



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

JUL 23 2010

Dee Freeman, Secretary
North Carolina Department of Environment and Natural Resources
1601 Mail Service Center
Raleigh, North Carolina 27699-1601

Dear Secretary Freeman:

Enclosed are the final evaluation findings for the North Carolina National Estuarine Research Reserve (NERR) for the period from December 2004 through November 2009.

The fundamental conclusion of this evaluation is that North Carolina is adhering to the programmatic requirements of the NERR system in its operation of the approved North Carolina NERR. This document contains six recommendations, none of which is mandatory.

We appreciate your cooperation and assistance and that of your staff during the accomplishment of this evaluation.

Sincerely,

Donna Wieting
Acting Director

Enclosure

cc: James H. Gregson, Director, Division of Coastal Management, NCDENR
Rebecca Ellin, Manager, North Carolina NERR, North Carolina
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Final Evaluation Findings
North Carolina National Estuarine Research Reserve
December 2004 through November 2009

July 23, 2010



Photos courtesy of NCNERR



Office of Ocean and Coastal Resource Management
National Ocean Service
National Oceanic and Atmospheric Administration
United States Department of Commerce

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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). Section (§) 312 and §315 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); §312 and their implementing regulations describe the evaluation process requirements. The review described in this document examined the operation and management of the North Carolina National Estuarine Research Reserve (NCNERR or “the Reserve”) during the evaluation period of December 2004 through November 2009. The North Carolina Department of Environment and Natural Resources’ (DENR’s) Division of Coastal Management (DCM) administers NCNERR.

This document describes the evaluation findings of the Director of NOAA’s Office of Ocean and Coastal Resource Management (OCRM) with respect to NCNERR during the evaluation period. These evaluation findings include discussions of major accomplishments as well as recommendations for program improvement. The conclusion of the findings is that the State of North Carolina successfully implemented its federally approved NERR during the evaluation period.

The evaluation team documented a number of accomplishments during this review period. The Reserve made significant progress towards integrating into DCM’s coastal zone management program. NCNERR completed a new management plan, based on comprehensive and inclusive strategic planning, that integrates Reserve goals across its sectors. Research staff elevated NCNERR’s stature and influence through participation on science and advisory panels, informing the state’s strategies for emerging coastal zone management issues. New market analyses and needs assessments drove educational curricula updates and coastal decision maker training offerings.

All of the recommendations for NCNERR are Program Suggestions, and describe actions that OCRM believes DCM should take to improve the program but that are not currently mandatory. Related to DCM’s 2006 reorganization, OCRM recommends that DCM more fully leverage NCNERR in implementing North Carolina’s coastal management program through permit compliance education and science-to-policy endeavors. OCRM strongly encourages DCM to continue accurate attribution of Reserve staff labor effort and costs relative its CZMA § 315 financial assistance awards. OCRM supports DCM funding initiatives that would fully staff NCNERR consistent with the Reserve’s staffing plan, particularly by funding core positions with state resources and establishing separate Southern Sites Manager and administrative assistant positions. OCRM encourages the Reserve to improve communication as a means to strengthen cross-sector collaboration. OCRM also encourages the Reserve to plan and implement visitor impact research and monitoring at NCNERR components.

II. PROGRAM REVIEW PROCEDURES

A. OVERVIEW

NOAA began its review of the NCNERR in January 2009. The CZMA §312 evaluation process involved four distinct components:

- an initial document review and identification of specific issues of particular concern;
- a site visit to North Carolina, including interviews and public meetings;
- development of draft evaluation findings; and
- 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 may be of two types:

Necessary Actions address programmatic requirements of the CZMA's implementing regulations and of the NCNERR approved by NOAA. These must be carried out by the date(s) specified;

Program Suggestions denote actions that OCRM believes would improve the program, but are not mandatory at this time. If no dates are indicated, OCRM expects the state will consider these Program Suggestions by the time of the next CZMA §312 evaluation.

Appendix A is OCRM's summary of accomplishments and recommendations.

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 reiterated in consecutive evaluations to address continuing problems may be elevated to Necessary Actions. NOAA will consider the findings in this evaluation document in making future financial award decisions relative to the NCNERR.

B. DOCUMENT REVIEW AND PRIORITY ISSUES

The evaluation team reviewed a wide variety of documents prior to the site visit, including: (1) 2005 §312 evaluation findings for the period June 2000 through December 2004; (2) federally approved Environmental Impact Statement and program documents; (3) financial assistance awards and work products; (4) semi-annual performance reports; (5) official correspondence; and (6) relevant publications on natural resource management issues in North Carolina.

Based on this review and on discussions with OCRM, the evaluation team identified the following priority issues:

- NCNERR's general administration, including financial assistance awards and fiscal management;
- facilities development and operations planning;
- research, monitoring, and education program implementation;
- NCNERR staffing and needs;
- the manner in which the NCNERR coordinates with other governmental and non-governmental organizations and programs in the state and region;
- major accomplishments during the review period; and
- the manner in which NCNERR addressed the recommendations contained in the §312 evaluation findings released in 2005.

Appendix B is NCNERR's assessment of how it responded to each of the 2005 evaluation findings necessary actions.

C. SITE VISIT TO NORTH CAROLINA

OCRM sent notification of the scheduled evaluation to DENR, DCM, NCNERR, relevant environmental agencies, members of North Carolina's congressional delegation, and regional newspapers. In addition, NOAA published its "Intent to Evaluate" in the Federal Register on September 2, 2009.

The site visit to North Carolina occurred December 7-11, 2009. The evaluation team consisted of Gregory Gervais, Evaluation Team Leader, OCRM National Policy and Evaluation Division; Amy Clark, Program Specialist, OCRM Estuarine Reserves Division; Kimberly Penn, Evaluator, OCRM National Policy and Evaluation Division; and Peter Wellenberger, Reserve Manager, Great Bay (New Hampshire) National Estuarine Research Reserve.

During the site visit, the evaluation team met with NCNERR personnel; DCM leadership and staff; DENR leadership; representatives of NCNERR partners; and customers from public education, government agencies, universities, and non-governmental organizations. Appendix C lists people and institutions contacted during this review.

NOAA held two advertised public meetings: December 8, 2009 at 7 pm at UNC-Wilmington, Center for Marine Science Auditorium, 5600 Marvin K. Moss Lane, Wilmington, N.C. and December 9, 2009 at 7 pm at NOAA/NCNERR Administration Building Auditorium, Center for Coastal Fisheries and Habitat Research, 101 Pivers Island Road, Beaufort, N.C. The public meetings gave members of the public the opportunity to express their opinions about the overall operation and management of NCNERR. Appendix D lists individuals who registered at the meetings. Appendix E is NOAA's response to written comments submitted during this review.

The NCNERR staff members provided essential support in setting up meetings and arranging logistics for the evaluation site visit, in addition to providing the evaluation team with needed

NCNERR information before, during, and after the site visit. The evaluation team appreciated their assistance and active participation.

III. RESERVE PROGRAM DESCRIPTION

NOAA approved the North Carolina National Estuarine Research Reserve in 1985, with designation of three components: Zeke's Island, Rachel Carson, and Currituck Banks. NOAA approved the Masonboro Island component designation in 1991. NCNERR's host agency and state partner is the North Carolina Department of Environment and Natural Resources, Division of Coastal Management. DCM also administers the North Carolina Coastal Reserve (NCCR) program, established in 1989. The four NCNERR components are also NCCR components. NCCR includes six additional components that are not part of the NCNERR: Kitty Hawk Woods, Emily and Richardson Preyer Buckridge, Buxton Woods, Permuda Island, Bald Head Woods, and Bird Island.

The following Reserve description is adapted from the executive summary of NCNERR's recently approved management plan. The management plan is available upon request from NCNERR or OCRM, and from NCNERR's website:

<http://www.nccoastalreserve.net/Resources/Publications/45.aspx>

Coastal North Carolina is unique in that it includes both the Virginian and Carolinian biogeographic regions as well as the three regions of the N.C. Coastal Plain. North Carolina established NCNERR as a multi-component Reserve to take advantage of this unique biogeography. The Reserve is comprised of four geographically disparate components representing diverse estuarine habitats:

1. The 965-acre Currituck Banks component located in Currituck County, just north of the village of Corolla at the end of North Carolina (N.C.) 12;
2. The 2,315-acre Rachel Carson component located in Carteret County between the town of Beaufort, Harkers Island and the Cape Lookout National Seashore;
3. The 5,653-acre Masonboro Island component, an undeveloped barrier island, situated in New Hanover County between the towns of Wrightsville Beach and Carolina Beach; and
4. The 1,635-acre Zeke's Island component, encompassing tracts in both New Hanover and Brunswick counties, reached via United States (U.S.) 421 south of Kure Beach.

The Reserve fulfills its mission of promoting informed management and stewardship of North Carolina's estuarine and coastal habitats through research, education, and example through three program sectors: education, research, and stewardship. Each sector fosters its aspect of the Reserve, under the guidance of the reserve manager and according to the management plan.

Each sector utilizes the four components of the NCNERR to implement its respective programs, promoting site-based management of the Reserve.

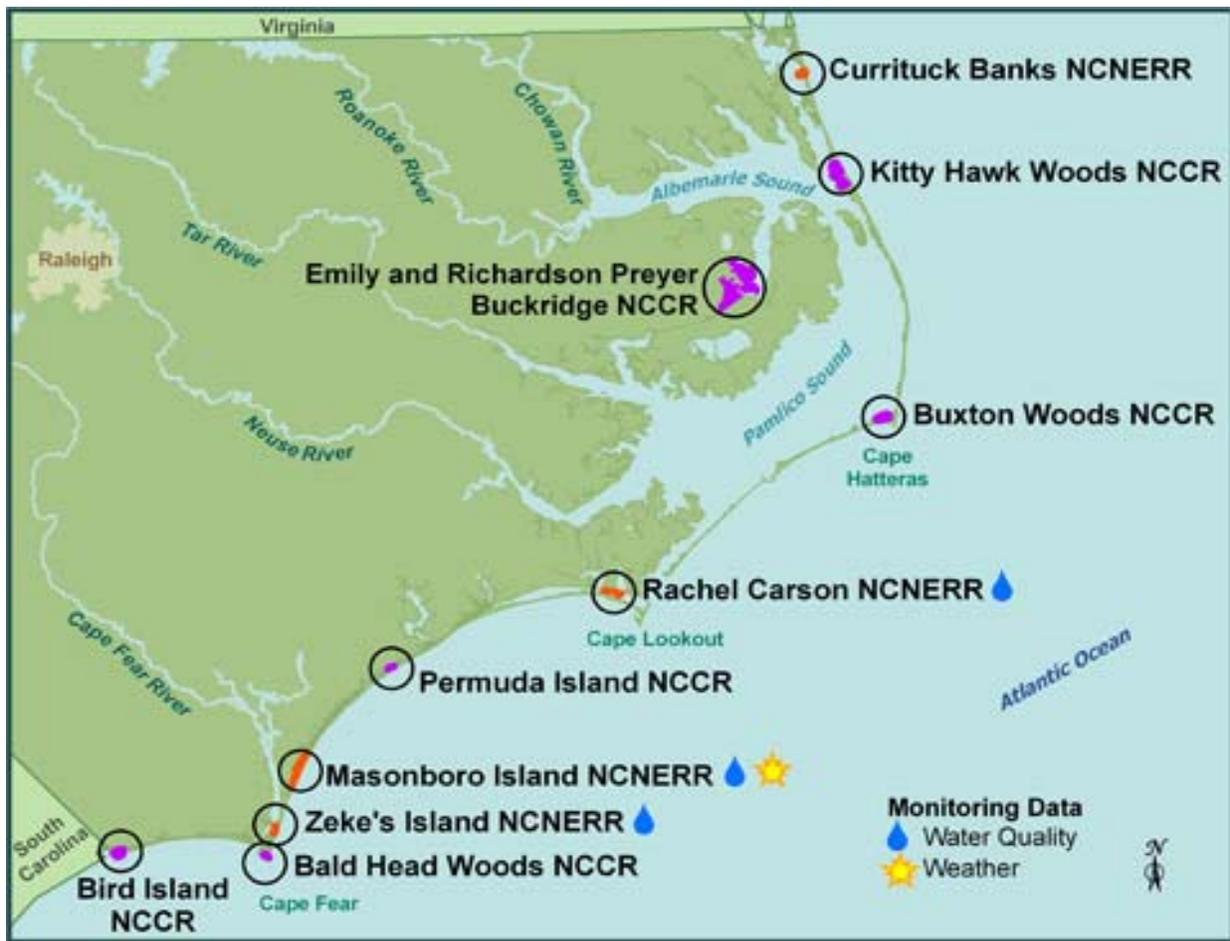


Figure 1 – North Carolina National Estuarine Research Reserve and North Carolina Coastal Reserve Component Locations (NCNERR Final Management Plan, September 2009)

IV. REVIEW FINDINGS, ACCOMPLISHMENTS, AND RECOMMENDATIONS

A. OPERATIONS AND MANAGEMENT

1. Integration into Coastal Management Program

NCNERR resides within DCM, a division of DENR. DCM reorganized in 2006, moving the reserve manager position from within its Policy & Planning Section and creating a discrete section with the DCM for the Reserve. Consequently, the reserve manager reports directly to the DCM director, which facilitates direct communication between the reserve manager and the director. In the previous evaluation period, OCRM found a lack of communication and strategic planning among NCNERR and DCM personnel and the potential that NCNERR leadership may not be present or consulted when DCM made decisions that would affect the Reserve. The previous findings report indicated a possible remedy would be moving the NCNERR reserve manager position to an assistant director position within DCM.

The evaluation team found that the NCNERR integrated well into DCM's coastal management program. DCM supported funding initiatives over the evaluation period, as described in section IV.A.3 below. Coastal management program staff in other DCM sections is cognizant of the capabilities of NCNERR, and actively engage NCNERR to both provide and receive support for DCM's coastal management program. Examples of DCM support for NCNERR included:

- DCM Policy & Planning staff supported development of rules changes that now allows NCNERR direct access to the N.C. Parks and Recreation Trust Fund (PARTF) funding. Effective February 1, 2009, DCM has the authority and flexibility to award funds to enhance public access on NCNERR and NCCR properties through a non-competitive process.
- DCM personnel performed stewardship activities at NCNERR components, such as monitoring visits to components, beach cleanup, and sign installation.
- DCM Policy & Planning staff provided technical and policy support to NCNERR and assisted in evaluating and drafting revisions to NCNERR/NCCR rules in the North Carolina Administrative Code.

For its part, NCNERR staff more actively supported other DCM functions, as described in detail elsewhere in this document. Several noteworthy examples of NCNERR supporting DCM's coastal management program were:

- The research coordinator served on a multi-organizational Ocean Policy Steering Committee, which developed forward thinking policies to deal with emerging coastal management issues in North Carolina.
- The education coordinator developed education plans for the entire Division as well as on specific topics such as estuarine shoreline stabilization.

- The CTP coordinator collaborated with Policy & Planning staff on two successful grant applications to the North Carolina Clean Water Management Trust Fund for a stormwater control plan and implementation for the joint NOAA/NCNERR Pivers Island facility in Beaufort.

OCRM recognizes DCM for improved divisional cooperation and collaboration, facilitated in part through its reorganization. OCRM commends DCM for its commitment to integrating NCNERR into its coastal management program and supporting an inclusive environment. OCRM notes numerous tangible outcomes from this reorganization during the evaluation period.

ACCOMPLISHMENT: DCM moved the NCNERR reserve manager position within its organizational structure to a position equivalent to an assistant director position, and through committed leadership made significant progress towards integrating the Reserve into the coastal management program and fostering inclusion and collaboration among NCNERR and other DCM sections.

The evaluation team noted areas where DCM and NCNERR can further enhance collaboration and coordination. DCM recognizes education as a means to improve coastal zone regulatory compliance and reduce the need for enforcement. DCM provided NCNERR coastal and estuarine educational materials to its enforcement staff, which enforcement staff now provides to the public to facilitate permit education. DCM leadership intends to pursue a compliance education program, which would educate the public on permits and provide a safe forum for the public to ask questions. Compliance education would enhance DCM's coastal management program, and the Reserve may be an excellent partner assuming NCNERR's educational priorities and resource limitations allow it.

North Carolina's Coastal Resources Commission (CRC) establishes policies for the coastal management program and adopts implementing rules for both the N.C. Coastal Area Management Act and the N.C. Dredge and Fill Act. DCM serves as staff to CRC, meaning DCM, including NCNERR, is responsible for providing support to CRC's policy and rule development. NCNERR is well suited to fill this role, particularly given the capability of its senior staff and excellent geographic representation of North Carolina's varied coastal environments through its components. OCRM encourages DCM to leverage NCNERR in its coastal management program where Reserve goals and resources allow. DCM and NCNERR can better inform CRC commissioners about the Reserve's capabilities. CRC may then develop its research, education and training priorities fully knowledgeable of NCNERR's capability and capacity to support these priorities, and as appropriate NCNERR and DCM would be able to align with CRC's priorities.

An excellent example of DCM's and NCNERR's science-to-policy work is the previously referenced clean water management grants for Pivers Island stormwater management. The stormwater control plan includes installation of cisterns, bioretention areas, stormwater, wetlands and several proprietary devices on Pivers Island, and a trail around the island to highlight the various stormwater control devices for educational purposes. Once constructed, the system will demonstrate full-scale implementation of new design approaches and provide credible data to inform future regulatory and permitting changes for coastal stormwater management. OCRM

encourages DCM and NCNERR to identify similar opportunities to leverage the Reserve in this manner.

