RESPONSE TO THE NATIONAL ACADEMIES DATA CALL

REVIEW OF NOAA'S EDUCATION PROGRAMS

Request for Evaluation Reports and Documents

The National Estuarine Research Reserve System Evaluation & Performance Measurement Framework

Measuring the Impact of Its Education Programs

Foreword

NOAA's National Estuarine Research Reserve System (NERRS) has been operating, in the last two years, with an approximate budget of $16.4 million. Research Reserves protect over 1.3 million acres of coastal land and waters from Alaska to Puerto Rico, and are located in 21 of the 35 U.S coastal states and territories.

Since its inception, NERRS has focused on developing and strengthening its education program. Evaluation of all of its programs has been a priority, but limited in its actual implementation. Research reserves have used different methods and tools to evaluate the effectiveness of their programs. With the development of system-wide programs, the use of performance measures was introduced and have since been continuously strengthened and improved.

We believe that the NERRS has done substantive progress in setting different strategies to be able to measure performance and assess the effectiveness of the NERRS education portfolio. This path starts with defining clear measurable goals and objectives that can be adopted by the vast majority of Research reserves. In the NERRS reaching such a level of agreement is a major accomplishment, especially because of the incredibly participatory process it has set for itself. In that process budgetary and programmatic decisions are reviewed and vetted with the whole system. In addition, this path includes a strong commitment to a research oriented approach which starts with a clear understanding of the target audience for individual educational programs. The use of market analysis and needs assessments are a key element to this research oriented approach, and step one in establishing a strong evaluation system for the education programs. We wish to highlight this point especially because the NERRS have fully embraced this approach and have translated this into the design and implementation of all of its education programs.

In this document, we provide a summary of the different strategies the NERRS employs to monitor progress towards measuring the results of our programs, and the strategies it uses to measure impact. All the documents employed to generate this summary are available for the National Academies to review. Selected key documents are being submitted as part of this data call. A list of all the existing documents is provided in the Appendix section and a note has been added as to whether or not they can be accessed online. In any case, we are more than happy to provide printed copies of any of these materials, if the committee requests it.

We are pleased to support and provide any necessary documents to the National Academies for the evaluation of NOAA's education programs.

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Introduction to the National Estuarine Research Reserve System

ABOUT NOAA'S NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

The National Estuarine Research Reserves System is a network of 27 areas representing different biogeographic regions of the United States that are protected for long-term research, monitoring, education and coastal stewardship in support of coastal management. Established by the Coastal Zone Management Act of 1972, as amended, the reserve system is a partnership program between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states.

The National Estuarine Research Reserve System is comprised of 27 research reserves in 21 of the 35 U.S coastal states and territories. Reserves protect over 1.3 million acres of coastal land and waters from Alaska to Puerto

NOAA coordinates the design and implementation of system-wide programs in research, monitoring, training, and education. In addition, NOAA provides funding (70%), national guidance, and technical assistance to individual reserves. State partners provide 30% matching funds for NOAA monies dedicated to operating reserves and facilities construction, and 50% match for land acquisition. Sites are managed by a lead state agency or university in collaboration with local partners.

Through integrated research and education, each reserve works with local communities and regional groups to develop strategies to address natural resource management issues, such as non-point source pollution, habitat restoration, and invasive species. Education is an important priority for the NERRS. Reserves provide adult audiences with training on estuarine issues of concern in their local communities and offer field classes for K-12 students and support teachers through professional development programs in coastal and estuarine education. Reserves also provide long-term water quality monitoring as well as opportunities for both scientists and graduate students to conduct research in a "living laboratory."

