planning Reports.

The stewardship program is the liaison with private contractors and the Fish and Game access work crew on infrastructure projects. Projects such as parking lot creation, culvert replacement, out door education exhibits and shoreline stabilization structures have been put in place or are in the planning stages.

Many technical meetings have been had with town and city public works staff, code officers, selectmen, planning boards and conservation commissions. For example, meetings with Portsmouth Public Works and legal staff to discuss mitigation of conservation land impacted by the Route 33 widening and bridge replacement.

## 6. Public Education and Involvement

### Community Land Stewards

Our community land stewards program is a group of volunteers who adopt a piece of property within the Reserve, becoming its "eyes and ears", as well as serving as a vital connection to the community. Stewards act as protectors for their properties; picking up trash and noting activity on the land, as well as answering questions from people they meet while making their visits. They are asked to walk their properties at least four times a year. Monitoring forms are completed and returned at the end of each season that documents all of the stewards' work. There are currently 14 stewards on 11 of the Reserve properties. An electronic newsletter specifically for Land Stewards is distributed four times a year.

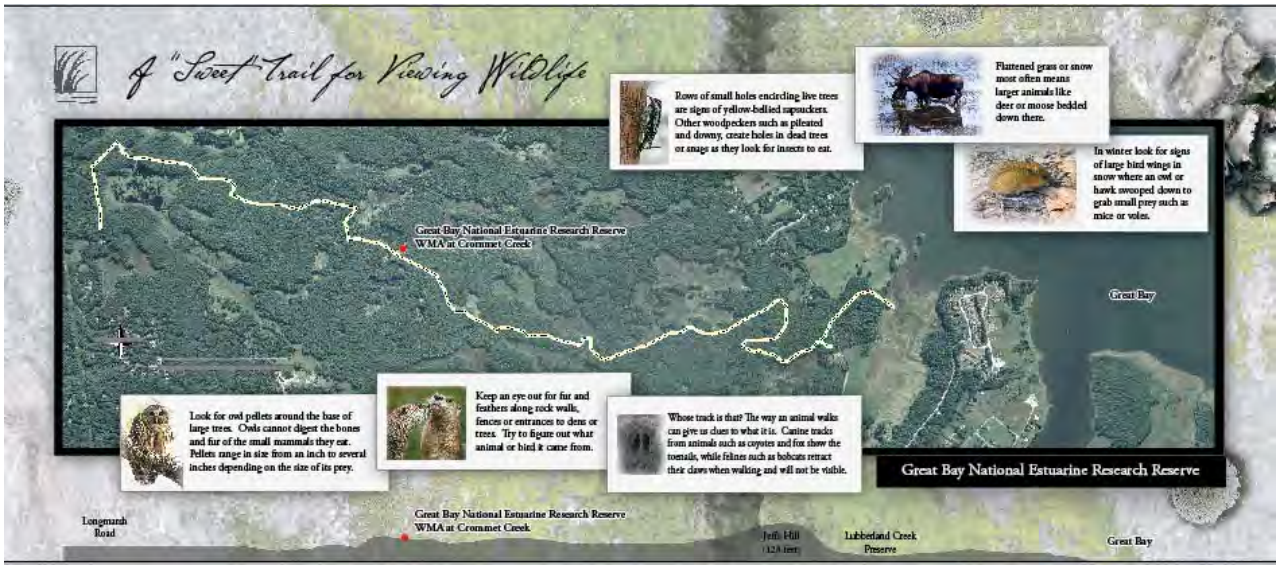

### Stewardship Internships

This program creates volunteer opportunities for undergraduate and high school students within the stewardship program and provides them with hands on experience managing public lands. Past projects include developing locally relevant volunteer training materials for the NERRS breeding marsh bird monitoring program, mapping rocky shore distribution, and a salt marsh developing digital elevation model.

### Workdays

Many community volunteer work days have been held. Examples include creating a trail on an island within the Reserve, cooperating with NH Port Authority to get everyone there by boat. The Reserve has held multiple volunteer cleanups and invasive plant control days. The Reserve was also a partner with TNC, NH Forest Society and the town of Durham on a bog bridge building workday, see:
**www.boston.com/news/local/articles/2007/10/25/heavy_lifting_boosts_trail_project/**

**Exhibit Design**
Stewardship staff has been involved with the concept design of exhibits in the barn and at an outdoor site. Graphic design was completed for the outdoor site.