PROGRAM SUGGESTION: OCRM encourages DCM to more fully leverage NCNERR in its implementing North Carolina's coastal management program.

2. NCNERR Strategic Planning and Execution

DCM and NCNERR convened a strategic planning workshop in 2005 to clarify roles and expectations, to facilitate better NCNERR integration into the coastal management program, and provide important context to NCNERR as it proceeded with strategic planning. NCNERR continued strategic planning activities, including a 2006 Reserve strategic planning workshop facilitated by NOAA's Coastal Services Center to develop the vision, mission, and goals for the Reserve. NCNERR also used sector-specific area market analyses and needs assessments to inform its management plan development. The Reserve defined its priorities and developed a road map for achieving them through meaningful strategic planning and thoughtful management plan development.

The management plan's quality is a significant accomplishment, particularly since the goals and objectives integrate NCNERR sectors and obscure the lines between education, research, and stewardship. NCNERR deliberately interconnected its sectors. For example, objective 1.2 ("the greater community, including the general public, visitors, and pre-school children, will receive educational programming") involves both the education and stewardship sectors. NCNERR included this objective in both the education and stewardship chapters of the management plan, with program-appropriate activity descriptions in each.

ACCOMPLISHMENT: NCNERR conducted strategic visioning and market analyses/needs assessments to guide its management plan development process. Its management plan interconnects its sectors in alignment with the Reserve goals.

NCNERR revised its March 2006 draft management plan in 2006 and 2007 based on OCRM comments, and the revisions included its present organizational structure and sector interconnections. NCNERR began using this revised draft as its road map for achieving its strategic goals and objectives well-before OCRM approved the September 2009 final management plan. As detailed in the sector discussions in the following subsections, NCNERR sectors and administration made overall progress towards implementing its draft and final management plans. NCNERR matured as a Reserve, correcting much of the administration and staffing instability identified in the previous evaluation findings report. NCNERR's major strategic planning work during the evaluation period effectively concluded in 2007, focusing the subsequent two-plus years on program execution. Subsequent to its strategic planning activities, NCNERR performed a large volume of programmatic work consistent with its strategic goals.

The management plan directs cross-sector collaboration to meet strategic objectives and makes sector coordinators and site managers responsible for coordinating with each other. The Reserve and OCRM agreed upon this cross-sector collaborative approach during draft management plan review and revision activities in 2006 and 2007. NCNERR indicated it began using the revised

draft management plan as a “road map” to guide its administrative and sector activities subsequent the referenced 2006 and 2007 interactions with ERD, prior to final approval of the management plan by OCRM in September 2009.

Sector coordinators and site managers stated insufficient coordination limited NCNERR sector effectiveness. NCNERR staff described instances where lack of communication, integration and collaboration led to inefficiencies and inconsistencies with staff responsibilities and duties outlined in the management plan. The evaluation team noted that NCNERR all-hands staff meetings, sector coordinator meetings (i.e., meetings among the coordinators), and site manager meetings with sector coordinators did not occur at a high frequency during the evaluation period. NCNERR staff meetings did not include many opportunities for group discussion and potential problem solving, which may bolster collaboration. OCRM encourages NCNERR to consider more frequent staff meetings, site manager meetings, and coordinator meetings as well as changes to meeting formats that align meeting objectives and format with interconnection.

NCNERR’s own accomplishments summary (Appendix F) provided few examples of the desired collaboration and coordination. NCNERR would implement its desired interconnected sectors more easily through fostering a communicative and collaborative environment. OCRM encourages NCNERR’s continued progress as a Reserve, and in particular the full interconnection of the Reserve sectors.

PROGRAM SUGGESTION: OCRM strongly encourages the Reserve to facilitate a more communicative and collaborative environment to strengthen cross-sector collaboration.

3. State Financial Support

During the previous evaluation period, DCM budget reductions caused NCNERR to shift salaries for the research coordinator and education coordinator, and half the salary of the reserve manager, from state to NOAA funds. OCRM considers these three positions as core Reserve staff, and their salaries are frequently state-funded by NERRs and used to match NOAA financial assistance awards that fund Reserve sectors. The previous evaluation noted the reserve manager’s responsibilities over the six NCCR components meant that some of the state funds leveraged as match for the NOAA financial assistance awards were for responsibilities outside NCNERR and raised a question of appropriateness. In response, DCM returned the reserve manager’s salary to fully state-funded beginning in 2006. DCM used 100% of the reserve manager’s salary in 2006, 2007, and 2008 as state match. In the federal fiscal year 2009 award, however, DCM used 75% of the reserve manager’s salary as match since the manager allocated 25% of her time to NCCR issues. OCRM expects DCM will continue to exclude the reserve manager’s NCCR responsibilities from state match calculations.

Upon review of NCNERR financial assistance applications for fiscal years during the current evaluation period, the evaluation team noted instances where NCNERR used NOAA financial assistance awards to pay for management of two NCCR components by the Northern Sites Manager. The Reserve indicated the Northern Sites Manager, who was 100% funded from CZMA § 315 financial assistance awards, spends 35% of his time managing the Currituck Banks NCNERR component and his remaining time for managing Kitty Hawk Woods and Buxton

Woods NCCR components. NCCR site management activities include monitoring and inspecting component conditions, managing invasive species and feral animals, monitoring and managing visitor use, interacting with NCCR component-specific Local Advisory Committees (LACs), issuing hunting licenses, maintaining trails, coordinating volunteer activities, and developing and maintaining partnerships. These NCCR site management activities do not have direct applicability to NERR components and may constitute inappropriate use of CZMA § 315 financial assistance funds.

OCRM's draft findings report for this evaluation period included a draft necessary action that would have required DCM to cease fully funding the Northern Sites Manager using NOAA financial assistance funds by July 1, 2010. Subsequent to the evaluation period but prior to its receipt of the draft findings report, DCM took steps to remedy this situation. DCM proposed and OCRM approved use of CZMA §306 funding from the North Carolina Coastal Management Program (CMP) for the Northern Sites Manager's NCCR responsibilities for the FY2010 financial assistance award period beginning July 1, 2010, so CZMA § 315 financial assistance awards would be used appropriately. Accordingly, OCRM changed the draft necessary action to a program suggestion. OCRM strongly encourages DCM to continue accurate attribution of Reserve staff responsibilities and costs relative its CZMA § 315 financial assistance awards in subsequent award cycles.

DCM supported state funding of both the research coordinator and Northern Sites Manager positions as its top budget request to DENR for the 2008-2009 and 2009-2011 budget requests. The final gubernatorial budget requests excluded these requests. OCRM appreciates NCNERR's, DCM's, and DENR's efforts to advocate budget increases for NCNERR.

PROGRAM SUGGESTION: OCRM strongly encourages DCM to continue accurate attribution of Reserve staff responsibilities and costs to DCM's CZMA § 315 financial assistance awards.

OCRM encourages DCM to make its highest NCNERR budget priorities to be returning the research coordinator and education coordinator positions to state funding as DCM did with the reserve manager position in 2006. Restoring core positions to state funding would stabilize NCNERR match and operations. NCNERR would be able to increase federal funding to program area work by approximately \$130,000 based on the federal fiscal year 2009 financial assistance application's cost of labor and fringe benefits for core positions. NCNERR fills several Reserve positions through a contractual agreement with the University of North Carolina-Wilmington (UNCW). UNCW waives a portion of its indirect costs for these positions, as it does for all its contracts with DENR. NCNERR uses the waived indirect costs toward its state match requirement for CZMA § 315 financial assistance funds. NCNERR's use of UNCW's waived indirect costs for its positions, while allowable, diminishes funds available for Reserve programming. Those waived indirect costs represent the approximate cost differential between DCM positions and UNCW positions, and thus the cost premium DCM pays for contracting for Reserve operations staff instead of using DCM staff. The waived costs are not available to implement Reserve sector programs. Use of state funding for core positions would free federal funds for sector activities.

PROGRAM SUGGESTION: OCRM encourages DCM to pursue and/or reallocate resources to fund the research coordinator and education coordinator positions with state dollars.

4. Staffing and Responsibilities

DCM and NCNERR completed positive staffing changes during the current evaluation period, including the hiring of a new reserve manager. The new reserve manager hired a new education coordinator, stewardship coordinator/Zeke's Island site manager/Masonboro Island site manager, Currituck Banks site manager, and a temporary Rachel Carson site manager. The reserve manager led a NCNERR/NCCR staff of 12, including seven direct reports.

The evaluation team noted little to no turnover in these positions once filled during the evaluation period, and few problems with vacancy durations. Numerous Reserve partners and customers noted the high quality work performed by Reserve staff. NCNERR became stable and functional during the current evaluation period. Several site visit participants expressed concerns regarding the non-permanent status of the Rachel Carson site manager. The evaluation team noted that this site manager also leads feral horse management and pilots the DCM boat used to support NCNERR sector efforts at Rachel Carson. OCRM shares concerns that temporary status of this key Reserve position leaves it more susceptible to attrition and workload capacity problems associated with staff turnover and long vacancy periods. OCRM supports measures DCM and NCNERR can take to stabilize this site manager position.

NCNERR's high level of programmatic activity during the evaluation period exemplified the newfound stability. The Reserve's staffing plan, detailed in the management plan, describes organizational hierarchy and assigns position responsibilities based largely on strategic planning activities performed 2005 to 2007. The staffing plan includes the reserve manager directly supervising seven staff, including the site manager for the Buckridge NCCR. The reserve manager participated in DCM's leadership team along with the director and assistant directors, and participated in regional and national partnerships. DCM and NCNERR took a step to better support the reserve manager and Reserve operations by providing a part-time administrative assistant on an ad hoc basis from DCM's Permits & Planning Section in Morehead City, near Beaufort. The reduction in permit applications caused by the current economic downturn provided the administrative assistant's workload capacity. It is unclear whether DCM will continue providing administrative support after permit applications increase.

NCNERR identified several staffing needs in its management plan. OCRM agrees that after providing state funding for the Northern Sites Manager's NCCR work, research coordinator, and education coordinator, the next highest staffing priorities should be filling the Southern Sites Manager as a dedicated position and formalizing DCM part-time administrative assistance for the Reserve. Coastal population increases in the Wilmington area over the last 20 years contributed to emerging visitor use pressures at the Masonboro Island component. The most visible pressures are large increases in recreational visitors during summer months, particularly during the Memorial Day, Independence Day, and Labor Day holidays. The Stewardship and Resource Management subsection later in this chapter addresses recreational visitor challenges. Time-consuming efforts to address complex coastal land use issues dominate the stewardship

coordinator's time, diverting attention from other Reserve-wide management issues as well as day-to-day Southern Sites management. The evaluation team understands that the reserve manager spends considerable time dealing with Masonboro Island visitor use at a strategic and policy level. The stewardship coordinator could focus on land use issues and other Reserve-wide stewardship if a dedicated Southern Sites Manager attended to day-to-day management of Zeke's Island and Masonboro Island. A Southern Sites Manager could provide support to the stewardship coordinator on the Masonboro Island-specific visitor use issues, which would allow the stewardship coordinator to lead the strategic and policy aspects of visitor use and potentially focus the reserve manager's efforts to the highest levels of strategy and policy. The evaluation team expects NCNERR's elevated organizational status within DCM would help its ability to enroll DCM support for filling unmet staffing needs.

PROGRAM SUGGESTION: OCRM encourages DCM to fill NCNERR's staffing needs for a dedicated full-time Southern Sites Manager and formally provide administrative assistant capacity, at least on a part-time basis.

OCRM encourages formal review of the staffing plan portion of the management plan before 2014-2019 management plan development. The evaluation team acknowledges the challenges associated with adding staff positions to the Reserve given budget realities. However, continued budget requests can accompany organizational planning. Assets available to NCNERR that were not available during the 2005-2006 strategic planning include ongoing Reserve program maturation and development of senior staff.

5. Facilities

NCNERR staff resides at facilities in Beaufort, Wilmington, and Kitty Hawk. The Reserve's Beaufort facilities primarily support its headquarters, education sector, and Rachel Carson component functions and include office, education, and meeting space in a building co-developed and shared with NOAA's Center for Coastal Fisheries and Habitat Research (CCFHR). The Reserve's Wilmington facilities primarily support its research and monitoring, and Zeke's Island and Masonboro Island component functions and include office, research laboratory, storage, and meeting space in a building co-developed and shared with UNCW's Center for Marine Science. NCNERR's Kitty Hawk facilities primarily support its Currituck Banks component functions and include office, storage and meeting space rented from the Town of Kitty Hawk.

NCNERR began joint facility planning with CCFHR in the 2002-2003 timeframe for Pivers Island in Beaufort. The Reserve secured NOAA financial assistance funds during the previous evaluation period to support new facility development for Beaufort and Wilmington. The Reserve now occupies these facilities. OCRM recognizes the high quality of these new facilities, and how well the Reserve uses these facilities to implement its sectors.

NCNERR continued facilities planning efforts during the evaluation period. NCNERR participated in a facilities planning group led by CCFHR that completed a Pivers Island campus master plan. The plan included provisions to replace old structures with modern research and support space. The previous evaluation noted that changes in NCNERR staff locations, initiated

by DCM, conflicted with facility designs developed for CCFHR and NCNERR. Consequently, NCNERR presently has no dedicated laboratory space in the new Pivers Island facility where it assigned the research coordinator. Using its own facilities plan, NCNERR advocated and successfully proposed inclusion in the Pivers Island master plan for NCNERR research laboratory space, additional office space, field gear storage, an outdoor classroom, and boat docks. CCFHR leadership described an excellent working partnership with NCNERR, particularly related to collaboration on campus master planning. NCNERR also enhanced the visitor experience and reduced visitor impact on Reserve lands by completing a boardwalk at the Rachel Carson component. NCNERR constructed a 500-foot long composite deck boardwalk in 2007 on Carrot Island, across from the Town of Beaufort public boat ramp. NCNERR built interpretive signs to highlight the different habitats and species located along the boardwalk. Signage project funds included those from NOAA's CZMA § 315 operations financial assistance award to DCM.

Several interviewees and public meeting participants described public access/visibility issues with both the Rachel Carson component (see IV.C.3) and NCNERR's space at Pivers Island. Some visibility issues at Pivers Island relate to compliance with NOAA security requirements, from which there is little flexibility. A mechanized gate bar restricts vehicle access to the Pivers Island access road. The gate remains open during normal business hours, and can be programmed open off-hours at NCNERR's request. Unfortunately, the off-hours accessibility is unreliable. Interviewees and public meeting attendees also indicated the CCFHR/NCNERR administrative and education building's entrance experience is uninviting and confusing, citing inadequate directional signage, locked doors, and badge and escort requirements.

The evaluation team also noted barely visible main road signage on U.S. 70 near the Pivers Island Road intersection. U.S. 70 signage mentions Duke University Marine Laboratory and CCFHR, but not NCNERR. On Pivers Island, there is one sign on Pivers Island Road indicating NCNERR's office location. The sign is small and provides little help to visitors attending K-12 and CTP educational programs.

Because public access and visitor experience are important to NCNERR's mission, OCRM encourages NCNERR to continue working with CCFHR on improving reliability of gate programming, providing directional signage that clearly directs visitor to appropriate entry points, and making the overall visitor experience to Pivers Island as inviting as possible.

B. RESEARCH AND MONITORING

The Research sector addresses scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary research program including site-directed research, monitoring, and the NERRS Graduate Research Fellowship Program. NCNERR prepared its latest research plan through its management plan development process. The research plan highlights research needs in the following areas, based in part on research program market analysis and needs assessment: strategic habitat areas, fish-habitat relationships, docks and marinas, estuarine erosion and shoreline stabilization, boating related impacts, beach nourishment, fishing gear impacts, managing non-native species, chemical effects, water supply, habitat status and trends, evaluating existing management measures, and comprehensive water

quality monitoring. As with other aspects of its management plan, the Reserve began implementing portions of the draft plan about half way through the evaluation period. Section IV of the management plan includes research plan details. The following subsections provide examples of the research and monitoring activities completed during the evaluation period.

NCNERR hired a new research coordinator in December 2004. NCNERR also filled two vacated research specialist positions in April 2005 and April 2008. Increased staff stability allowed NCNERR to complete its site profile in August 2008, in response to a necessary action from the previous evaluation. The site profile is an excellent resource for the Reserve sectors as they plan and execute research, monitoring, education, and stewardship activities, and external parties like researchers contemplating projects at the Reserve.

The research coordinator and staff serve on many state and national science and policy panels. Active panel participation serves to both advertise NCNERR and provide a mechanism for NCNERR to inform research activities and coastal management policy in North Carolina and nationally using science-based considerations. The research coordinator's participation on Ocean Policy Steering Committee provided NCNERR the opportunity to inform the North Carolina coastal zone management program's strategies for addressing emerging coastal management issues like coastal energy generation, sand resource ownership, and ocean governance.

ACCOMPLISHMENT: NCNERR's research staff elevated NCNERR's stature through participation in numerous state and national science and policy panels. The research coordinator's Ocean Policy Steering Committee work demonstrated NCNERR's science-to-management capabilities and provided a venue for NCNERR to inform North Carolina's strategies for emerging coastal zone management issues.