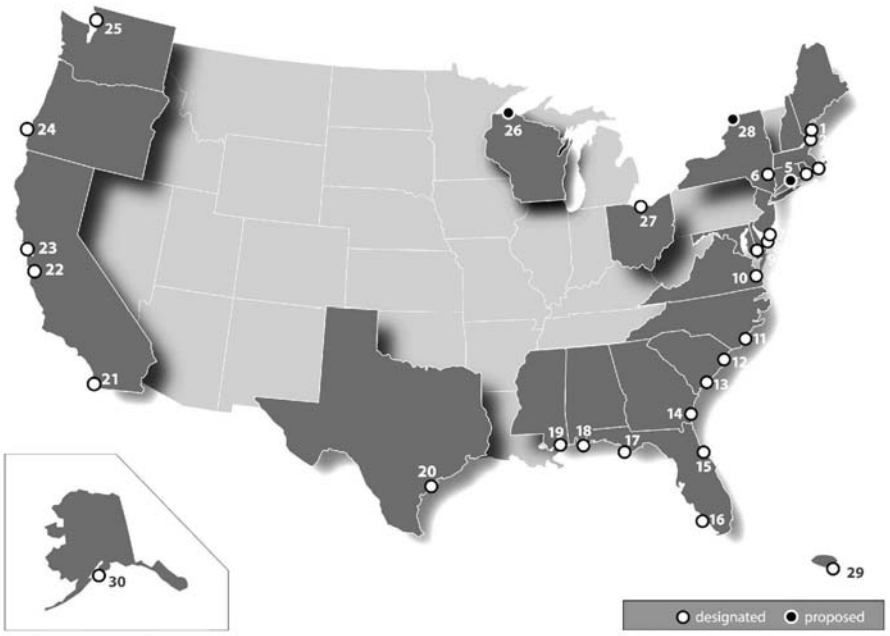
Each of the 27 research reserves work with a staff comprised of the following: Manager, Education Coordinator, Coastal Training Program Coordinator, Research Coordinator, Stewardship Coordinator, GIS Specialist, and SWMP Technician. Each Education Coordinator works with other education specialists to provide formal, informal and outreach related activities. Coastal Training Program Coordinators provide training opportunities for a variety of coastal-decision maker audiences. Many reserves have volunteer programs and internships to assist with education activities.

National Estuarine Research Reserve System Administrative Framework

The national office, the Estuarine Reserves Division (ERD) of the Office of Ocean and Coastal Resource Management (OCRM) administers the reserve system. The Division establishes standards for designating and operating reserves, provides support for reserve operations and system-wide programming, undertakes projects that benefit the reserve system, and integrates information from individual reserves to support decision-making at the national level. ERD also coordinates with other federal agencies, national education, scientific and environmental organizations, and interest groups to advance the education goals and ocean and coastal literacy. ERD currently provides support for four system-wide programs: the System-Wide Monitoring Program, the Graduate Research Fellowship Program, K-12 Estuarine Education Program and the Coastal Training Program. A staff person from ERD is fully dedicated to support these and site level programs. In the case of education the National Education Coordinator is represented by Atziri Ibanez. ERD also provides support for reserve initiatives on restoration science, invasive species, K-12 education, and reserve specific research, monitoring, education and resource stewardship initiatives and programs.

Each reserve is an active member of the local and regional education community and a representative of the state and NOAA stewardship community. Through this network of placed based areas around the country, the reserve system takes a local approach in advancing estuarine education and generating meaningful experiences for all kinds

The National Estuarine Research Reserve System (NERRS)



1. Wells, Maine
2. Great Bay, New Hampshire
3. Waquoit Bay, Massachusetts
4. Narragansett Bay, Rhode Island
5. Connecticut*
6. Hudson River, New York
7. Jacques Cousteau, New Jersey
8. Delaware
9. Chesapeake Bay, Maryland
10. Chesapeake Bay, Virginia
11. North Carolina
12. North Inlet-Winyah Bay, South Carolina
13. ACE Basin, South Carolina
14. Sapelo Island, Georgia
15. Guana Tolomato Matanzas, Florida
16. Rookery Bay, Florida
17. Apalachicola, Florida
18. Weeks Bay, Alabama
19. Grand Bay, Mississippi
20. Mission-Aransas, Texas
21. Tijuana River, California
22. Elkhorn Slough, California
23. San Francisco Bay, California
24. South Slough, Oregon
25. Padilla Bay, Washington
26. Wisconsin*
27. Old Woman Creek, Ohio
28. St. Lawrence River, New York*
29. Jobos Bay, Puerto Rico
30. Kachemak Bay, Alaska

* Proposed Reserve

of people interested in protecting and restoring estuaries. Working at both the site level and as a national system, reserves have a greater impact than could be achieved through community efforts alone.