**Workshops, Presentations and Publications**
Multiple presentations have been given, often in partnership with other natural resource agencies. Multiple publications have been authored for the general public. Examples of each are listed below;

- *It's Your Choice workshop: Invasive Plant Control Options for Landowners.* In conjunction with UNH and the US Forest Service. Please see:
  **http://www.wildnh.com/marine/invasives.html and**
  **http://www.wildnh.com/marine/invasives/introduction/index.html**

- *Breaking Through Barriers: A Roadmap to Invasive Species Control*. In conjunction with members of NH CWIPP. Please see:
  **http://www.extension.unh.edu/forestry/Docs/Invasive_CWIPP.pdf**

- State-wide invasive plant mapping training workshop for natural resource professionals (Boscawen)

- "Ecological Trends in the Great Bay Estuary" as part of the Great Bay NERR's 20th Anniversary

- "Bats and Habitats" community kayak trip

- Nature's Construction Crew: Beavers, Dams and Wetlands. In partnership with UNH Cooperative Extension.
- NH Wildlife Journal article "Secrets of the Salt Marsh"

The stewardship program is also responsible for landowner relations and public land inquiries. This includes posting safety zones, working with farmers to negotiate wildlife habitat improvement agreements, and general inquiries. The stewardship program is also the liaison with coastal Fish and Game conservation officers for land management issues.

**7. Partnerships and Collaboration**

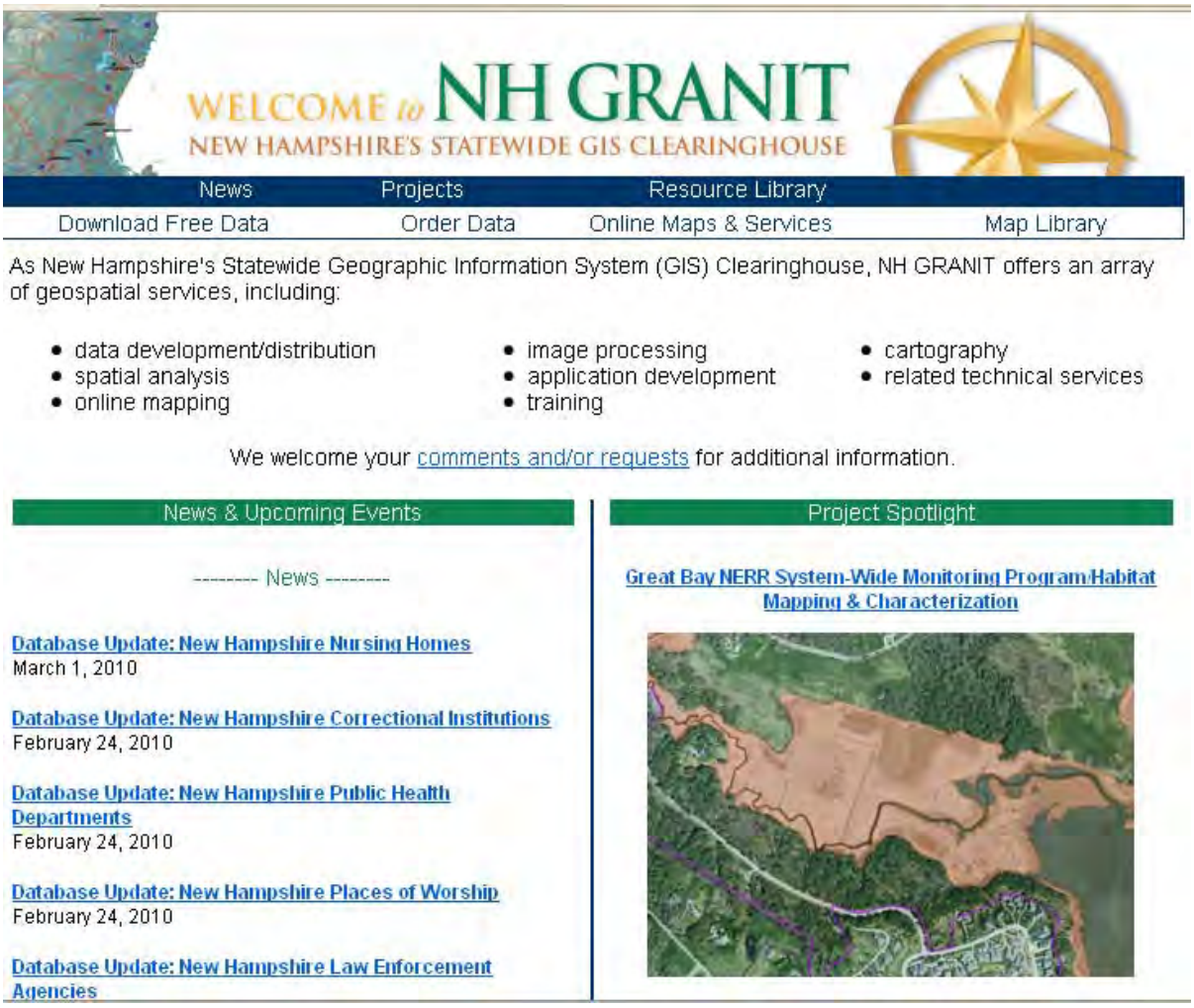
- NH Fish and Game Lands Team. Includes Special Use Permits review, developing policy, and management advisory decisions.
- NH Fish and Game Invasive Plants Committee.
- NH Coastal Watershed Invasive Plant Partnership (CWIPP) Vice chair, member geospatial database subcommittee, and significant ecological areas subcommittee.
- NERRS Community Education Vice Chair.
- NERRS Strategic Committee SC representative.
- The Great Bay Resource Protection Partnership (GBRPP).
    - GBRPP – Field Assessment Team evaluate ecological conditions of properties for protection.