1. Research Activities

NCNERR led or participated in several research projects without external funding to supplement its limited research budget. Research staff assessed water quality of a restored oyster reef area at Masonboro Island, in collaboration with the North Carolina Coastal Federation. Research staff collected fundulus and oysters at Zeke's Island and Masonboro Island for CCFHR's methyl mercury distribution study of the eastern seaboard of the United States.

Research staff also actively sought external research funding and resources. NCNERR secured a mini-grant from North Carolina Sea Grant in 2005 to initiate atmospheric monitoring for wet deposition of nutrients at Currituck Banks, in partnership with the University of North Carolina – Institute of Marine Sciences (UNC-IMS). These data provided baseline information on ammonia deposition at Currituck Banks, which also serves as a reference site for a larger airborne ammonia emissions research collaboration between U.S. Fish and Wildlife Service, UNC-IMS, North Carolina State University, and NCNERR. NCNERR and CCFHR partnered on a successful grant from the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) for sustainable estuarine shoreline multidisciplinary project. This project is a multi-institution collaboration that also includes UNCW and UNC-IMS. Within NCNERR, the research and education sectors work collaboratively on the CICEET project. Project objectives include designing and installing a demonstration project utilizing alternative shoreline

stabilization approaches at Rachel Carson and developing effective communication methods for scientists, regulatory agencies, the business community, politicians and other relevant stakeholders to deliberate the short- and long-term costs and benefits of shoreline stabilization approaches.

ACCOMPLISHMENT: NCNERR's research sector performed meaningful estuarine research with limited funding. Research staff sought, developed, and leveraged research partnerships and external funding sources to meet its research goals.

OCRM encourages NCNERR to continue developing its research partnerships. The research coordinator reviews Sea Grant mini-grant proposals and serves on the North Carolina Sea Grant Advisory Board. Sea Grant reviews NERRS Graduate Research Fellow applications for NCNERR. Reserve and North Carolina Sea Grant leadership communicate and collaborate well, and acknowledge the need to seek common research opportunities. The Reserve can provide an updated list of its research needs to North Carolina Sea Grant, who could then inform and encourage its research funding applicants to perform their research at the Reserve. Opportunities may include joint funding and coordination for research held at Reserve components (e.g., NCNERR facilitates a project and provides field and laboratory support to researcher, and North Carolina Sea Grant provides research funding) and collaboration on the NERRS sea level rise sentinel sites initiative.

The new NERRS Science Collaborative provides a new opportunity for research in the NERRS. CCFHR and NCNERR researchers expressed concerns that future joint research could not effectively use NERRS Science Collaborative funding because NOAA cannot provide Science Collaborative funds directly to federal agency partners like CCFHR.

The Reserve needs additional resources to capitalize on research opportunities, particularly those to inform CRC policy and rule makers. For example, NCNERR conducts little research at the Currituck Banks component. The remote location of this portion of the Outer Banks has limited population growth and development. Future Outer Banks access improvements (e.g., a new bridge connecting Corolla with mainland Currituck County) may cause population growth and associated development similar to the Wilmington-New Hanover County growth since 1990. NCNERR's mission, expertise, and land ownership and management on both the Atlantic Ocean and Currituck Sound would provide a unique opportunity to study population growth impacts through research and monitoring. Such examples may provide opportunities for DCM to support NCNERR through funding research that directly supports its CMP. CZMA § 306 financial assistance award funds might be a source of funding research that benefits both the Reserve and the CMP. OCRM encourages DCM and NCNERR to continue seeking intramural and extramural funding to enhance research at this Reserve component.

The Reserve's research permit process does not adequately account for outside researchers performing work on NCNERR components. NCNERR indicated research permits serve three primary purposes: (1) help manage all research projects on the Reserve to help prevent conflicts (e.g., plot encroachment), (2) help justify the usefulness of the NCNERR and NERRS as research platforms to various funding agencies and Congress, and (3) track projects as they reach completion and assist with the dissemination of the results and final reports. The research

coordinator indicated a desire to migrate from a fillable PDF-based permit form to an online permit application and tracking process. OCRM encourages NCNERR to identify and deploy improved monitoring techniques for outside research conducted on Reserve properties.

DCM funds NCNERR's geographic information system (GIS) staff using DCM's CZMA § 306 coastal zone management program funds. NCNERR indicated its Wilmington-based GIS specialist spends 70% of her time directly supporting NCNERR programs and operations, and 30% supporting other DCM coastal zone management activities. All NCNERR sectors received GIS support during the evaluation period. Research sector GIS support included data and digital image analyses to classify intertidal and upland habitats of the NCNERR components. The NCNERR site profile includes the habitat classification methods, resulting maps, area statistics and brief descriptions of the habitat sub-classes. NCNERR's GIS specialist presented these analytical data and results at the 2006 North Carolina GIS Conference and Estuarine Research Federation 2007 conference. NCNERR applied these data to determine the acres of estuarine intertidal wetland vs. the total supratidal and upland habitats for Rachel Carson. A proposal to study feral horse grazing impacts at Rachel Carson incorporated these data.

2. Monitoring

NCNERR's multiple components provide unique opportunities to preserve and research locations representative of North Carolina's extensive coastal zone. The components have varied monitoring challenges with four geographically distant components and a variety of habitats across the components. These kinds of opportunities are why OCRM approves multiple components for some reserves.

NCNERR has participated in the NERRS System-wide Monitoring Program (SWMP) Phase 1 (abiotic parameters, including atmospheric conditions and water quality) since 1994, and maintained two SWMP sites at Zeke's Island and two at Masonboro Island. NCNERR installed telemetry equipment at the Masonboro-Research Creek (weather and water quality data) and Zeke's Island-Zeke's Basin (water quality data) SWMP sites during the evaluation period. Telemetry installation occurred in partnership with the Integrated Ocean Observing System (Research Creek) and the UNCW Coastal Ocean Research and Monitoring Program (Zeke's Basin). The telemetry equipment facilitated real-time data transmission and use, and provided researchers, fishers, and recreationalists with valuable information on weather and water conditions in these locations. NCNERR's two research specialists maintained the SWMP station equipment, and retrieved and uploaded data from the stations without telemetry equipment. NCNERR research staff upgraded its SWMP sonde deployment structures, which now allow sonde locations to be static, and benchmarked and tied to a vertical datum in the future. Research staff positioned each sonde above the mudline within the water column then mounted the sonde to a piling, minimizing sedimentation and biofouling of sensors. NCNERR completed sonde deployment structure upgrades at the two Masonboro Island stations during the evaluation period, and scheduled the Zeke's Island upgrades for early 2010.

NCNERR expanded its water quality monitoring during the evaluation period by collaborating with the National Park Service (NPS) to implement SWMP-like water quality monitoring stations at Rachel Carson and the Cape Lookout National Seashore. Via a 2006 Memorandum of

Understanding, NPS provided station monitoring equipment and equipment repair and calibration, and NCNERR performed data collection via monthly station visits, as well as routine maintenance. NCNERR also collaborated with the U.S. Army Corps of Engineers (USACE) to collect water quality data within Currituck Sound in support of USACE's hydrodynamic water quality modeling effort. NCNERR obtained external State funds (i.e., not CZMA funds) to conduct its work for the collaboration. The collaboration performed monitoring from January 2006 to October 2007, with these data representing the first water quality data ever collected within the Currituck Banks component. While acknowledging limited budgets, OCRM encourages monitoring for all NCNERR components, furthering the Reserve's ability to use the relatively pristine conditions within the Reserve as a baseline for comparing impacts of coastal development and climate change elsewhere in North Carolina's coastal zone.

ACCOMPLISHMENT: NCNERR added telemetry to two of its four SWMP stations, providing real-time data to researchers, fishers, and recreationalists. NCNERR leveraged outside partnerships and non-CZMA State funds to institute ongoing SWMP-like water quality data collection at Rachel Carson and to collect Currituck Banks' first water quality data during a 22-month project.

Research staff analyzed monthly water samples in-house for chlorophyll-*a* using a fluorometer purchased with external State funds. NCNERR reported that in-house chlorophyll-*a* analysis saved approximately \$2,000 per year. NCNERR also acquired optical dissolved oxygen (DO) probes for the SWMP stations. Conversion to the optical DO probes will reduce research specialist level of effort with SWMP stations as these sensors hold their calibrations longer and require less maintenance than other DO probes.

Research and education sector staff initiated a review of NCNERR's SWMP data to determine any statistically relevant trends since 1994. NCNERR completed an annual station-by-station data trend summary during the evaluation period. NCNERR indicated this project would continue into the next evaluation period, with additional data interpretation, a project findings report, updated educational materials using relevant SWMP trend analysis findings. OCRM encourages NCNERR to complete this trends analysis to inform educational efforts, determine data gaps to be filled by future monitoring, and identify potential research. OCRM also suggests periodic updates (e.g., every three years) to this data trend analysis, as resources permit.

Limited personnel and funds during the evaluation period further challenged NCNERR's ability to monitor biological, chemical, physical, and ecological conditions at the Reserve components. NCNERR stewardship staff indicated a need for baseline monitoring, particularly fauna data at the Currituck Banks component. NCNERR's 2008 site profile echoed the need to fill this data gap. However, NCNERR did not prioritize such baseline monitoring in the later stages of the evaluation period. NCNERR research and stewardship staff should work with the reserve manager to re-evaluate baseline monitoring data gaps and determine whether to prioritize this monitoring in the context of quantifying changes as well as data for making Reserve land management decisions.

C. EDUCATION AND OUTREACH

The education sector, through programs and activities, strives to increase understanding and awareness of estuarine systems and improve decision-making to promote stewardship of North Carolina's coastal resources among the public, K-12 students and teachers, and coastal decision-makers. The NCNERR education sector's goal is to promote estuarine literacy by increasing understanding of natural estuarine systems, people's connections to them, and the benefits derived from them. The Reserve's education plan indicates NCNERR will accomplish this goal by delivering information on North Carolina's coastal resources to formal and informal educators, K-12 and college students, and coastal decision makers to foster environmental stewardship and inform decision-making. The greater community, including the public, visitors, and pre-school children, will also receive educational programming to meet the education goal.

NCNERR's education sector activities during the evaluation period included K-12 student education, teacher professional development, coastal management decision maker education via the Coastal Training Program (CTP), and community education and outreach. At the time of the evaluation site visit, the education staff included the education coordinator, an education specialist, and the CTP coordinator. OCRM understands the education coordinator left NCNERR in March 2010 and the position was vacant at the time of this report.

1. K-12 Student Education and Teacher Professional Development

NCNERR participates in the NERRS K-12 Estuarine Education Program (KEEP), which uses a sequenced implementation model that includes a market analysis and needs assessment to establish an understanding of the needs of education providers and to address those needs. NCNERR's education coordinator and education specialist completed a market analysis and needs assessment of 49 organizations within North Carolina's twenty coastal zone counties that provide education and/or outreach related to estuaries and the coastal environment. The market analysis included NCNERR's use of a 28-question survey of the organizations for identifying gaps in NCNERR's existing K-12 education and teacher professional development programs. NCNERR solicited needs assessment input from its Education Advisory Committee. The needs assessment included NCNERR's survey of over 1,300 coastal zone county public school teachers to identify the needs of teachers and students and what types of changes would be necessary to meet those needs.

NCNERR's teacher professional development program strives to increase the number of teachers trained to instruct students about estuaries and coastal ecosystems, thereby increasing environmental literacy in teachers and students. NCNERR education staff updated its curriculum based on the market analysis and needs assessment, and is now consistent with North Carolina environmental education standards. Teacher workshop participants are eligible for teaching certificate renewal credits and/or North Carolina Environmental Education Certification credits. NCNERR used post-workshop evaluation surveys to verify workshop content and delivery met participant needs. NCNERR held 38 teacher professional development trainings and taught over 650 teachers during the evaluation period.

The Reserve's K-12 education program cannot fully take advantage of educational opportunities at the Currituck Banks, Masonboro Island and Zeke's Island components since education staff in

Beaufort already have a large workload and are located a significant distance from these components. The education coordinator verified her sector limited their K-12 classroom education activities to the Beaufort area. Education staff made 40 classroom visits and conducted hands-on activities with 926 schoolchildren during the five-year evaluation period. Education staff made only nine classroom visits with 215 students the last two years of the evaluation period. K-12 field trips became a higher education priority due to NCNERR's own staffing and travel limitations. School budget constraints also limited K-12 field trip participation. NCNERR provided significant assistance for schools by transporting field trip groups from Pivers Island to Rachel Carson at NCNERR's expense. NCNERR also hosted approximately 3,800 students from 184 classrooms for two-hour interpretive field trips during the evaluation period, though only 1,040 students from 53 classrooms made field trips the last two years of the evaluation period.

Evaluation and curriculum development tasks, as well as the 2008 downsizing from two education specialists to one, contributed to NCNERR's decision to reduce its frequency of classroom visits. The evaluation team met with a Rachel Carson LAC member who is also a local fourth grade teacher. This teacher indicated school budget cuts contributed to declining numbers of field trips to Rachel Carson, even with NCNERR providing boat transportation at no cost. NCNERR should have more education staff capacity in the next evaluation period for K-12 instruction and teacher workshops now that it updated the K-12 curriculum.

ACCOMPLISHMENT: NCNERR education staff updated its curriculum, conducted a market analysis and needs assessment to guide future educational programming and products, and is now consistent with North Carolina environmental education standards.

NCNERR supplemented its school year K-12 education program with summer camps for school age students at Rachel Carson. NCNERR education staff and the North Carolina Maritime Museum in Beaufort also collaborated on the Salt Water Science summer camp. Public meeting attendees expressed their gratitude to NCNERR education staff for the high-quality summer camp programs, and recounted their positive impact on individual students and their families. Participants displayed a deep passion for their estuary and appreciation for NCNERR's contributions to their community.

Education sector staff led two *EstuaryLIVE* events during the evaluation period. *EstuaryLIVE*, a program co-founded by NCNERR in 1998, celebrates National Estuaries Day and provides live streaming video via the internet to classrooms and elsewhere. NCNERR indicated approximately 2,000 students participated in their 2006 event, but less than 1,500 students participated in the 2007 event. Based on decreasing participation, significant staff preparatory time, and production expenses the education sector canceled its *EstuaryLIVE* activities and is currently evaluating the cost and benefits of production. Education staff conducted a needs assessment of teachers that previously utilized *EstuaryLIVE* in their classrooms. NCNERR reported only 21% of responding teachers indicated *EstuaryLIVE* would be useful in their classrooms. The remaining respondents indicated a preference for pre-taped segments vs. live content at a specific day and time. The evaluation team appreciated NCNERR's evaluation of its *EstuaryLIVE* program and willingness to scrutinize its legacy programs.

NCNERR's education plan includes college students as a primary audience. The Reserve conducted college education programs for pre-service teachers and delivers a variety of presentations to visiting and resident college classes. NCNERR indicated fifteen education programs reached 249 college students from 2007-2009. The evaluation team considered UNCW Center for Marine Science as an opportunity to extend education sector offerings to the Masonboro Island component and UNCW. OCRM encourages NCNERR to continually assess its education goals and continue to prioritize its activities for efficient use of its limited education sector staff.

2. Coastal Training Program

NCNERR established its CTP goals during the strategic planning and management plan development process through market analyses and needs assessments in 2005 and 2006. NCNERR's Coastal Training Program targets some of its offerings towards local coastal planning board members, in some instances tailoring a particular planning board's training based on a targeted needs assessment. Planning board-specific workshops included Stormwater Management & Sustainable Development, and Barrier Island Development Issues.

Other evaluation period workshops designed for other coastal decision makers like county permitting officials, real estate professionals, and developers included wetland identification and delineation, conservation planning, septic system basics, stormwater management, and grant writing. The evaluation team noted the stormwater management workshop's timeliness relative new N.C. Division of Water Quality stormwater rules taking effect. The CTP also partnered with the North Carolina Cooperative Extension to deliver workshops on stormwater issues. The CTP had previous experience working with Cooperative Extension on septic system issues. Through this partnership, the CTP coordinator encouraged real estate agent participation by working with the North Carolina Real Estate Commission to gain continuing education credits for several CTP workshops. The CTP coordinator also effectively used subject-matter experts within the Reserve, as well as from DCM and other partners like CCFHR, as workshop and training speakers. NCNERR enhanced its CTP workshops using GIS-based map posters to facilitate examples and discussions. Mapping and educational support capabilities validated DCM's investments in GIS over the last several evaluation periods. Workshop participants numbered nearly 1,400 in 43 training events conducted during the evaluation period. Participants included DCM staff, coastal county land use planning board members, real estate agents, builders, developers, and elected officials. NCNERR met OCRM's minimum performance measures for CTP.

Two workshop participants met with the evaluation team. These participants indicated the workshops provided a scientific context for regulations as well as opportunities to learn best management practices and develop professional relationships through networking.

ACCOMPLISHMENT: NCNERR's Coastal Training Program developed and delivered relevant and timely training regarding a new stormwater management rule, reaching key coastal decision makers like developers and real estate agents.

NCNERR continued partnering with reserves in South Carolina, Georgia, and Florida. The evaluation team believed NCNERR benefited from the regional collaboration by leveraging

other states' NERR staff to develop mutually beneficial training and providing de facto "train the trainer" events for the region's CTP coordinators.