BRIEF INTRODUCTION TO THE NERRS EDUCATION PROGRAMS

The reserve system provides a vehicle to increase understanding and awareness of estuarine systems and improve decision-making among key audiences to promote stewardship of the nation's coastal resources. Education and interpretation in the reserves incorporates a range of programs and methodologies that are systematically tailored to key audiences around priority coastal resource issues and incorporate science based content. Reserve staff members work with local communities and regional groups to address coastal resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education programs, the reserves help communities develop strategies to deal successfully with these coastal resource issues.

Formal and non-formal education and training programs in the NERRS target K-12 students, teachers, university and college students and faculty, as well as coastal decision maker audiences such as environmental groups, professionals involved in coastal resource management, municipal and county zoning boards, planners, elected officials, landscapers, eco-tour operators and professional associations. Since 2006, 400 evaluated CTP training events were held throughout the NERRS and a total of 13,434 coastal decision-makers were reached during these events. In addition, 80,000 teachers and students have participated in a variety of education programs offered by individual research reserves, and 25,315 individuals participated in the 2006 national EstuaryLive program via the Internet.

K-12 and professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involves both on-site and in-school follow-up activity. Reserve education activities are guided by national plans that identify goals,

priorities, and implementation strategies for these programs. Education and training programs, interpretive exhibits and community outreach programs integrate elements of NERRS science, research and monitoring activities and ensure a systematic, multi-faceted, and locally focused approach to fostering stewardship.

Reserve Education Programs can be categorized in three areas:

- **NERRS System-wide Program**: A program that is implemented in a minimum of 75% of the reserves utilizing a similar approach or protocols to meet agreed upon goals and objectives. Program progress and impact are reported by individual reserves and are aggregated and synthesized at the national level.
- **NERRS National Program**: A program implemented by a subset of reserves, or any other entity, on behalf of the NERRS. National programs use expertise, products, and material from reserves across the system. Program progress and impact is monitored and reported on a national scale.
- **NERRS Local Programs:** A program implemented by an individual reserve site. At the local level, the NERRS Education Program targets a culturally diverse audience of educators and students, coastal decision-makers, environmental professionals, resource users and the general public.

Following is a brief description of several of the education programs offered by the NERRS:

- **Training for Coastal Decision-Makers:** Education and training is provided for professionals who make decisions about coastal resources on a regular basis such as planners, conservation council members, resource managers and community leaders. The Coastal Training Program (CTP) is a system-wide program offered in almost all 27 reserves and provides up-to-date scientific information and skill-building opportunities to individuals who are responsible for making decisions that affect coastal resources. The common purpose is to ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities.
- **K-12 Education Programs:** Reserves also provide *K-12 education programs*, ranging from hands-on field experiences for students to professional teacher development opportunities. A K-12 Estuarine Education Program (KEEP) is a system-wide program that has just recently been designed by all Education Coordinators, but has not yet been implemented because of a lack of funds. An Estuaries 101 Curriculum has been designed for use and adoption by all Education Coordinators. Reserve staff also work with local schools through teacher training and consulting to implement curriculum on coastal topics.
- **EstuaryLive Program:** The EstuaryLive Program is a free interactive field trip over the internet where students learn about estuaries and have their questions answered over the Internet. This program, is considered a national program, and has been implemented since 2001 by a variety of individual research reserves coordinated by ERD. The program has established an evaluation strategy which is implemented by an independent evaluator working in close collaboration with participating research reserves.
- **Community Education Programs:** *Community education & outreach* is another priority for the NERRS. Community education programs foster behavioral change to promote resource conservation and to support the mission of the Reserve System. These programs work with audiences whose choices directly impact the integrity of our estuaries and their associated watersheds. Community courses are offered on topics ranging from groundwater dynamics to green home practices, climate change and ecological gardening techniques.
- **Public Outreach:** Twenty three reserves have an Environmental Learning and/or Interpretation Center which, in several cases, include research laboratories, classrooms, an auditorium and a visitor center. These Learning or Interpretation Centers conduct activities to disseminate estuarine sciences information to the public and engage local communities and volunteers. These include regularly scheduled *public programs and special events,* such as presentations and lectures, seminars and workshops, kayak, bird-watching trips, among many other type of activities. Different environmental education programs are provided to libraries, schools, service clubs and a variety of civic organizations.
- **Fellowships Opportunities:** The Graduate Research Fellowship provides master's degree students and Ph.D. candidates with an opportunity to conduct research of local and national significance that focuses on enhancing coastal zone management. Fellows conduct their research within a NERRS and gain hands-on experience by participating in their host reserve's research and monitoring programs. Fellows receive a stipend of $20,000 per year, but funds are available on a competitive basis. The Graduate Research Fellowship Program began in 1997,