- GBRPP – Stewardship Issues Committee meetings to discuss management objectives for properties protected through the Partnership.
- GBRPP – Recreational Access Team meetings.
- GBRPP - Conservation Areas Management Planning Committee.
- GBRPP - Performance Indicators Group**.**

- Past member of NH's salt marsh technical advisory committee.
- Served on state-wide Mosquito Control Committee to develop a policy on mosquito spraying.

- NH Natural Resource Volunteers Network steering committee.

**GIS and GPS**




The stewardship coordinator supports all elements of the Reserve's GIS program. Numerous maps for our land acquisition program and the Reserve management plan have been completed. Some additional example projects are listed below;

1. **NERRS Habitat Mapping and Change**
    - The high/low salt marsh boundary was mapped as an early vegetative indicator of any sea level change throughout the entire Reserve.
    - Worked with Complex Systems at UNH to hand digitize all salt marsh, including small-sized fringing marsh throughout the Reserve.
    - Worked with Complex Systems at UNH to hand digitize all early successional habitat within the Reserve boundary.
    - Helped map floodplain forest at two sites along the Lamprey River.
    - Classification of successional stage of all wetlands within the boundary and development of GIS layer.
    - Rocky Shore GPS mapping project.
2. **Management Plans**
    - Developed "Conservation Areas' shape files for Great Bay Resource Protection Partnership Management Plans.
    - Developed co-occurrence model for regional trail route decision making.
    - Developed a model for areas that have soil and other condition types that may support an early successional restoration project that would regenerate beaver forage.
3. **NERRS Vertical Control**
    - A Vertical Control plan was written for Great Bay NERR and implementation started.
    - In partnership with NHDOT and NOAA's State Geodetic Advisor, five new "GBNERR" benchmarks were established, 3 have been tied into the NGS OPUS system. This is an ongoing project.
    - A partial digital elevation model was developed for one of our three "reference" salt marshes.
4. **Outreach**
    - Work with several college and high school interns to teach GPS and ecological mapping skills.
    - Developed maps and other contributions for the publication "Ecological Trends in the Great Bay Estuary".
    - Developed imagery for the land use change exhibit in the Gregg Center.
    - Maps were also developed for the Great Bay Passport publication