The evaluation team noted a number of opportunities for NCNERR to leverage CTP in more cross-sector contexts. Representatives from DCM management and a CRC commissioner met with the evaluation team. These coastal decision makers expressed great interest in NCNERR pursuing research that directly informs development of and public relations for regulations (section IV.A.1 of this report). NCNERR's sustainable estuarine shoreline research project (section IV.B.1 of this report) would be the first time a specific NCNERR research project directly supported regulation development and public relations. The evaluation team believed completion of the multi-sector shoreline research project will provide NCNERR research products to the coastal management community and would provide opportunities to strengthen the Reserve's desired cross-sector integrated approach. OCRM encourages NCNERR to continue looking for opportunities to connect coastal decision maker needs with Reserve research priorities, and leverage research and education sector staff to effectively interpret and communicate those research data and findings.

3. Outreach and Public Education

NCNERR assigned outreach management to the education and stewardship coordinators. In practice, all NCNERR staff performed Reserve outreach. NCNERR conducted numerous outreach activities during the evaluation period, including hosted public field trips at Rachel Carson and Currituck Banks, Rachel Carson summer camps for children, workshops and seminars for the public, presentations to civic groups, and community festival participation. NCNERR redesigned its web site and reported positive feedback from its partners, customers, and component visitors. NCNERR sector and GIS staff collaborated on numerous publications, including outreach materials like updated brochure maps and Currituck Banks hunting guides.

NCNERR staff and others described the Reserve's outreach challenges. NCNERR has no dedicated visitor center, a common focal point for outreach and public education at many NERRS reserves. OCRM encourages the Reserve to explore alternatives to a dedicated visitor center, such as using neighboring partner facilities for outreach and exhibit space and improving outdoor interpretive signage. Public meeting attendees strongly recommended that NCNERR establish a "store front" presence on the Beaufort waterfront. NCNERR education staff and the North Carolina Maritime Museum, located on the Beaufort waterfront, discussed potential museum exhibit space as a public education venue for NCNERR. NCNERR staff indicated budget limitations limited the number and quantity of outreach publications they produced and distributed. As discussed in IV.A.3, funding core staff positions with state funds would increase the amount of CZMA § 315 financial assistance funds available for programs, including outreach. The evaluation team encouraged NCNERR to explore creative solutions to its limited printing budget, like private partnerships with stakeholders who directly benefit from NCNERR component visitation (e.g., transportation providers, restaurants, and hotels).

D. STEWARDSHIP AND RESOURCE MANAGEMENT

The Stewardship sector performs a wide range of activities including land acquisition, site access infrastructure development and maintenance, ecological restoration, resource inventories, watershed management projects, endangered species protection, visitor use management, regional planning, policy development and more. The overall goal of stewardship in the NCNERR is to protect or restore the natural integrity of each site and ensure a suitable environment for coastal research and education. NCNERR intends stewardship to link closely to its research and education sectors. A stewardship coordinator leads planning and monitoring of stewardship activities for the four NCNERR components, using NCNERR staff, DCM staff, external researchers, and volunteers. Additionally, each component has a site manager who directs stewardship activities at that component. NCNERR's broad stewardship program activities included species of concern monitoring, research, and protection; visitor use monitoring; habitat mapping; marine debris and solid waste cleanup; restoration; invasive and feral species management; volunteer coordination; and land acquisition and access improvements.

The Reserve reinstated sea turtle nesting research and monitoring at Masonboro Island through a contract with a UNCW researcher. NCNERR considers this project a stewardship activity because of the focus on sensitive species. The contract is funded from the stewardship task in the Reserve's using CZMA §315 operations funds. The stewardship sector supports and monitors the sea turtle nesting work on behalf of the Reserve. Prior to the establishment of this contract, Masonboro Island was the only unmonitored area on the North Carolina coast for sea turtle nesting activity. Research included testing of predation prevention strategies once preliminary monitoring data indicated a near 50% predation impact on nests. The following subsections include additional examples of these stewardship activities.

NCNERR experienced stewardship sector staffing limitations during the evaluation period. The Northern Sites Manager spends only 35% of his time attending to Currituck Banks issues. The Rachel Carson site manager performs significant collateral duties including piloting a DCM boat for education visitors. The stewardship coordinator also serves as the site manager for Masonboro Island and Zeke's Island ("Southern Sites Manager"). Section IV.A.4 above describes possible alternatives to increase stewardship staffing levels.

1. Volunteers

Reserve volunteers are an excellent source of help and necessary given that site management, stewardship, education and research tasks require more resources than are available internally. The stewardship and education coordinators and staff managed NCNERR's volunteer program during the evaluation period. NCNERR formalized its volunteer program by developing defined roles and providing additional training for education and monitoring volunteers. NCNERR updated its volunteer handbook. NCNERR sought to both increase the number of trained volunteers and retain them.

NCNERR trained volunteers were a small group but a productive part of the Reserve's accomplishments during the evaluation period. Trained volunteer activities included public field trip leadership and support, and support for feral horse management, sea turtle monitoring,

terrapin survey, and shorebird monitoring. NCNERR also developed a pilot program for volunteers to provide regular reports on the condition of Masonboro Island to the site manager. The Reserve leveraged its volunteers and groups like Surfrider Foundation, the NC Coastal Land Trust, the National Charity League, and Boy Scouts of America troops, for periodic marine debris and solid waste/litter cleanup that help to maintain the natural character of the NCNERR and protect its resources.

NCNERR did not significantly increase the number of trained volunteers during the evaluation period. The present cadre of trained volunteers is small relative to NCNERR's needs. The Reserve intends to develop and evaluate a new Reserve-wide volunteer training program in response to the Reserve's needs, and improve volunteer recruiting and retention through attention to volunteer needs and interests. NCNERR's most sophisticated volunteer program exists at the Rachel Carson component, however volunteer recruitment and retention efforts during the evaluation period did not result in larger numbers of trained volunteers for this component.

The evaluation team met with two trained volunteers, who indicated the number of education volunteers at Rachel Carson dropped by over half during the last few years. These volunteers reported that NCNERR no longer calls volunteer meetings on a regular basis, and volunteers did not interact much with one another. The evaluation team noted a lack of camaraderie might harm retention efforts. Use of volunteer incentives and rewards may aid with recruitment and retention efforts. In order to inform and strengthen its volunteer program, NCNERR could solicit feedback from its current volunteers, and use it to strengthen volunteer recruitment and retention efforts.

The Carolina Estuarine Reserve Foundation (CERF) supports NCNERR and NCCR as a nonprofit "friends" group. CERF performed fundraisers during the evaluation period, whose proceeds allowed its members to host NCNERR volunteer appreciation events and fund clothing and hats for NCNERR volunteers, Reserve banners, binoculars for Reserve field trips, boat bottom painting, and signs for the Reserve components. CERF also raised money to replace an outboard motor on a DCM boat that supports Reserve activities. CERF indicated its dues-paying membership is less than 10; however, recent reorganization and additions to its leadership team should help its ability to increase membership. CERF accomplished meaningful fundraising during the evaluation period and fulfilled its mission to support North Carolina's reserves. The Reserve should continue encouraging CERF and identifying opportunities for CERF to support NCNERR.

Once NCNERR hires a separate Southern Sites Manager (IV.A.4 above), the stewardship coordinator, in partnership with the education sector, may be able to better emphasize volunteer program development and implementation to support all NCNERR sectors and components. OCRM encourages the Reserve to implement the volunteer program envisioned in the management plan.

2. Visitor Access and Impacts

NCNERR improved its infrastructure and component access during the evaluation period to enhance the visitor experience and Reserve education. NCNERR installed a raised boardwalk at Rachel Carson (section IV.A.5 of this report), and an osprey pole and interpretive signs at

Currituck Banks. Several site visit participants praised the raised boardwalk for improving Rachel Carson access for visitors and education field trip groups, while limiting user impacts. The boardwalk is visible from the Beaufort waterfront, though Beaufort waterfront signage would improve Rachel Carson's visibility and draw for interpretive visitation.

Visitor use impacts and potential Reserve rule changes became a concern for the reserve manager and stewardship sector during the last half of the evaluation period. The 7/4/2009 holiday reportedly saw over 2,000 people on Masonboro Island, and over 1,000 boats anchored in a cove and rafted together. Public safety, littering, and disturbance of estuarine habitat are the primary concerns of NCNERR. Some NCNERR visitors also use Masonboro Island as an off-leash area for their dogs. New Hanover County law, where Masonboro Island resides, prohibits owners from allowing dogs to run loose. New Hanover County Sheriff's Department officers began enforcing this prohibition during the evaluation period. NCNERR engaged the law enforcement agencies, with New Hanover County Sheriff's Department taking a lead in public safety at Masonboro Island. NCNERR and law enforcement pursued outreach and education activities to mitigate problems.

Concurrent with its visitor use outreach and education activities, NCNERR has considered a rule change that would prohibit consumption of alcohol on NCCR and NCNERR components. There is a vocal opposition to this, as expressed at the evaluation's Wilmington public meeting, though most express concerns about public lands having more restrictive rules that may ultimately lead to complete prohibition of recreational activities. The Wilmington evaluation public meeting attendees focused their comments and questions on visitor use concerns at Masonboro Island, and most expressed confusion over NCNERR's decision-making process and perceived a lack of public involvement in NCNERR's deliberation. The reserve manager used this public forum as an opportunity to explain that the Secretary of DENR makes rule changes, though there are public input elements throughout the rule-making process including NCNERR soliciting input from each of its LACs. OCRM commends NCNERR's deliberate rule change consideration and collaboration with the law enforcement agencies and the Masonboro Island LAC to explore solutions to these issues.

NCNERR held a public meeting in October 2009 to discuss the proposed rule change, and over 80 citizens attended with many expressing their opposition to a ban on alcohol. NCNERR should continue its outreach and education efforts related to component visitor usage. NCNERR may improve its outreach efforts regarding the Masonboro Island visitor issues by more fully leveraging its education and research staff.

The previous evaluation period included a study to assess visitor activities at Zeke's Island, Masonboro Island, and Rachel Carson and impacts to resources. During the current evaluation period, NCNERR contracted UNCW to perform a visitor use survey that revealed the need for additional visitor use education. NCNERR designed and installed additional component signage, and updated presentation and brochures using UNCW survey results. Despite these efforts, the Reserve still lacks critical information on the impacts of visitor use on Reserve natural resources.

The evaluation team did not identify any recently completed, ongoing, or planned research or monitoring projects that specifically assess visitor use impacts at the Reserve. As stated earlier,

the overall goal of stewardship in the NCNERR is to protect or restore the natural integrity of each site and ensure a suitable environment for coastal research and education. Visitor use at Currituck Banks, Rachel Carson, and Masonboro Island appears to affect the natural integrity of those components; visitor use at Zeke's Island may affect that component. NCNERR rules allow resource extraction (e.g., Currituck Banks feral hog hunting, beachcombing). However, the Reserve does not know all of the different visitor activities causing impact, or the extent of the impacts on Reserve natural resources. Visitor use impacts may reduce the value of the Reserve for long-term research, and consequently NCNERR's value to the state and to OCRM. The evaluation team met with the UNCW professor leading the NCNERR-funded sea turtle monitoring at Masonboro Island, who indicated the summer holiday partygoers might have large impacts to sea turtle nesting habitat. The Reserve indicated that sea turtle monitoring included visitor use impacts for the 2010 monitoring, but did not address visitor use impacts in previous years.

OCRM recommends research and monitoring that better informs NCNERR's land management decisions, beginning with the pressing land use issues at Masonboro Island. NCNERR produced and conducted a CTP workshop titled "Managing Visitor Use in Coastal and Marine Protected Areas" prior to this evaluation period. The Reserve should consider specific actions resulting from utilizing its Managing Visitor Use training, and engage future NERRS Graduate Research Fellowship positions to study visitor use issues, impacts, and management.

PROGRAM SUGGESTION: OCRM strongly encourages the Reserve to plan and implement visitor impact research and monitoring at the NERR components, beginning with Masonboro Island given its proximity to North Carolina's coastal population center and the potential rule change deliberations.

3. Local Advisory Committees

NCNERR uses LACs at each component as a means to obtain public and stakeholder input into Reserve planning and program implementation. NCNERR began reconstituting the LACs during the evaluation period, adding new members. NCNERR worked through the DENR Secretary to appoint committee members for each location. The Reserve indicated the timeline for appointments is long, in part due to their desire to hold appointment recommendations until there are several at a time for the Secretary's consideration. Additionally, NCNERR indicated there is no specific process for removing disengaged members from their LAC appointment. The Reserve indicated it is working on a new process to define the roles and responsibilities of the LACs, member appointment procedures, and protocols for operation of the committees. The Reserve indicated that its LACs meet about once each year, and that site managers spent a lot of time planning for the annual meetings. OCRM encourages NCNERR to continue examining the roles and purposes of the LACs and frequency of LAC meetings, and obtain the most benefit for the Reserve given the level of effort required by both the LAC members and Reserve staff.

The Reserve obtained visitor use policy input from each of the NCNERR component LACs. OCRM commends NCNERR for informing its Masonboro Island visitor use policy deliberations with LAC input, and encourages NCNERR to engage its LACs on other issues of great local interest and importance in the future.

4. Other Stewardship Activities

NCNERR monitors and manages invasive and feral species at all components. NCNERR's GIS specialist quantified *Phragmites* expansion at Currituck Banks using aerial imagery from 1980 to 2007. The Reserve conducted a *Phragmites* removal research project on this stand based on this spatial data product, publishing its results on the NCNERR website. NCNERR worked with the Corolla Wild Horse Fund, Currituck County, U.S. Fish & Wildlife Service and The Nature Conservancy regarding feral horse management, including development of a feral horse enclosure study. The Reserve reported challenges in getting consensus on the enclosure study methodology, which may make the study results less credible. OCRM urges NCNERR and its partners to continue working to establish a mutually acceptable enclosure study design prior to expending additional resources.

NCNERR acquired 23.3 acres of ocean beach, dune, and supratidal shrub thicket at Masonboro Island in 2008, leaving only approximately 27 acres privately owned on Masonboro Island proper and its associated intertidal and subtidal habitats.

E. RESPONSIVENESS TO PREVIOUS NECESSARY ACTIONS

OCRM issued four necessary actions to NCNERR in the previous evaluation period. Appendix B contains the State's official response to these necessary actions. The following paragraphs are a brief summary of the necessary actions and the State's responses.

1. Submit a draft management plan by 3/31/2006: The Reserve submitted the required document, including all required contents, by the specified date. OCRM approved the final management plan in September 2009.
2. Develop separate outlines for a staffing plan, facilities plan, and safety plan by 12/31/2005: The Reserve submitted the required plan outlines by the specified date. OCRM approved the plans as part of the final management plan in September 2009.
3. Address the appropriate use of federal funds and develop options for state support, including match identification, in a submittal to OCRM by April 2006: The Reserve submitted its response by the specified date. The previous evaluation findings report included the following statement in connection with this necessary action: "Although half of the Reserve manager's salary has been used as match, a portion of the manager's responsibilities lies outside the NCNERR, raising a question about the appropriateness of that funding as match." DCM and NCNERR continue to struggle with state match and questions of appropriateness, particularly for the use of federal funds in the current evaluation period for the Northern Sites Manager's work on NCCR sites (IV.A.3 of this report).
4. Submit an outline for the Reserve's site profile within 120 days of the 2005 findings (i.e., by early January 2006), and submit a draft site profile by 3/31/2006: The Reserve submitted the outline prior to the specified date. The Reserve submitted the draft site plan by the specified date. OCRM approved the final site profile in April 2008.

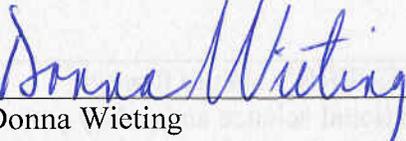
V. CONCLUSION

For the reasons stated herein, I find that North Carolina is adhering to the programmatic requirements of the Coastal Zone Management Act and the regulations of the National Estuarine Research Reserve System in the operation of the North Carolina National Estuarine Research Reserve.

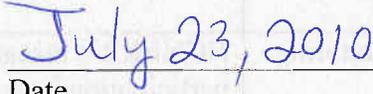
NCNERR made notable progress in the following areas: integration into North Carolina's coastal zone management program, strategic planning, research and monitoring activities, K-12 student education, and coastal training for decision makers.

These evaluation findings also contain six (6) recommendations. The recommendations are in the form of six (6) Program Suggestions; there are no Necessary Action findings for this evaluation period. The Program Suggestions should be addressed before the next regularly scheduled program evaluation, but they are not mandatory at this time. Program Suggestions that must be repeated in subsequent evaluations may be elevated to Necessary Actions. Summary tables of program accomplishments and recommendations are provided in section VI.

This is a programmatic evaluation of the North Carolina National Estuarine Research Reserve that may have implications regarding the state's financial assistance awards. However, it does not make any judgment about or replace any financial audits.