since that time 293 fellows have received funding to perform master's or doctoral research in one or more of 27 National Estuarine Research Reserves around the country.

NERRS EDUCATION PROGRAM MANDATES

The Coastal Zone Management Act (CZMA)

Through passage of the Coastal Zone Management Act (CZMA) in 1972, Congress declared as national policy to "preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone for this and future generations." The CZMA established a framework for a federal and state coastal management partnership to balance economic growth with coastal protection. The National Coastal Management Program (NCMP) and the National Estuarine Research Reserve System (NERRS) work together to achieve the goals of the CZMA.

As stated in the NERRS regulations, 15 C.F.R. Part 921.1(a), the National Estuarine Research Reserve System mission is:

"The establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and estuarine types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education, and stewardship."

The enabling legislation for the National Estuarine Research Reserve System, the Coastal Zone Management Act (CZMA), denotes specific educational mandates. The legislation states that one of the purposes of the NERRS is:

"[t]o enhance public awareness and understanding of estuarine areas and to provide suitable opportunities for public education and interpretation". (Summarized from 15 CFR § 921.1)

In addition:

The Reserve Management Plan should include an education/interpretive education plan. (Summarized from 15 CFR §921.13)

NOAA may determine a reserve is non-adherent if the reserve does not have the staff necessary for education/interpretation, or does not adequately implement the education/interpretation plan. (Summarized from 15 CFR §921.40)

2007-2012 Strategic Plan for the Office of Ocean and Coastal and Resource Management (OCRM)

NOAA's Office of Ocean and Coastal Resource Management (OCRM) provides national leadership, strategic direction, and assistance to state and territory coastal management programs, estuarine research reserves, and other U.S. and international partners to sustain healthy coastal and ocean ecosystems.

The 2007-2012 Strategic Plan for OCRM, includes a goal and specific objectives for education:

Goal 3: Involved Coastal Citizens

Improve people's ability and motivation to take actions that benefit coastal communities and ecosystems.

Objectives:

3.1. Improve coastal and ocean literacy and motivate individuals and groups to take actions that benefit coastal communities and ecosystems.

3.2 Strengthen the scientific basis of decision-making on coastal and ocean resources through informed public involvement and outreach and professional training programs.

2005-2010 NERRS Strategic Plan

NOAA's Estuarine Reserves Division and reserve staff has conducted a multi-year action planning process on an annual basis since 1996. The resulting five-year action plan provides an overall vision and direction for the reserve system.

The National Estuarine Research Reserve System's 2005-2010 Strategic Plan articulates how the strengths of the reserve system will be applied to address the major vision of having " healthy estuaries and coastal watersheds where coastal communities and ecosystems thrive". The goals, objectives and strategies outlined in this strategic plan will guide and support the NERRS in its nation-wide efforts to improve coastal management, advance estuarine research, and educate current and future generations of coastal stewards. Specific educational goals and strategies were established to guide the progress of the Education and Outreach program.

Goal 3: Enhance people's ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Objectives:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.
2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.
3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

NERRS Management Plans

At the reserve level specific educational program offerings are further directed by the Management Plan for that site. The Reserve management plan must include reserve goals and objectives, an administrative plan, a research plan, an education/interpretive plan, a public access plan, a construction plan, an acquisition plan, and memorandum of understanding (MOU) between the state and NOAA. The management plan must be revised every five years. (Summarized from 15 CFR §921.13 and §921.33)

These management plans, not only describe specific site level educational programs that will be implemented, they also describe which system-wide educational program they will plan to participate in. Participation in system-wide programs is voluntary, but sites that which to implement them need to commit staff people to their implementation and this needs to be reflected in the management plan.