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



Date

VI. APPENDICES

APPENDIX A. OCRM SUMMARY OF ACCOMPLISHMENTS AND RECOMMENDATIONS

The evaluation team documented a number of NCNERR's accomplishments during the review period. These include:

Issue Area	Accomplishment
Integration into Coastal Management Program	DCM moved the NCNERR reserve manager position within its organizational structure to a position equivalent to an assistant director position, and through committed leadership made significant progress towards integrating the Reserve into the coastal management program and fostering inclusion and collaboration among NCNERR and other DCM sections.
NCNERR Strategic Planning and Execution	NCNERR conducted strategic visioning and market analyses/needs assessments to guide its management plan development process. Its management plan interconnects its sectors in alignment with the Reserve goals.
Research and Monitoring	NCNERR's research staff elevated NCNERR's stature through participation in numerous state and national science and policy panels. The research coordinator's DCM Ocean Policy Steering Committee work demonstrated NCNERR's science-to-management capabilities and provided a venue for NCNERR to inform North Carolina's strategies for emerging coastal zone management issues.
Research Activities	NCNERR's research sector performed meaningful estuarine research with limited funding. Research staff sought, developed, and leveraged research partnerships and external funding sources to meet its research goals.
Monitoring	NCNERR added telemetry to two of its four SWMP stations, providing real-time data to researchers, fishers, and recreationalists. NCNERR leveraged outside partnerships and non-CZMA State funds to institute ongoing SWMP-like water quality data collection at Rachel Carson and to collect Currituck Banks' first water quality data during a 22-month project.

K-12 Student Education and Teacher Professional Development	NCNERR education staff updated its curriculum, conducted a market analysis and needs assessment to guide future educational programming and products, and is now consistent with North Carolina environmental education standards.
Coastal Training Program	NCNERR's Coastal Training Program developed and delivered just-relevant and timely training regarding a new stormwater management rule, reaching key coastal decision makers like developers and real estate agents.

In addition to the accomplishments listed above, the evaluation team identified several areas where the program could be strengthened. Recommendations are in the form of Program Suggestions. Areas for improvement include:

Issue Area	Recommendation
Integration into Coastal Management Program	PROGRAM SUGGESTION: OCRM encourages DCM to more fully leverage NCNERR in its implementing North Carolina's coastal management program.
NCNERR Strategic Planning and Execution	PROGRAM SUGGESTION: OCRM strongly encourages the Reserve to facilitate a more communicative and collaborative environment to strengthen cross-sector collaboration.
State Financial Support	PROGRAM SUGGESTION: OCRM strongly encourages DCM to continue accurate attribution of Reserve staff responsibilities and costs to DCM's CZMA § 315 financial assistance awards.
State Financial Support	PROGRAM SUGGESTION: OCRM encourages DCM to pursue and/or reallocate resources to fund the research coordinator and education coordinator positions with state dollars.
Staffing and Responsibilities	PROGRAM SUGGESTION: OCRM encourages DCM to fill NCNERR's staffing needs for a dedicated full-time Southern Sites Manager and formally provide administrative assistant capacity, at least on a part-time basis.
Visitor Access and Impacts	PROGRAM SUGGESTION: OCRM strongly encourages the Reserve to plan and implement visitor impact research and monitoring at the NERR components, beginning with Masonboro Island given its proximity to North Carolina's coastal population center and the potential rule change deliberations.

APPENDIX B. RESPONSE TO 2000-2004 EVALUATION FINDINGS

Program Suggestion: The DCM and the Reserve are strongly encouraged to seek out and take advantage of the many opportunities for partnerships and collaborations that exist at all the site components, particularly when those opportunities could enhance or strengthen Reserve activities.

Response: Partnerships are essential to organization relevancy and growth. The NCNERR maintains a variety of partnerships to accomplish its mission and will continue to do so through current Memoranda of Understanding and collaborative projects. The September 2005 312 Evaluation Findings recognize the accomplishments of the education and stewardship programs through partnerships and suggest seeking additional partnerships to leverage and strengthen the research program. Significant progress has been made on the research partnerships since the last 312 evaluation. Projects reflecting new research partnerships include the NCNERR's involvement in the Currituck Sound Study to monitor water quality at the Currituck Banks component (N.C. Division of Water Resources and United States Geologic Survey), atmospheric deposition monitoring at the Currituck Banks component (N.C. State University, United States Fish and Wildlife Service, and UNC Institute of Marine Sciences), reinstating SWMP-like monitoring at the Rachel Carson component (National Park Service), and collaboration on an estuarine shoreline stabilization project (NOAA-CCFHR, UNC-Wilmington, and UNC Institute of Marine Sciences). (Additional organizations with which the Reserve currently works with and how are listed as Attachment B to the state's formal response, but is not included in OCRM's evaluation findings report for brevity's sake).

Program Suggestion: NOAA encourages the NCNERR to reconsider the membership, roles, and meeting schedules of the local advisory committees (LACs) as it revises the Reserve's management plan to seek ways in which the LACs might better serve as mechanisms for citizen input and involvement.

Response: Local Advisory Committees (LAC) serve as advisory groups, through which local citizens work with NCNERR staff to provide feedback and recommendations on site management, research, and education activities at the components, and review management plan policies and implementation strategies. The LAC membership, roles, and schedule were evaluated and expanded to include greater representation from component user groups with an increased focus on research and education partners, as well as commercial users, enforcement agencies, and adjacent landowners. Committee composition consists of representatives from the following public sectors as appropriate based on the Reserve component: citizen, adjacent landowner, local government, state government, research, education, volunteer, commercial business that operates on the component, traditional user, law enforcement, and non-profit organization. Committee members are expected to bring successes, issues, and concerns to the Reserve's attention, discuss relevant issues with the local community, and provide feedback on Reserve activities and management. The committees meet at least annually at the request of the Reserve and include updates from Reserve staff and discussion of programs and issues relevant to the component.

After a lengthy nomination process, new members were confirmed by the Secretary of the N.C. Department of Environment and Natural Resources as required by the N.C. Administrative Code. The annual meeting schedule has been reinitiated: Masonboro and Zeke's Islands LACs met in the fall of 2008, Currituck Banks and Rachel Carson LACs met in the spring of 2009, and all LACs met in the fall of 2009. The 2008/2009 meetings have revealed an interest in meeting more regularly to increase effectiveness and thus, future meeting schedules may include two meetings per year: the formal annual meeting and a less formal meeting six months following the formal meeting. Additional meetings may be scheduled as needed.

Each component of the NCNERR is required by the N.C. Administrative Code to have a LAC. The Reserve will evaluate the need for a Reserve-wide advisory committee to provide input and oversight of the entire NCNERR in addition to the local committees for each component per an activity in the management plan. Additionally, the Reserve formed an Education Advisory Committee in 2009 to guide and inform K-12 student and teacher programs.

Program Suggestion: NOAA urges the NCNERR to encourage, support, and collaborate with appropriate nonprofit friends/support groups, both locally and nationally.

Response: The Carolina Estuarine Reserve Foundation (CERF) is a non-profit organization that works exclusively to support the North Carolina Coastal Reserve and NCNERR for charitable, educational, and scientific purposes. The CERF moved headquarters from Beaufort to Kitty Hawk in 2004 and back to Beaufort in 2006 in an effort to provide better geographic representation on the board of directors. The board is comprised of representatives from the northern, central, and southern regions of the coast to reflect the distribution of Reserve components. The reserve manager serves on the board in an ex-officio capacity and ensures that CERF is aware of and is addressing NCNERR needs and is coordinating with existing NCNERR programs. The direction and foci of CERF are articulated in its 2008 strategic plan and the goals and actions address high priority Reserve needs. The CERF has been active in supporting the Reserve by hosting volunteer appreciation events and purchasing clothing and hats for volunteers, Reserve banners, binoculars for Reserve field trips, boat bottom painting, and signs for the Reserve components, all based on the needs of the NCNERR. Additionally, the CERF has written letters to federal and state legislators supporting increased federal funding for the National Estuarine Research Reserve System and stormwater legislation, respectively. The CERF has redesigned its newsletter and is currently updating its website and expanding its membership to provide better service to its members, which translates into greater support for the Reserve. The NCNERR appreciates the dedication and continued support of the CERF board of directors and looks forward to an even more productive partnership in future years.

The reserve manager currently serves as President of the National Estuarine Research Reserve Association (NERRA).

Necessary Action: The NCNERR must submit a complete draft management plan to OCRM for review and approval by March 31, 2006. In addition to the systemwide requirements for content of the management plan, and the staffing, facilities, and safety plans discussed elsewhere in these findings, the NCNERR management plan must incorporate or reflect the following:

- a) state financial support for the Reserve;
- b) definition of priority program goals, both Reserve-wide and at each of the four site components; and
- c) planning to develop collaborations that push forward reserve initiatives, including the development of new, or revisions to existing, memoranda of understanding or agreement.

Response: The Reserve submitted its initial draft management plan to NOAA on March 31, 2006 which included all system-wide requirements and the additional items required by the 2005 evaluation findings. The management plan was informed by two planning workshops: 1. Division of Coastal Management-Reserve workshop to determine respective roles and expectations conducted in 2005, and 2. Reserve strategic planning workshop facilitated by Ann Weaver from NOAA's Coastal Services Center to develop the vision, mission, and goals for the Reserve conducted in 2006. OCRM comments, program updates, and public comments were incorporated into the final plan which was approved by NOAA in September 2009.

Necessary Action: The Reserve must develop separate outlines of a staffing plan, a facilities plan, and a safety plan and submit these outlines to OCRM by December 31, 2005, for review and approval. Complete staffing, facilities, and safety plans must be incorporated into the Reserve's management plan and be submitted to OCRM as part of the complete draft management plan as required in the Necessary Action addressing the management plan.

Response: Staffing plan, facilities plan, and safety plan outlines were submitted to OCRM by December 31, 2005. Complete plans are included in the management plan which was approved by NOAA in September 2009.

Necessary Action: The DCM and the Reserve must address the appropriate use of federal funds and develop options for state support for the NCNERR, including match identification. Written documentation of this effort must be submitted to NOAA in April 2006 for review and approval as part of the draft cooperative agreement application due at that time.

Response: The requisite written documentation was submitted via a memorandum to OCRM in April 2006 and included recognition of the evaluation team's concerns, progress made since the findings were finalized, and additional steps to take in the future. The progress and future strategies sections of the memorandum were updated and form the basis of an appendix to the approved management plan which addresses appropriate use of federal funds and options for increasing state fiscal support. (The referenced appendix is included as an attachment to the state's formal response, but is not included in OCRM's evaluation findings report for brevity's sake).

Necessary Action: The Reserve must complete its site profile. An outline of the site profile must be submitted to NOAA within 120 days of the date of these findings for review and approval. A complete draft of the site profile must be submitted to NOAA by March 31, 2006, for review and approval.

Response: The Reserve site profile was approved by NOAA on April 17, 2008. The document was compiled by a cross-sectoral working group of Reserve staff. A small number of bound copies are available and the entire site profile is also available on the Reserve's website.

APPENDIX C. PERSONS AND INSTITUTIONS CONTACTED

U.S. Senators

Sen. Richard Burr

Sen. Kay Hagan

U.S. Representatives

Rep. G.K. Butterfield

Rep. Bob Etheridge

Rep. Walter B. Jones

Rep. Larry Kissell

Rep. Mike McIntyre

Rep. Brad Miller

Rep. Heath Shuler

Rep. Melvin L. Watt

Department of Environment and Natural Resources

Dee Freeman, Secretary

Manly Wilder, Chief Deputy Secretary

Robin Smith, Assistant Secretary for Environment

Bill Crowell, Albemarle-Pamlico National Estuary Program

Joanne Harke, NC Aquarium at Fort Fisher & Carolina Estuarine Reserve Foundation

Lisa Tolley, Office of Environmental Education

Sarah Yelton, Office of Environmental Education

Division of Coastal Management

Bob Emory, Chair of N.C. Coastal Resources Commission

Jim Gregson, Director

Mike Lopazanski, Policy Analyst Manager

Ted Tyndall, Assistant Director of Permits & Enforcement

Steve Underwood, Assistant Director of Policy & Planning

North Carolina National Estuarine Reserve

Rebecca Ellin, Reserve Manager

Lori Davis, Education Specialist

John Fear, Research Coordinator

Jill Fegley, Education Coordinator

Whitney Jenkins, Coastal Training Program Coordinator

Paula Gillikin, Rachel Carson Site Manager

Jacquie Ott, GIS Specialist

Hope Sutton, Stewardship Coordinator/Southern Sites Manager

Bo Dame, Northern Sites Manager

Byron Toothman, Research Specialist

Michele Walker, Public Information Officer

Heather Wells, Research Specialist

Federal Agencies

Carolyn Currin, NOAA NOS Center for Coastal Fisheries and Habitat Research
Mike Hoff, U.S. Fish & Wildlife Service, Currituck Banks Wildlife Refuge
David Johnson, NOAA NOS Center for Coastal Fisheries and Habitat Research
Shay Viehman, NOAA NOS Center for Coastal Fisheries and Habitat Research

Academia

Anne Beach, University of North Carolina-Wilmington Center for Marine Science
Charlie Humphrey, East Carolina University (formerly of N.C. Cooperative Extension)
Gloria Putnam, N.C. Sea Grant
Ron Sizemore, University of North Carolina-Wilmington Center for Marine Science
Anthony Snider, University of North Carolina-Wilmington Department of Environmental Studies
Amanda Southwood, University of North Carolina-Wilmington Department of Biology and Marine Biology
Mike Voiland, N.C. Sea Grant

Local Government Representatives

Bill Norris, Onslow County Soil & Water Conservation District
Lt. Matt Payne, New Hanover Sheriff's Office

Other Organizations and Representatives

Allison Besch, N.C. Maritime Museum
Paige Clark, National Charity League OBX Chapter
Aaron McCall, The Nature Conservancy
Pat Rapaport, NCNERR Volunteer
Bob Rapaport, NCNERR Volunteer
Ashley Ross, Newport Elementary School

APPENDIX D. PERSONS ATTENDING THE PUBLIC MEETINGS

OCRM hosted two public meetings, one on December 8, 2009 at 7:00 pm at the University of North Carolina-Wilmington, Center for Marine Sciences Auditorium, 5600 Marvin K. Moss Lane, Wilmington, North Carolina and the other at the Center for Coastal Fisheries and Habitat Research, NOAA/NCNERR Administrative Building Auditorium, 101 Pivers Island Road, Beaufort, North Carolina.

The following attended the meetings:

Sean Ahlum
Perry Barrow
Scott Barrows
Charlie Burgess
Bridget DelMese
Steve Everhart
Jennifer Frati
Brian Freskos
John Fussell
Dean Griffin
Dillon Griffin
Kim Griffin
Colleen Higgins
Eliza Higgins
Miles Higgins
Ashley Huffman
Richard Johnson
Patricia Matson
Bruce McCutcheon
Catherine Nesbit
Jim Nesbit
Haywood Newkirk
Bill Raney
Ken Rittenmeyer
Pat Rittenmeyer
Keith Sanders
Jody Smith
Holley Snyder
Bill Traina
Martin Willard

APPENDIX E. NOAA'S RESPONSE TO WRITTEN COMMENTS

NOAA received written comments regarding the North Carolina National Estuarine Research Reserve. Each of the letters is part of the official record of the evaluation and is briefly summarized below, followed by NOAA's response.

John Fussell

Morehead City, North Carolina

Comment: Mr. Fussell described his avian experiences with the Rachel Carson component in general the Beaufort Inlet System. He expressed concerns regarding declines in the wintering piping plover population at the Rachel Carson component, and suggested human disturbance was one possible reason for the declines. He expressed there is a need for Reserve research targeted at the declining piping plover wintering population at Rachel Carson, better monitoring for all rare bird species associated with the reserve, and further habitat conservation through Reserve boundary expansion. Finally, he stated there is a great need for a permanent full-time site manager for the Rachel Carson component.

NOAA's Response: OCRM appreciates Mr. Fussell's thoughtful comments. OCRM provided Mr. Fussell's comments to NCNERR for their consideration, particularly related to avian research and monitoring opportunities. OCRM encourages the Reserve to use its management plan to guide its prioritization of sector needs and potential boundary expansion, and address them as funding allows. OCRM supports any DCM and NCNERR efforts to stabilize the personnel status of the Rachel Carson site manager position.

**APPENDIX F. NCNERR'S OWN SUMMARY OF ACCOMPLISHMENTS FOR THE
EVALUATION PERIOD**

(see following pages)



NORTH CAROLINA NATIONAL ESTUARINE RESEARCH RESERVE

ACCOMPLISHMENTS DECEMBER 2004 – NOVEMBER 2009

OPERATIONS AND MANAGEMENT

MANAGEMENT PLAN

The Reserve's updated management plan for 2009-2014 was approved in September 2009. The plan includes an updated vision, mission, goals, and activities that reflect a new management philosophy that promotes the Reserve and its components, and prioritizes the needs and opportunities for core programs at the components. The management plan also identifies coastal management and site specific issues that will be addressed by the programs and needs for the future.

FACILITIES

Two new office facilities were completed within the evaluation period. The Reserve headquarters is now located at the NOAA Center for Coastal Fisheries and Habitat Research on Pivers Island in Beaufort, N.C., across from the Rachel Carson component. The headquarters office includes office space for 11 Reserve staff and a teaching laboratory for education programming. The building also houses Center administration and includes a shared auditorium used for Coastal Training Program events and a conference room. Reserve staff moved into this facility in July 2007.

The Reserve now has dedicated office and laboratory space at the University of North Carolina at Wilmington's Center for Marine Science. The space houses 4 Reserve staff and the laboratory accommodates the System Wide Monitoring Program and other research and stewardship activities. The Center for Marine Science is across the waterway from the Masonboro Island component and Reserve staff moved into this facility in May 2008.

STATE PARTNER RELATIONSHIP

The Reserve-Division of Coastal Management (DCM) partnership has strengthened considerably in recent years with strong commitments from both the Division Director and Reserve Manager to work more closely together to accomplish the vision of the Coastal Zone Management Act for an integrated coastal management program. This enhanced positive relationship has yielded more administrative and program support for the Reserve from the Division as well as more program support for the Division from the Reserve. Specific examples of this increased collaborative effort are detailed in the partner bullets.

FISCAL MANAGEMENT

The Reserve Manager and Coordinators work closely to plan and manage the Reserve budget. The budgets for the operations awards are developed with input from the Coordinators, who manage their program budgets. Reserve staff tracks all expenditures in a shared Google spreadsheet per the award budgets. This method yields transparency and allows the Reserve to more efficiently manage its budget and operations awards. The Reserve works closely with DCM budget staff and this tracking methodology helps the budget staff accomplish their duties as well. This approach to fiscal management is a significant improvement from the method used previously in which Reserve staff did not interact with the budget at all.

PARTNERSHIPS

Partnerships are essential to organization relevancy and growth. The NCNERR maintains a variety of partnerships to accomplish its mission and recognizes that a significant portion of the work the Reserve does would not be accomplished without the partnerships the program maintains. This is detailed in the response to the 2005 evaluation findings which outlines current program partnerships and describes how the Reserve is working with its local advisory committees and non-profit friends group, the Carolina Estuarine Reserve Foundation. The variety and strength of Reserve partnerships is also echoed by the partner bullets prepared for the partner meetings during the evaluation site visit.

VISIBILITY

The Reserve is working to enhance its visibility and recognition within its local communities and the state. The logo was recently updated and includes features from both the National Estuarine Research Reserve logo and the DCM logo. The Reserve completely redesigned its website to better communicate with partners, customers, and visitors; the website includes a calendar, hot topics, program and project descriptions, links to System Wide Monitoring Program data, registration for Coastal Training Program events, maps, and publications.

EXTERNAL FUNDING

The Reserve has successfully received a variety of external funding to enhance NCNERR operations. Please also see the Research and Education sections of this accomplishments report.

The Reserve received two National Estuarine Research Reserve Land Acquisition and Construction grants within the evaluation period:

- NCNERR Pivers Island construction Phase II (2006): This grant supported completion of the Reserve's headquarters office on Pivers Island in Beaufort, N.C. and purchased furniture for the office and shared spaces, landscaping, acoustical panels for the auditorium, and a variety of other items to equip the building for occupation.
- Masonboro Island acquisition (2007): This grant funded acquisition of one of the remaining privately-held parcels within the Masonboro Island component, 23.3 acres of ocean beach, dune, and supratidal shrub thicket, advancing a high priority acquisition goal.

RESEARCH AND MONITORING

Site Profile Completed:

The NCNERR completed its site profile in response to the stated necessary action from the December 2004 312 evaluation. The site profile was completed by a working group comprised of NCNERR staff from all sectors. The finalized site profile was accepted by NOAA on April 17, 2009. Final text edits and document arrangement for printing were completed in August 2009. The finalized document is available on NCNERR's website (www.nccoastalreserve.net). A small number of copies of the site profile were printed for distribution.

SWMP phase I upgrades

The research sector has made many strides in improving our implementation of the System Wide Monitoring Program phase I. These updates make our data both more robust and accessible. We have also utilized external partnerships to expand SWMP-like monitoring to our other NERR components. SWMP-like monitoring includes stations that utilize the NERR SWMP protocols but are not official SWMP stations. The bullet list below describes some of the highlights of this effort.

- **Telemetry installation:** Telemetry was installed at our Research Creek SWMP site (weather and water) during the summer of 2006 as part of the NERRS-IOOS partnership. Telemetry was installed at our Zeke's Basin SWMP site (water) during the fall of 2008. This work was conducted in partnership with the University of North Carolina at Wilmington's Coastal Ocean Research and Monitoring Program (CORMP). (Note: CORMP is being integrated into the South Carolina based Carolinas Coastal Ocean Observing and Predictions System (CaroCOOPS)). The research and education sectors are working with the North Carolina Aquarium at Fort Fisher to make these data available to the aquarium visitors through an educational kiosk.
- **SWMP expansion:** NCNERR partnered with the National Park Service (NPS) to implement SWMP-like water quality monitoring at the Rachel Carson component of the NCNERR and the Cape Lookout National Seashore. This work, codified by an MOU in November 2006, provides for two SWMP-like water quality stations and monthly nutrient and chlorophyll *a* sampling. The NPS provides all needed equipment, calibration, and repairs and NCNERR provides the manpower to maintain the equipment and conduct the monthly station visits. Instrumentation from this project was first deployed in October 2007 and continues to date. Through this partnership, NCNERR has been able to bring continuous water quality monitoring back to the Rachel Carson component after a 5 year hiatus. Discussions are currently

underway with UNCW's CORMP to equip one of these sites with telemetry. Movement on this effort is expected in early 2010.

NCNERR obtained external State funds to conduct SWMP-like monitoring at our Currituck Banks component and within the greater Currituck Sound as part of a U.S. Army Corps of Engineers (USACE) project to create a hydrodynamic water quality model for Currituck Sound. This project also included the USGS and Elizabeth City State University as partners. As part of this project, NCNERR maintained two water quality monitoring locations, and conducted monthly nutrient and chlorophyll *a* sampling. The active data collection phase of this project ran from January 2006 to October 2007. Model development by the USACE is ongoing. During this project, NCNERR secured access to the UNC-Coastal Studies Institute's (CSI) labs in Nags Head, NC thanks to Dr. Michael Piehler. These facilities are less than 5 miles from our Kitty Hawk office. This collaboration with Dr. Piehler's lab has continued and NCNERR enjoys continual access to the CSI labs in support of future projects. This dataset represented the first water quality data ever collected within the Currituck Banks component and will serve as a great baseline to compare future data collections against. NCNERR remains committed to bringing water quality monitoring back to the Currituck Banks component as funding allows.

- **SWMP deployment structure upgrades:** Since the last 312, the research sector has upgraded the deployment method for our SWMP sondes. Previous deployment structures utilized a weighted bottom resting cage to house the sonde. This method left room for much improvement. Toward that end, NCNERR is moving toward a USGS style piling deployment system. This will enhance the data collected by NCNERR in the following ways: the sondes will always be deployed in exactly the same location and depth; the sondes will be able to be benchmarked and tied into a vertical datum; the sondes will be secured to a piling and less prone to vandalism and disruption by non-NERR persons; the new deployment method moves the sondes off the bottom, minimizing sedimentation and biofouling. Vertical deployment structures have been successfully installed at both SWMP stations with the Masonboro component and installation is underway at the Zeke's Basin sites. The final SWMP station will be converted in Spring 2010.
- **Chlorophyll *a* analysis:** In 2006, NCNERR began conducting all chlorophyll *a* analyses in-house. The Reserve acquired a new Turner fluorometer using external State funds. Analyzing the SWMP chlorophyll *a* samples in-house results in a net savings to the Reserve of approximately \$2,000 per year.
- **Conversion to optical dissolved oxygen sensors:** NCNERR has been working to convert all its SWMP stations to optical dissolved oxygen (DO) probe capability. The optical DO probes hold their calibrations longer, enhancing the quality of the data NCNERR collects and also require less maintenance. As of November 2009, NCNERR has acquired enough optical DO probes to convert all of our SWMP stations to full time optical DO capability.

- **SWMP data analysis:** NCNERR has been conducting SWMP since 1994. This represents one of the best long-term monitoring datasets for estuarine waters within the State. In 2008, NCNERR decided that it was time to conduct a review of all the SWMP data that NCNERR has collected since 1994. The goal of this process is to see if any long-term trends can be observed within the dataset and to conduct a statistical assessment of the dataset. This effort is a joint research and education sector project. Findings from this effort will be summarized in a report and applicable information will be incorporated into education materials. A first step of this process was completed as part of the NCNERR site profile which contains annual trends of the data from each SWMP and SWMP-like station at all NERR components. The first draft of this data compilation is expected by January 2010.

Externally funded research projects

The research sector of NCNERR strives to secure external funding and outside researchers to conduct research projects within the Reserves and their watersheds. The research sector of NCNERR has been very successful in this endeavor. Listed below are highlights from this effort that have occurred during the time period of this review. In addition, NCNERR currently has four external proposal submissions that are in various stages of review.

- **Sea Grant mini-grant and resultant atmospheric deposition - bioassay project:** The research sector of NCNERR secured a \$5,000 mini-grant from North Carolina Sea Grant in 2005 to initiate atmospheric monitoring for wet deposition of nutrients at our Currituck Banks component. This project was conducted in partnership with the University of North Carolina at Chapel Hill – Institute of Marine Sciences (UNC-IMS). The data from this project was used to help leverage a much larger project titled *NC - Impacts of Airborne Ammonia Emissions from a Large-Scale Commercial Egg-Laying Operation at Pocosin Lakes National Wildlife Refuge* funded by the U.S. Fish and Wildlife Service. This project examines the potential impacts to the Pocosin Lakes National Wildlife Refuge and adjacent areas from a large egg laying factory. Currituck Banks is being used by this project as a reference site to compare near factory atmospheric deposition. NCNERR staff is assisting with bioassay experiments that are part of this project designed to quantify the susceptibility of area surface water phytoplankton communities to nutrient impacts. This data combined with the atmospheric deposition data will allow the potential eutrophic impacts of the egg factory to be determined. This project is a multi-partner collaboration between the U.S. Fish and Wildlife Service, UNC-IMS, North Carolina State University, and NCNERR. Active sampling for this project wrapped up in 2008. The Research Coordinator presented results from this project at the Estuarine Research Federation meeting in Providence, RI in November 2008. Final data interpretation and manuscript preparation are currently underway.
- **CICEET project funded:** NCNERR, in cooperation with the NOAA Center for Coastal Fisheries and Habitat Research in Beaufort, NC, was awarded a grant in

February 2008 from the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) for a project titled: *Sustainable estuarine shoreline stabilization: research, education, and public policy in North Carolina*. The short-term (Phase I) objectives of this multidisciplinary project are to 1) conduct research to quantify ecosystem service tradeoffs as a consequence of shoreline stabilization, 2) design and install demonstration projects utilizing alternative shoreline stabilization approaches for research and education purposes on the Rachel Carson component, 3) develop an approach for evaluating ecological and socioeconomic costs and benefits of shoreline erosion and protection alternatives and 4) develop effective communication methods for exchanging information between scientists, regulatory agencies, the business community, politicians and other relevant stakeholders in regard to short-term and long-term cost-benefits of shoreline stabilization plans. This project is being conducted in all areas of the North Carolina coast (northern, central, and southern). At the end of this project, we will have the foundation to move towards a comprehensive analysis of the ecological and socioeconomic costs and benefits of various shoreline stabilization and erosion mitigation approaches. This project is a multi-institution collaboration including NCNERR, NOAA, UNCW, and UNC-IMS. Within NCNERR, the research and education sectors are working collaboratively as part of this project. Work completed thus far include hiring a research education technician, completion of all year 1 sampling, formation of a stakeholder advisory panel, and completion of a waterfront land owner needs assessment.

- **Marsh monitoring project:** In October 2005, the Research Coordinator assisted personnel from the NOAA Center for Coastal Fisheries and Habitat Research in Beaufort, NC in Beaufort working under the direction of Dr. Carolyn Currin with the installation of sediment elevation tables, and vegetation surveys within the Rachel Carson component. These activities were in support of a project aimed at determining the effects of sea level rise on coastal marsh habitats. This effort was instrumental in the successful application by NCNERR in 2007 for a grant from the NOAA Restoration Center to conduct marsh vegetation monitoring in and around the Rachel Carson Reserve component. This project is a multi-reserve effort aimed at determining which marsh restoration methods work best. This project directly supports SWMP phase II as well. Dr. Currin and her staff have assisted NCNERR with this project as an extension of their previous project. In support of this project the Research Coordinator attended a week-long training in Corbin and Gloucester, VA in March 2008. This training taught project partners how to benchmark sampling sites to tidal datums, use SETs, and install groundwater wells. To date, NCNERR has completed all year 1 and 2 monitoring for this project. Data entry and interpretation are ongoing. The efforts of the Reserves participating in this project led to the development of a strategic committee proposal regarding the Reserves as sentinel sites. This proposal has received lots of attention by NOAA. One year remains in this project and then all data from the five reserves will be compared to each other by a fellow working under the direction of Dr. Michele Dionne at the Wells NERR.

- **Groundwater project:** NCNERR worked in collaboration with faculty from the UNC-IMS on determining the importance of submerged groundwater discharge to the Neuse River Estuary. This project was supported by a grant written by the Research Coordinator submitted to the North Carolina Water Resources Research Institute. NCNERR participated in all aspects of this project. The active sampling portion of this project was conducted from July 2005 through June 2006. Although not based within the NCNERR boundaries, this project provided valuable knowledge that is applicable to many North Carolina coastal regions including the Reserve properties. In addition, based on collaboration developed as part of this project and the generosity of Dr. Hans Paerl, the Research Coordinator has gained full access to the lab facilities at UNC-IMS. UNC-IMS is located 5 miles from the Beaufort NCNERR office. Results from this work were compiled by the Research Coordinator into a manuscript titled *Importance of Submarine Groundwater Discharge as a Source of Nutrients for the Neuse River Estuary, North Carolina* that was published in *Estuaries and Coast* Vol. 30, No. 6, p. 1027–1033, December 2007).
- **Hollings Marine Lab Tidal Creek and Probabilistic Sampling Project:** In April 2006, the research staff met with researchers from the NOAA, NCCOS, Hollings Marine Lab in Wilmington, NC. Plans were made for a tidal creek and probabilistic sampling project within NCNERR. It was decided to conduct the tidal creek sampling at sites in and near Masonboro Island and the probabilistic sampling at all four NCNERR components. Staff from NCNERR and the Hollings Marine lab completed sampling during 2007. This work provided NCNERR with extremely valuable data about the contaminant level within the Reserve components and how the adjacent development in the Wilmington area is impacting Masonboro Sound. It also allowed researchers from Hollings to determine that models based on work in South Carolina were transferable to North Carolina despite the much different tidal regime. Results from this work have been compiled into reports: NOAA Technical Memorandum NOS NCCOS 82 and NOAA Technical Memorandum NOS NCCOS 83.

Participation on committees

The Research Coordinator and research staff serve on many State and NERRS committees. This activity serves to both advertise the Reserve and also provide a mechanism for the Reserve to influence research activities and coastal management policy within the State of North Carolina and system-wide. The few examples below provide a good sampling of the breadth of these panels.

- **North Carolina Sea Grant Advisory Board:** The Research Coordinator has served as an advisory board member to North Carolina Sea Grant since September 2006. This board is charged with assisting Sea Grant with its strategic planning and current year's focus areas.

- **Ocean Policy Steering Committee:** The Research Coordinator served on DCM's Ocean Policy Steering Committee. This committee was charged with developing forward thinking policy to deal with emerging coastal management issues. The committee held meetings throughout 2008 and its recommendations were summarized into a report that was presented to the N.C. Coastal Resources Commission in November 2008. The Commission has developed an implementation committee to determine how best to implement the suggestions contained in the report. Topics covered include alternative energy generation, sand resource ownership, and ocean zoning.
- **North Carolina Division of Marine Fisheries - Strategic Habitat Area Advisory Committee:** The Research Coordinator served on the Strategic Habitat Area advisory committee. This committee was charged with developing the definition of a strategic habitat area (SHAs) and determining the best way to implement SHAs as part of the North Carolina Coastal Habitat Protection Plan. The committee's recommendations were adopted by the North Carolina Marine Fisheries Commission. The Division of Marine Fisheries is now in the process of designating strategic habitat areas within coastal waters.
- **Albemarle Pamlico National Estuary Program - STAC liaison:** The Science and Technical Advisory Committee (STAC) is the formal advisory council for Albemarle Pamlico National Estuary Program regarding science issues. As a liaison, the Research Coordinator attends all STAC meetings and participates in their discussions. This affiliation provides a linkage with the National Estuary Program and has provided a means to foster partnership opportunities.
- **NERRS Data Management Committee member:** The NCNERR SWMP Coordinator served on the data management committee from January 2006 to February 2008. As part of this service, a technician survey was compiled by the SWMP Coordinator to help understand the high turnover rate in the tech positions across the NERRS. Results from this survey were presented by the SWMP Coordinator at the annual meeting in October 2006 and were compiled into a white paper.
- **NERRS GRF internal review workgroup:** The Research Coordinator served on the NERRS GRF internal review workgroup: The workgroup was charged with determining to what extent the GRF program was meeting its mission, and how the program could be improved. The workgroup discussions were summarized into a white paper and were presented to managers at their annual meeting in Washington, DC.
- **Defense Coastal/Estuarine Research Program (DCERP) regional coordinating committee member:** In August 2007, the Research Coordinator was appointed to the Regional Coordinating Committee for the Defense Coastal/Estuarine Research Program (DCERP) at Cape Lejeune Marine Corps Base, North Carolina. This committee is intended to provide a means for DCERP to reach out to key members of conservation organizations and other members of the regional community, including stakeholders such as federal, state, and local regulators. The committee is also expected to provide a means

for sharing information and results, as well as to provide an avenue for promoting collaboration between DCERP and the regional community.