Over the past three years, the Estuarine Reserves Division has worked closely with all Research reserves to ensure that all the management plans are completed and/or updated. A detailed scheduled is currently being followed for the revision of these managements plan and final approval. A copy of this schedule can be provided upon request.

While a detailed performance measurement system has been set in place for all research reserves (see section titled NERRS Performance Measurement Framework), research reserves are not required to outline, in the management plans, how they will collect and/or review any of the performance measures they submit to the Estuarine Reserves Division. In addition, there is currently no requirement for research reserves to outline an evaluation strategy for their education programs. Even though it is not a requirement, many research reserves do include mention of the need to evaluate their education programs and include strategies or action items that will guide them into taking on this task. And again, if a reserve site is participating in a system-wide program, it is automatically assumed that they will comply with all the requirements as established by that program.

Figure 1. Reserve Designation Dates and Acreage

Reserve	State	Date Designated	Acres	Education/Interpretation or Visitor Center	Education Coordinator	CTP Coordinator
Sapelo Island	Georgia	1976	6,110	Yes	Yes	Yes
Rookery Bay	Florida	1978	110,000	Yes	Yes	Yes
Apalachicola Bay	Florida	1979	246,000	Yes	Yes	Yes
Elkhorn Slough	California	1979	1,400	Yes	Yes	Yes
Padilla Bay	Washington	1980	11,000	Yes	Yes	Yes
Narragansett Bay	Rhode Island	1980	4,259	Yes	Yes	Yes
Old Woman Creek	Ohio	1980	571	Yes	No	Yes
Jobos Bay	Puerto Rico	1981	2,883	Yes	Yes	Yes
Tijuana River	California	1982	2,513	Yes	Yes	Yes
Hudson River (4 components)	New York	1982	4,838	Yes	Yes	Yes
North Carolina (4 components)	North Carolina	1985, 1991	10,000	No	Yes	Yes
Wells	Maine	1986	2,250	Yes	Yes	Yes
Chesapeake Bay MD (3 components)	Maryland	1985, 1990	4,820	Yes	Yes	Yes
Weeks Bay	Alabama	1986	6,525	Yes	Yes	Yes
Waquoit Bay	Massachusetts	1988	2780	Yes	Yes	Yes
Great Bay	New Hampshire	1989	10,235	Yes	Yes	Yes
Chesapeake Bay VA (4 components)	Virginia	1991	4,435	Yes	Yes	Yes
Ace Basin	South Carolina	1992	134,710	No	Yes	Yes
N. Inlet Winyah Bay	South Carolina	1992	12,327	Yes	Yes	Yes
Delaware	Delaware	1993	4,930	Yes	Yes	No
Jacques Cousteau	New Jersey	1998	114,665	Yes	Yes	Yes
Kachemak Bay	Alaska	1999	365,000	Yes	Yes	Yes

Reserve	State	Date Designated	Acres	Education/Interpretation or Visitor Center	Education Coordinator	CTP Coordinator
Grand Bay	Mississippi	1999	18,400	No (will open Fall 08)	Yes	Yes
GTM	Florida	1999	55,000	Yes	Yes	Yes
San Francisco Bay	California	2003	3,710	No	Yes	Yes
Mission-Aransas	Texas	2006	185,708	No	Yes	No

Acreages are based on current, federally approved management plans.

The NERRS Strategy for Measuring Progress & Moving Forward

OVERVIEW

To measure progress toward its goals and objectives, inform adjustments to its strategic direction over time, and measure overall impact of the education program, NERRS employs several evaluation tools:

- **Performance Measures** - Performance measures allow NERRS to track how well a program is achieving its objectives. The reserve system has been using the terms indicator and measure interchangeably, and they have the same meaning in this document. Performance measures can gauge progress on any aspect of programming: efficiency of fiscal management (cost to operate a building), quality of programs (teacher demand for products or quality of SWMP data), magnitude or quantity (number of EstuaryLive viewers or number of research projects implemented in the NERRS), and impact of NERRS activities (improved understanding, application of knowledge, changes in the resource or in a policy). NERRS is using performance measures as one way to evaluate its progress toward strategic goals and to inform revisions in strategic direction and program priorities. A full performance measurement system has been set in place since 2006.
- **Site-based Evaluations** - As required by Federal regulation, 15 C.F.R. Part 921.40, OCRM periodically evaluates reserves for compliance with Federal requirements and with the individual reserve's Federally-approved management plan, and to ensure effective program implementation. These evaluations help OCRM identify emerging management issues and needs, adjust program priorities, leverage resources, and build partnerships.
- **Education Sector Evaluations and Performance Measurement System** – NERRS system-wide programs provide common activities and therefore common indicators for tracking performance. Individual system-wide programs have specific approaches for monitoring the implementation and progress made in the program, and/or to evaluate its impact. The Coastal Training Program follows a robust Performance Measurement System. The K-12 Estuarine Education Program is currently developing a full evaluation strategy to measure increased understanding in estuarine literacy. The EstuaryLive program, which is a national program, has implemented a more formal evaluation strategy since 2004. Finally, individual reserve site educational programs have adopted various methods and tools to evaluate their programs.
- **Program Reviews** - NERRS periodically uses external and/or internal program reviews to assess program effectiveness and to make recommendations for future direction and priorities. The education sector in the NERRS underwent a program review in 2002. Results of this evaluation can be found in a document titled "Inventory and Assessment of K-12 and Professional Teacher Development Programs in NOAA's National Estuarine Research Reserve System (2003)". The Coastal Training Program will undergo an external review which will presumably be completed in January 2009. These reviews help programs ensure that they are moving toward their goals, as well as supporting NERRS and NOAA strategic priorities.

These evaluation mechanisms provide NERRS with valuable feedback from our partners on how we are progressing toward our goals and objectives and impact of our programs. Information obtained from these evaluation tools inform future updates of the NERRS strategic plan, provide direction and help redefine priorities.

NERRS PERFORMANCE MEASUREMENT SYSTEM

The National Estuarine Research Reserve System is collecting performance measures to communicate what we do to key audiences, to inform planning and budgeting, and to assess how effective we are in working toward our mission. The data can be used to identify and establish important trends that could influence NERRS policy and strategic planning. The Estuarine Reserve Division must report performance data to several groups within NOAA each year, and having reliable data from sites is an important part of this effort.

The NERRS Strategic Plan was updated in 2005 and the measures recommended by a performance measure workgroup, formed by several individuals representing the different sectors form the NERRS, were evaluated against

the new plan at the 2005 Annual Meeting. Draft measures were taken to sector meetings in 2006 and discussed in detail. Only measures that sectors were comfortable with were submitted for manager approval. Estuarine Reserve Division staff worked with sectors to help define the measures and appropriate collection methods. This performance measurement system was rolled out to all research reserves starting in FY06.

NERRS SITE-BASED EVALUATIONS

NOAA is required by §312 of the Coastal Zone Management Act (CZMA), as amended, to conduct evaluations of NERRs (15 CFR §923.132 and §921.40). These evaluations, conducted roughly every three years, provide NOAA and its state partners an opportunity to highlight and share program accomplishments, as well as identify challenges and opportunities for improvement in the programs. NOAA's Office of Ocean and Coastal Resource Management staff conduct a detailed analysis of documents and performance reports, site visits, information assessments, report preparations, and follow-ups. The process also includes the close participation of state and local stakeholders and other interested parties. The document review and interviews with program staff and stakeholders are aimed at answering a series of broad questions.

The evaluation results in findings regarding how well a state has (1) met NERR system goals, (2) implemented the Federally-approved NERR management plan, and (3) adhered to the terms of its financial assistance awards. Findings are used by the Office of Ocean and Coastal Resource Management (OCRM) to make decisions relevant to a current award or to negotiate future financial assistance awards. The evaluation findings include a description of the NERR under review and a synopsis of the significant ongoing activities and accomplishments since the previous evaluation. The recommendations of the evaluation findings identify areas in need of improvement. Based on the findings and the nature of the recommendations, a state can be found adhering, not fully adhering, or not adhering to its NERR management plan.