Additional Research Staff highlights

- NCNERR research staff conducted a water quality assessment of a restored oyster reef area within the Masonboro Island component (2007-2009). This project was a collaborative effort with the North Carolina Coastal Federation. NCNERR completed an internal white paper report that assessed the findings from this effort.
- NCNERR research staff collaborated with the GIS Specialist to assist with the completion of the NCNERR habitat mapping effort (see GIS section for project details).
- NCNERR research staff assisted with stewardship activities including: visitor use surveys, oyster catcher monitoring, beach vitex removal and treatment, litter clean ups, NOAA in the Carolinas hurricane awareness day, terrapin monitoring research, posting of Reserve signage and public outreach efforts.
- NCNERR research staff collected fundulus and oysters for methyl mercury analyses by Dr. David Evans, NOAA, NOS, NCCOS Center for Coastal Fisheries and Habitat Research (CCFHR) in both Zeke's Basin and Masonboro Island components (2009). This NCCOS project is geared toward understanding the change in methyl mercury concentrations that exist along the eastern seaboard. Multiple east and gulf coast NERRS are participating in this project.
- The NCNERR research staff in cooperation with the GIS and stewardship staff conducted a *Phragmites* removal project at the Currituck Banks component. The purpose of the project was to remove the *Phragmites* and monitor what type of vegetation (natives or *Phragmites*) returned to the study area. The three year study concluded in 2008 and an internal white paper of project results was produced. The white paper is available on the NCNERR website. In summary, our efforts did not achieve the desired control of *Phragmites* and it is currently revegetating in the areas where we removed it and even expanding a bit into new areas.

EDUCATION

K-12 Student Education

The K-12 student education program provides students with hands-on, inquiry-based learning opportunities where the content is focused on estuarine habitats, organisms or coastal issues. Teachers bring their classes to the Reserve for a two-hour interpretive nature hike. Field trips and field studies are held primarily at the Rachel Carson component from April - October. Education staff also offer hands-on learning activities such as seining for fish, conducting shore profiles, or testing water quality. For schools that cannot travel, the Reserve offers a variety of classroom-based programs that are led by Reserve education staff on estuarine-related topics.

- **Field trips:** From July 2005 through November 2009, approximately 3,800 students from 184 classrooms around the State visited the Reserve for a two-hour interpretive field trip. These field trips were led by Reserve education staff.
- **Classroom visits:** During that same time period, Reserve staff visited 40 local classrooms and conducted hands-on activities with 926 schoolchildren.
- **Education Advisory Committee:** A nine-member Education Advisory Committee composed of the Reserve Research Coordinator, a Reserve volunteer, local school teachers and informal educators from local State agencies met for the first time in February 2009. The purpose of the Education Advisory Committee is to provide the Reserve's education program with guidance and future direction. Committee suggestions will be incorporated into future program planning.
- **Free boat transportation:** With the recent downturn in the economy, the number of schools visiting the Reserve decreased significantly in 2008. In an attempt to reduce costs to the local school districts, the Reserve now offers free boat transportation to and from the Rachel Carson component instead of the schools having to pay a ferry service for transportation to the island. This service is currently being advertised to all schools in Carteret, Craven and Onslow counties in an attempt to increase school group usage. We already have 15 classes schedule for field trips in the spring.
- Future plans include expanding our local school outreach efforts. These outreach efforts include conducting hands-on, inquiry-based activities in the classroom, giving classroom presentations about the Reserve and its habitats, and distributing estuarine curricula to teachers. Again, this service is being advertised to all schools in Carteret, Craven and Onslow counties.

Teacher Professional Development

The purpose of the teacher professional development program is to increase the number of teachers trained to teach students about estuaries and coastal ecosystems thus increasing environmental literacy in both teachers and students. The Reserve accomplishes this through workshops and by providing supplementary curricular materials. Teacher professional development workshops target formal and informal educators across the State as well as pre-service teachers. All educator workshops are based on curricula developed either locally by NCNERR educators or by the NERRS. North Carolina teacher workshop participants are eligible to receive teaching certificate renewal credits and/or North Carolina Environmental Education Certification credits. Post-workshop evaluations are conducted for every workshop to ensure that the content and delivery are meeting participant needs. Many teacher professional development workshops are conducted in partnership with other organizations.

- **Teacher trainings:** Since summer 2005 the Reserve has held 38 teacher professional development trainings and taught 656 teachers about estuarine principles and concepts.
- **Workshop revisions:** In 2007 and 2008 the Education staff revised the Coastal Explorations teacher workshop content to reflect the Reserve's updated curriculum (see publication section). In addition, the Coastal Explorations workshop is in the process of being overhauled to meet the new 2009 N.C. environmental education standards. New teacher professional development opportunities are being developed for the upcoming year using the Teachers on the Estuary (TOTE) program and incorporating Estuaries 101 curricular activities.
- **Partnerships:** The Reserve has conducted numerous workshops in partnership with other organizations including: N.C. Wildlife Resources Commission, N.C. Office of Environmental Education; College of the Albemarle; Mid-Atlantic Marine Education Association; N.C. Coastal Federation; N.C. Museum of Natural Sciences; N.C. Teaching Fellows Program; Bald Head Island Conservancy; N.C. Science Teachers Association; Environmental Educators of North Carolina; National Science Teachers Association; University of North Carolina at Greensboro; Southeast Center for Ocean Sciences Education Excellence; N.C. Soil and Water Conservation; National Marine Education Association; N.C. Maritime Museum; and the Carteret County School System. In the future, through expanded partnerships, the Reserve hopes to be able to conduct educator professional development workshops in other coastal regions (north and south) thus increasing the Reserve's programmatic impact.

Market Analysis (MA) & Needs Assessment (NA)

Individual reserve sites that choose to participate in the K-12 Estuarine Education Program (KEEP) are required to follow a sequenced model that begins with a Market Analysis (MA) and a Needs Assessment (NA) prior to implementation. The goal is to prioritize products

and service needs so that reserve educational programs are tailored to fill a specific niche and address the needs of formal educators within their region.

- **Market Analysis:** NCNERR conducted a MA of agencies within NC that provide formal education, informal education and/or outreach related to estuaries and the coastal environment to identify gaps in the existing programs offered to the teachers and students of the 20 coastal N.C. counties. Questions developed by the NERRS MA/NA workgroup were pilot tested in an online assessment using SurveyMonkey. Forty-nine organizations in N.C. were emailed the 28 question survey.
- **Needs Assessment:** A needs assessment survey was conducted to identify gaps in existing educational programs and to determine what types of changes need to be made to current K-12 and teacher professional development programs to better meet the needs of teachers and students in N.C.'s 20 coastal counties. Most survey questions were developed by the NERRS MA/NA workgroup. Site-specific questions were developed by the NCNERR education staff. The NA was developed in SurveyMonkey and consisted of 40 questions. The survey was emailed to 1,326 public school teachers in the 20 coastal counties.
- **Results:** Final reports were shared with fellow Education Coordinators at the NERRS annual meeting and are posted on the NERRS Intranet. A poster was also presented at the annual meeting on the results of our MA and NA.

Community Education and Outreach

The community education and outreach program strives to increase public awareness of the goals and mission of the NCNERR and to enhance an understanding of estuarine systems and processes among the general public including pre-school children, local citizens, and visitors of coastal North Carolina. The intent of the outreach program is to increase estuarine literacy and foster environmental stewardship in citizens of all ages. Outreach activities include: public field trips; summer camps; workshops, seminars, and science symposia on coastal topics; participation at environmental festivals and fairs; and production of educational materials.

- **Public field trips:** Every summer the Reserve offers naturalist-led public field trips twice a week to the Rachel Carson Reserve. These outings are led by trained volunteers and/or education staff. Public field trips are also offered on National Estuaries Day and during Take A Child Outside Week (late September). Public nature hikes have been offered by Reserve staff at the Currituck Banks site in the summer as staff and resources allow. When offered, the public field trips at this location are very well attended. We hope to eventually hire a part-time educator at this site to take full advantage of the educational opportunities. During summers from 2005 through 2009, 1320 individuals participated in 88 public field trips to either the Rachel Carson component or the Currituck Banks component of the NCNERR.

- **Summer Camps:** In 2008, the Reserve began offering summer camps for children including: Preschool Storytime and Crafts (ages 3-5); Adventures in the Estuary summer camp (grades 1-3); and a Junior Naturalist summer camp (grades 4-8). These programs are held in the Reserve's facility in Beaufort with daily field trips to the Rachel Carson Reserve where the students conduct field investigations and learn from hands-on activities. Since 2008, 259 students participated in the Reserve's summer camp activities. The Reserve has also annually collaborated with the N.C. Maritime Museum in Beaufort to teach its Salt Water Science summer camp.
- **Workshops/Seminars/Symposia:** The Reserve has held or co-hosted numerous workshops, seminars and science symposia on coastal issues/topics for the general public including: Beach Nourishment, Coastal Birds, Coastal Mammals, Barrier Island Wildlife, and Wildlife Photography.
- **Presentations:** Public presentations on a variety of topics are given year-round to an assortment of organizations including: Boys and Girls Clubs; Boy Scout Troops; church groups; garden clubs; science clubs; preschools; colleges and universities; and other interested parties. Since 2005 the Reserve has given 96 outreach presentations and reached 1,897 individuals.
- **Festivals/Fairs:** The Reserve has participated in numerous festivals and fairs including: the North Carolina Seafood Festival (~150,000 visitors); the Kitty Hawk Heritage Day Festival (~2000 visitors); the Core Sound Decoy Festival (~5,000 visitors); Marine Careers Day at Fort Fisher Aquarium; Waterside Afterschool at the NC Maritime Museum; Raleigh Earth Day; and Halyburton Park Nature Festival in Wilmington, to name a few. The Reserve hosted a National Estuaries/Public Lands Day celebration in September 2009 on the Beaufort waterfront in conjunction with the N.C. Maritime Museum.

Publications

To inform local citizens and visitors about the Reserve and estuarine habitats, informational brochures, pamphlets, interpretive signs, Digital Video Discs (DVDs), and display boards have been developed. The Reserve also provides K-12 teachers with written, estuarine-based, curricular material for both classroom and field-based activities. In addition to the curriculum, the Reserve produces educational posters, activity books and Newspapers in Education (NIE) inserts. Web resources are also available and include basic estuarine information, curricula, field guides, and archived Estuary Live sessions.

- **Maritime Forest Activity Book:** In 2006 a Maritime Forest Activity Book was developed for students in grades 5-7. This book was distributed to area teachers in 2007 and 2008.
- **Critter Posters:** Two new critter posters (oysters & horseshoe crabs) were developed and sent to classroom teachers in 2007.

- **Newspapers in Education insert:** In November 2007, the Reserve partnered with the Albemarle-Pamlico National Estuary Program to produce a “Newspapers in Education” insert on estuaries. This 12-page insert was distributed to 170,000 schoolchildren in N.C.
- **Curriculum revisions:** All Reserve curricular activities were updated in 2007-2008 and three new hands-on activities were created. The North Carolina Office of Environmental Education staff reviewed the curricula to ensure compliance with State science education standards and to offer suggested improvements. The North Carolina Division of Coastal Management’s public information officer also edited the curricula. All K-12 educational materials were printed in-house. In January 2008 NCNERR hosted a Regional Educational Retreat with North Inlet-Winyah Bay NERR and ACE Basin NERR education staff to exchange educational materials and to peer-review our new curriculum.
- **Interpretive signs:** Education staff designed and developed six interpretive signs for the Rachel Carson component boardwalk which was dedicated in August 2008. The interpretive signs were on the following topics: estuary basics; coastal birds; coastal plants; feral horses; coastal habitats; and Rachel Carson.
- **Newsletter redesigned:** The Reserve’s newsletter, The Tidal Flat, was re-designed in the fall of 2007 and will be produced in the spring and fall each year. The newsletter is being distributed to a broader audience including educators, decision-makers, town officials, volunteers, and other interested parties.
- **Updated site brochures:** Site brochures are in the process of being updated and will include a new design and format with specific information on site location, habitats, natural history, allowable visitor uses, and a trail map.

Estuary Live

During the review period, the N.C. National Estuarine Research Reserve produced two local Estuary Live Programs, which are interactive, web-based, field trips available nationwide. These live broadcasts were designed for classroom use but could be viewed by anyone.

- **2006 Estuary Live:** A three-day Estuary Live event was held on May 2-4, 2006 with contractual assistance from Marine Graphics. Education staff along with state and local partners covered topics including: submerged aquatic vegetation, horseshoe crabs, blue crabs, water circulation in estuaries, the Integrated Ocean Observing System, reptiles, snails, coastal geology, lionfish, and coastal habitats. Approximately 2,000 students participated in this event.
- **2007 Estuary Live:** Another three-day Estuary Live event was held on May 9-11, 2007. This event focused on the NOAA in the Carolinas partnerships and NOAA’s 200th anniversary. Topics included: history of NOAA, rip currents, cetacean and sea turtle

research, weather, oyster recycling, coastal fish habitats, estuarine ecology, and echinoderm biology. Initial participation numbers for the Estuary Live events were grossly overestimated. A more accurate estimate of the number of students that participated in our three-day Estuary Live event in May 2007 was 1,460 students, not 5,500 students as previously reported.

- **Staff time:** The number of staff hours required to prepare for the three-day event was estimated to be in excess of 500 hours (based on previous events). When we combined the cost of staff time with the filming expense and divided it by the actual number of participants, the cost per participant was very high (~\$8/student). Based on this information we decided to cancel the program until it could be further evaluated.
- **NA results:** The NCNERR education program conducted a teacher Needs Assessment in the spring of 2009. Only 21% of N.C. respondents thought that Estuary Live would be useful in the classroom. The remaining respondents indicated that they would prefer pre-taped video segments that could be used year-round.

External Funding

The education sector of NCNERR seeks to secure external funding to educate the public on estuarine related topics, financially assist with the production of educational materials, and to support the mission and goals of the education program. Listed below are highlights from this effort that have occurred during the time period of this review.

- **CICEET project funded:** NCNERR, in cooperation with the NOAA Center for Coastal Fisheries and Habitat Research in Beaufort, NC, was awarded a grant in February 2008 from the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) for a project titled: *Sustainable estuarine shoreline stabilization: research, education, and public policy in North Carolina*. The short-term (Phase I) objectives of this multidisciplinary project are to 1) conduct research to quantify ecosystem service tradeoffs as a consequence of shoreline stabilization, 2) design and install demonstration projects utilizing alternative shoreline stabilization approaches for research and education purposes on the Rachel Carson component, 3) develop an approach for evaluating ecological and socioeconomic costs and benefits of shoreline erosion and protection alternatives and 4) develop effective communication methods for exchanging information between scientists, regulatory agencies, the business community, politicians and other relevant stakeholders in regard to short-term and long-term cost-benefits of shoreline stabilization plans. This project is being conducted in all areas of the North Carolina coast (northern, central, and southern). At the end of this project, we will have the foundation to move towards a comprehensive analysis of the ecological and socioeconomic costs and benefits of various shoreline stabilization and erosion mitigation approaches. This project is a multi-institution collaboration including NCNERR, NOAA, UNCW, and UNC-IMS. Within NCNERR, the research and education sectors are working collaboratively as part of this project. Work completed thus far include hiring a research education technician,

completion of all year 1 sampling, formation of a stakeholder advisory panel, and completion of a waterfront land owner needs assessment.

- **Lowes Charitable and Educational Foundation Grant (\$500):** Lori Davis (Reserve Education Specialist), on behalf of the Carolina Estuarine Reserve Foundation, was recently awarded \$500 from Lowes Home Improvement Store to buy five picnic tables for outside gatherings and/or lunch and snack space for visiting groups at our new facility on Pivers Island in Beaufort.
 - **Youth Advocacy and Involvement Office Internship (\$3300):** NCNERR received a North Carolina State Government Intern for the summer of 2008 through a competitive proposal process. The Marine Science Education Intern assisted the Reserve Education staff with summer marine science camps, field trips and classroom activities.
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COASTAL TRAINING PROGRAM

Assessing Audience Needs & Coordinating Training in Response

The Coastal Training Program (CTP) is based upon determining audiences' knowledge and skills to relevant topics. The goal is to determine if there are information needs that the CTP can address to help decision-makers perform their duties better. The N.C. CTP routinely conducts these assessments to ensure programming is specific to the needs of North Carolina's coastal decision-makers. Assessments that were conducted during this evaluation period include:

- **A needs assessment** of Carteret County Planning Board members was conducted during the winter of 2005-2006.
- **Market analyses and needs assessments** was performed during the winter of 2005-2006 in conjunction with Research, Stewardship, and Education sectors to guide development of the Reserve's Management Plan.
- **Workshops offered**, as a direct result of the County Planning Board Assessment, include Stormwater Management & Sustainable Development and Barrier Island Development Issues.

Enhancing the N.C. Division of Coastal Management Through Training

The CTP routinely works with the other sections of the N.C. Division of Coastal Management to guide the development of education products and disseminate permitting and policy information to decision-makers. The CTP has assisted with the development of education plans for the entire Division as well as on specific topics such as estuarine shoreline stabilization. The CTP works with Division leadership to develop and deliver training for Division staff. The CTP routinely serves as a consultant on education-related initiatives, including public meeting structure, needs assessments, and training conducted by Division partners. Highlights of assistance include:

- **Workshops** have included those for marina operators and owners, marine contractors, local government staff, and Division staff.
- **Assisted with grant applications** submitted by the Division and other partners to the N.C. Clean Water Management Trust Fund; a project was funded in two phases at \$40K and \$496K.
- **Supported the Clean Marina Program** through funding and supervision of the program's temporary staff and Clean Marina workshop development and delivery.
- **Administered needs assessments** for the N.C. Coastal Resources Commission and Coastal Resources Advisory Council; the N.C. Division of Coastal Management's Local

Permit Officers; and all N.C. Division of Coastal Management staff. Data from the three surveys will be combined into one report to help guide the training needs of all associated with the Division.

Coordinating Fundamental Training for Decision-Makers

Fundamental trainings are targeted at realtors, land use planning board members, newly elected officials, and other decision-makers in need of basic information. Realtors receive continuing education credits from the N.C. Real Estate Commission for their participation. The CTP works closely with partners, such as N.C. Cooperative Extension, N.C. Sea Grant, and NOAA's Center for Coastal Fisheries and Habitat Research, to coordinate these trainings.

The CTP has put together a catalog of workshops, based on needs assessment data, that will offered on a regular basis. Topics for these workshops include:

- Grant writing,
- Wetland identification and delineation,
- Conservation planning,
- Septic system basics, and
- Stormwater management.

As new needs assessment data becomes available or as new coastal policies are put into place, the CTP will add to this catalog. Topics for future events may include barrier island & estuarine shoreline development and water issues including groundwater issues & rainwater harvesting.

Over the course of this evaluation period, 43 CTP training events have been offered, reaching 1,392 coastal decision-makers.

Collaborating with Regional NERRS Coastal Training Programs

The southeast region NERRs consist of the North Carolina, North Inlet-Winyah Bay, ACE Basin, Sapelo Island and GTM Reserves. Since 2004 the CTPs of these Reserves have collaborated on a variety of trainings, which was spearheaded by the first southeast regional meeting between CTP and Education Coordinators at the Sapelo Island NERR. Regional collaboration is challenging, since the Reserves are far from each other geographically and the decision-makers of each state have to abide by different local regulations. Activities during this period include:

- **Regional training** began with most of the Reserves hosting a green building workshop in their local areas.
- **Regional training efforts focus** on issues that are not affected by political boundaries, such as resources management. On December 3, 2009 these Reserves will host the 2nd

annual southeast Diamondback Terrapin workshop in Wilmington, NC. On February 1-3, these Reserves will host an invasive plant species control symposium in Seabrook Island, SC.

- **A model for regional collaboration** is emerging, where a large regional event is hosted in a central location (i.e., South Carolina) and then that topic is presented at the local level by each individual CTP at a later date.

STEWARDSHIP

SITE MANAGEMENT

The Stewardship Coordinator/Southern Sites Manager, Northern Sites Manager, and Rachel Carson Site Manager are responsible for protecting the integrity of the ecosystems and organisms of the NCNERR so that the primary missions of research and education can be fulfilled. Although management activities vary widely between the sites and across the seasons and require an ever-evolving set of skills, tools and strategies, the fundamental duties completed by the stewardship staff include: 1. Identifying, designating, monitoring and protecting critical habitats and species as needed; 2. Serving as the liaison between the NCNERR and the surrounding communities; 3. Enforcing existing policies and rules of use in cooperation with local enforcement agencies and developing additional policies as needed; 4. Identifying and coordinating restoration opportunities at the NCNERR components; 4. Enhancing visitor experience through interpretation and infrastructure; 5. Conducting education and outreach to the general public and partners in collaboration with education staff; and 6. Collaborating with research staff to conduct, promote, and assist with research, monitoring, and restoration projects.

- **Species of concern monitoring and protection** is ongoing at all components. In some cases, these efforts are performed in cooperation with partners such as N.C. Wildlife Resources Commission, N.C. State Parks or N.C. Audubon. Ground nesting shorebirds, particularly those of concern such as the American Oystercatcher (*Haematopus palliatus*) and Piping Plover (*Charadrius melodus*), are surveyed annually, with nesting areas protected and marked. Additional efforts have been made to include monitoring of reproductive success of these species when resources allow. Surveying for the presence of other species of concern, including Diamondback Terrapin (*Malaclemys terrapin*) and Sea Beach Amaranth (*Amaranthus pumilis*), is also completed as resources allow.
- **Sea turtle nesting monitoring** at Masonboro Island was reinstated through a contract with a UNCW researcher. Prior to the reestablishment of this contract, which has been renewed each season since 2006, this stretch of beach was the only area on the N.C. coast not being monitored for sea turtle nesting activity. This contract has yielded valuable data about the Loggerhead turtle in the northern limits of its nesting range. More recently, testing of predation prevention strategies have been added to the contract after preliminary data revealed a near 50% predation impact to nests. As predation of sea turtle nests is a regional resource management challenge, the results will be useful in informing management strategies at NCNERR components, as well as on other protected lands.
- **Visitor use** has increased with increasing coastal populations. The associated potential threat to the resources of the NCNERR has led to a multi-step effort to understand the public's knowledge of the NCNERR and its mission, as well as to better understand the public's use of the NCNERR components. A visitor use survey, completed through a contract with UNCW researchers, revealed the need for additional visitor use education. A logo revision, development and installation of additional signage, and updated presentations and materials are components of this effort.

- **Infrastructure and access improvements** designed to enhance visitor experience and provide additional educational opportunities include the completion of a raised boardwalk at the Rachel Carson component, and installation of an osprey pole at Currituck Banks and interpretive signs along the Currituck Banks boardwalk. A complete reworking of the shared public facilities, including parking and boat launching areas adjacent to the Zeke's Island component is underway with the design phase completed and partial funding secured. This project is being undertaken in cooperation with a regional land managers group which includes several other state and federal partners whose properties are adjacent to the Reserve property.
- **Understanding of the NCNERR ecosystems** has been increased through habitat mapping, which site managers worked collaboratively with the GIS Specialist to complete. In addition, site managers continue to document the presence of species of interest noted in the course of routine monitoring and have begun to develop site specific comprehensive species lists. When possible, collaborative efforts with the U.S. Fish and Wildlife Service, N.C. Botanical Garden and N.C. Vegetation Survey are pursued to increase the effectiveness of these efforts.
- **Marine debris and cleanup efforts** are ongoing at all components. Often completed with partners such as Surfrider, the N.C. Coastal Land Trust, the National Charity League or Boy Scouts of America, these periodic cleanups help to maintain the natural character of the NCNERR and protect its resources. Additional efforts have been undertaken at the Rachel Carson component where a marine debris research project was conducted to document the quantity and makeup of debris on the component, determine its origin and decrease its impact. This work also sought to understand the public perception of marine debris on the Reserve. At the Masonboro Island component, a multi-year trend of extensive and sometimes inappropriate public use on the July Fourth holiday has resulted in significant quantities of trash being left by visitors. Public education campaigns designed to increase public awareness of the purpose of the Reserve and the rules of use for visitors, as well as to reduce litter have been underway. These efforts were completed during the Labor Day holidays during the 2008 and 2009 seasons, garnering tremendous public support and volunteer participation.
- **Restoration projects** undertaken at NCNERR components include a Phragmites (*Phragmites australis*) effort at the Currituck Banks component, an oyster restoration project at the Masonboro Island component which was completed by a partner organization and is being monitored by NCNERR staff, and a pilot project to restore habitat for the Crystal Skipper butterfly (*Atrytonopsis loammi*) by planting little bluestem (*Schizachyrium scoparium*) at the Rachel Carson component.
- **Invasive and feral species** are managed at all NCNERR components. In most cases, management of these species is ongoing, with complete eradication being impossible. Species requiring management are feral hogs, feral horses and Phragmites at Currituck Banks, tamarisk (*Tamarisk sp.*) and feral horses at Rachel Carson, Beach Vitex (*Vitex rotundifolia*) and red foxes at Masonboro Island, and red foxes at Zeke's Island. A variety of methods and levels of effort are used to manage the invasive and feral species depending on the magnitude of the problem and available resources. Management techniques to address feral hogs include hunting. Feral horses at Currituck are managed by the Corolla Wild Horse Fund with input

from the Reserve. At Rachel Carson, a complete census of the feral horse herd was completed and contraceptive treatment is used to manage the population. Invasive vegetation is managed with mapping, herbicide treatment, and manual removal, as appropriate. Partnership organizations are frequently involved with these efforts to maximize effectiveness, such as the treatment of Beach Vitex on Masonboro which is completed in conjunction with the North Carolina Beach Vitex Task Force.

VOLUNTEER PROGRAM

The volunteer program represents an important opportunity to engage the public, as well as increasing the effectiveness of the stewardship program. The NCNERR has always benefitted from volunteer service, but recent efforts have sought to formalize the volunteer program, including the development of specific volunteer roles and higher levels of training for volunteers, particularly those serving in education and monitoring roles. These efforts to further develop the Reserve's volunteer program are a result of Reserve staff's recognition that it is essential that volunteer efforts be effective in order that there is real benefit realized by the Reserve through the involvement of volunteers, and that there is a need to provide a high quality volunteer experience so that volunteers stay actively engaged by their volunteer efforts. Examples of activities volunteers at the components of the Reserve include: trained volunteers conducting or assisting with public field trips at Rachel Carson and Currituck Banks; volunteers assisting with the feral horse management program at Rachel Carson; and volunteers assisting with sea turtle monitoring, terrapin surveys and shorebird monitoring activities at Masonboro Island. In addition to these activities, a pilot volunteer monitor program has been developed at the Masonboro Island component to provide the site manager with additional regular reports on the condition of the reserve.

LAND ACQUISITION

The Reserve acquired one of the remaining privately-held parcels within the Masonboro Island component in 2008, 23.3 acres of ocean beach, dune, and supratidal shrub thicket, advancing a high priority acquisition goal.

COLLABORATION & COORDINATION

To maximize resources and increase efficiency, it is important to develop and maintain effective partnerships. Coordination of the various participating entities remains a significant and essential part of the duties of the NCNERR site managers.

- Site managers participate in **the Cape Fear Arch, Onslow Bight, and northeast regional conservation collaboratives**. These organizations provide managers with the opportunity to approach conservation issues at the landscape level, as well as allowing for maximization of effectiveness of efforts and development of new partnerships and strengthening of existing partnerships through mutual support of each other's programs. On a more local level, site

managers participate in other collaborations such as the Corolla Wild Horse Fund and the Federal Point managers group.

- **Partnerships** continue to be important in accomplishing regular ongoing stewardship tasks, as well as taking on larger scale projects. Site managers work in partnership with numerous organizations and agencies such as N.C. Wildlife Resources Commission, N.C. Coastal Federation, University of North Carolina at Wilmington, U.S. Fish and Wildlife Service, The Nature Conservancy, and Audubon Society. Local municipalities continue to be strong allies and excellent partners, as well.
- **Law enforcement** at the NCNERR components is accomplished primarily through close communication and strong working relationships with various law enforcement agencies. Although needs vary from site to site, these agencies generally include local sheriff's departments, local municipal police, the N.C. Division of Marine Fisheries, the N.C. Wildlife Resources Commission, and the U.S. Coast Guard. Site managers interact with these entities on a regular or as needed basis to ensure effective enforcement of State and local laws.

GEOGRAPHIC INFORMATION SYSTEMS

The NCNERR GIS program provides geospatial information, products and services to enhance Reserve research, stewardship, education, management and stakeholder activities. The GIS Specialist is now directly under the leadership of the Reserve Manager, rather than the Research Coordinator. This promotes cross-sector interaction and GIS contributions have been increasingly used by Reserve staff during this evaluation period. Funding for the Reserve GIS Specialist is provided by the section 306 annual award from NOAA.

RESERVE SUPPORT

A wide variety of hardcopy and electronic data, maps, and graphics are continuously prepared in response to the dynamic geographic information needs of the Reserve. Representative examples are provided below.

- **Reserve site characteristics** have been depicted on maps prepared for specific applications such as the new Coastal Reserve Web site, updated site brochures, hiking and kayak guides, multiple maps for the Reserve site profile and management plan; hunting guides for the Currituck Banks component, boat maps and staffing support for the Rachel Carson boardwalk dedication.
- **Distribution and field survey results** of species of interest have been plotted to support wildlife research and site management, including the following: turtles at Masonboro Island, long leaf pine and feral horse habitats at Currituck Banks, tamarisk trees at Rachel Carson, oyster restoration sites at Masonboro Island for a project conducted by the N.C. Division of Marine Fisheries and the N.C. Coastal Federation, and maps and digital geospatial data of habitats within the Reserve boundaries to support research by a consortium of researchers from the Hollings Marine Lab in Charleston, SC.
- **Presentation material** is often provided to help promote group discussions. Examples are: large format image posters of selected communities that were used for CTP Coastal Community Planning workshops, PowerPoint map presentation of the Ft. Fisher area adjacent to the Zeke's Island component for use as a tool for N.C. Aquarium at Ft. Fisher staff to evaluate potential locations and impacts of a public fishing pier, pier house and parking area, a poster of shorebird use areas at Masonboro Island for a display at the Wrightsville Beach Museum, a session on "Mapping through the Ages" for the interactive internet production of 2007 Estuary Live and a PowerPoint presentation to Reserve staff to review GIS concepts and to stimulate fresh ideas for GIS contributions to Reserve activities.

GIS PROJECTS

GIS tools have been applied to provide more in-depth information about the Reserve components and their watersheds. Projects include:

- **Classification of NCNERR intertidal and upland habitats** was completed for all four Reserve components. The NERRS Classification Scheme was implemented following field

data collection and digital image analysis protocols that were developed by NCNERR during a pilot project conducted for the Zeke's Island component. Methods include production and field verification of preliminary, revised, and final versions of the habitat information. Habitat classification methods, resulting maps, area statistics and brief descriptions of the habitat sub-classes are presented in the NCNERR Site Profile. Methods were presented in a poster titled "Practical Habitat Classification of the NCNERR" at the 2006 North Carolina GIS Conference. Results were described in a poster titled "Classification of Habitats of the NCNERR to Inform Coastal Management" for the Estuarine Research Federation 2007 Conference. An example application of the digital habitat data was to determine acreages of estuarine intertidal wetland vs. the total of supratidal and upland habitats for the Rachel Carson component. The numbers and associated map were requested for a proposal to study the impacts of feral horse grazing at the site.

- **Land Cover Status and Changes** were evaluated for each of the watersheds that encompass the NCNERR components. The 1991 and 1997 land cover data were obtained for coastal North Carolina from NOAA's Coastal Services Center's Coastal Change Analysis Program (C-CAP). Data were extracted for each watershed as defined by United States Geologic Survey (USGS) hydrologic cataloging units. Maps, area statistics and a brief analysis of land cover patterns for 1991, 1997 and the difference between the two years was compiled for each watershed and included in the NCNERR site profile. The 1996 – 2001 C-CAP data has been obtained from NOAA's Coastal Services Center. These data are currently being analyzed following similar methods and will be compared to the 1991 – 1997 results.
- **Submerged Aquatic Vegetation (SAV)** was mapped during the summers of 2006 and 2007 for Rachel Carson and 2007 for Masonboro Island. Systematic field surveys, including collection of geo-coordinates and environmental parameters, were conducted for the estuarine areas using protocols adapted from North Carolina Inter-agency SAV workgroup ground truth methods. A large SAV bed within Middle Marsh and multiple smaller beds around Carrot Island were documented for the Rachel Carson component. No SAV was found at Masonboro Island. The environmental data collected at Masonboro may be compared to those gathered from existing SAV beds at other locations to help clarify habitat conditions that support SAV recruitment and growth. Maps were prepared for Rachel Carson with the identified SAV beds color coded by SAV species type present, divided into 8 size classes (<10m² to >50m²). These activities support implementation of the N.C. Coastal Habitat Protection Plan. The SAV methods and results were presented in a poster at the NERRA/NERRS Annual Meeting in October 2006.
- ***Phragmites* stands at the Currituck Banks component** were mapped from GPS data and multi-year aerial imagery to guide invasive species control efforts. The extent of a major stand was determined from 1980 – 2007 to illustrate its rapid expansion over time. Four smaller, yet new, stands of *Phragmites* were delineated using 2007 aerial photography.
- **Shoreline extent at the eastern end of East Carrot Island** (Rachel Carson component) was delineated from digital aerial photography for 1994, 1998, 2000 and 2004. Nine transects were drawn and measured to illustrate the movement of the shoreline during the 10 year period.

Keeping In Touch with Technology

A component of a successful GIS program is to keep up with new tools that become available due to continuously evolving technologies. Related efforts during this period include:

- **GIS software was upgraded from ArcView 3.2 to ArcGIS 9** through the State of North Carolina and UNCW enterprise licenses with ESRI. The software has been installed on multiple Reserve computers and is used by GIS and stewardship staff.
- **Training opportunities** that the Reserve GIS Specialist attended include Mastering ArcGIS with tuition sponsored by NC DENR, Coastal Inundation Mapping hosted by the NCNERR CTP in partnership with NOAA's Coastal Services Center, and Web-Ex instruction on the NOAA Coastal Services Center's Habitat Priority Planner.
- **Two Trimble 2005GEO XM mapping grade GPS units** were acquired, as allowed through the State purchasing system. Brief introductory training for Reserve staff on how to use the units was provided by DCM GIS staff.
- **Coastal-Maritime Geographic Information Science workshop** was organized by East Carolina University's (ECU) Renaissance Computing Institute and attended at ECU's invitation by the Reserve GIS Specialist. Information was presented on a variety of advanced geographic characterization tools and projects. The NCNERR was also included in a grant recently submitted by ECU for development of advanced geo-visualization tools for sea level rise. If awarded, NCNERR GIS staff will evaluate GIS tools as they are developed and will host workshops for less-technical SLR geo-visualization products.