NERRS EDUCATION EVALUATION PHILOSOPHICAL FRAMEWORK

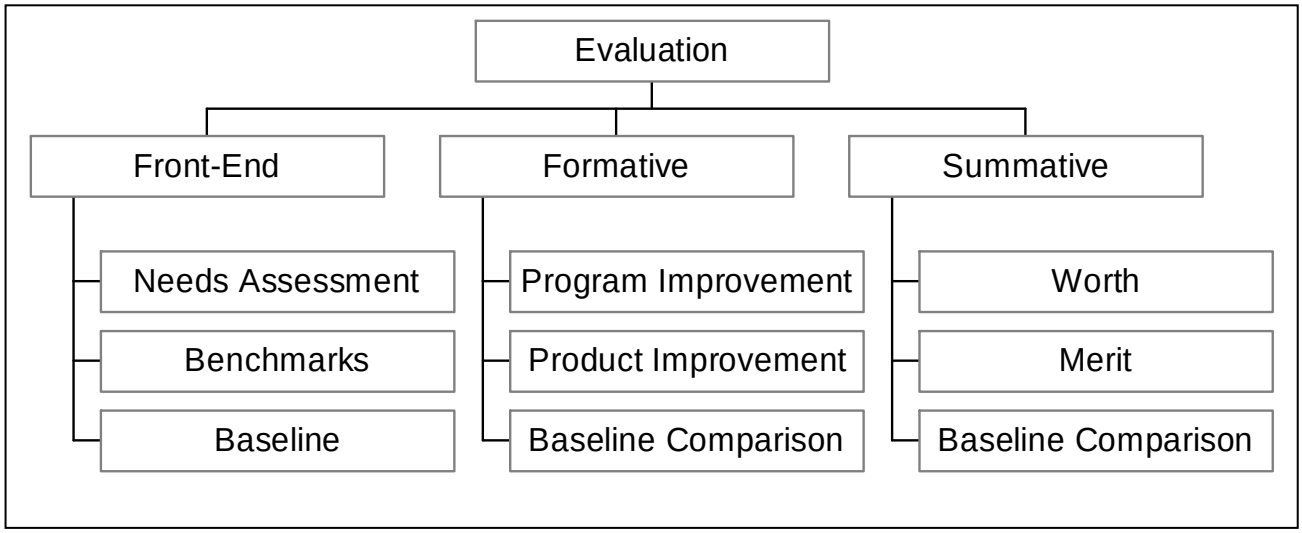
The NERRS education programs have adopted a systematic approach to assessing, designing, developing, implementing and evaluating their learning materials and activities. Application of this approach results in an iterative process where the results of one phase become the starting products for the next phase, and results of the formative evaluation of each step may lead the instructional designer back to any previous phase.

Two NERRS system-wide education programs, the Coastal Training Program and the K-12 Estuarine Education Program, apply this approach and require that research reserves who plan to implement these programs take the following steps:

- Implement a Market Analysis
- Implement a Needs Assessment
- Develop a strategic plan and action plan for the implementation of the program
- Design, develop and implement an evaluation strategy OR if it's a CTP program follow the performance measurement system
- Produce a report

The development of needs assessments is often referred to as "front end" evaluation. This first step on the evaluation strategy followed by the NERRS is required for research reserves participating in these system-wide programs. A schematic below shows the overall vision for the NERRS education evaluation strategy.

Figure 2. NERRS Education Evaluation Philosophical Framework



PROGRAM REVIEWS

As previously mentioned, NERRS periodically uses external and/or internal program reviews to assess program effectiveness and to make recommendations for future direction and priorities. Following are two examples of this kind of reviews:

Education Sector Program Review: In 2002-2003 NERRS Education Coordinators identified that a K-12 and PTD inventory and assessment project was a high priority action item. It would provide baseline data, synthesis, and recommendations for program improvements in support of the NERRS Strategic Plan. In September of 2002, Pandion Systems was contracted to complete the project with the following study objectives:

- An inventory and assessment, both quantitative and qualitative, of current programming for K-12 and professional teacher development (PTD) across the 25 Reserves and how these programs integrate state and national standards.
- Recommendations for improved program evaluation and performance measurement.
- Recommendations for improving program design and implementation, as well as needs for national-level support and capacity building activity.
- Recommendations and associated implications for a national "niche" or system-wide program or activity in the areas of K-12 education and professional teacher development.

Results of this evaluation can be found in a document titled "Inventory and Assessment of K-12 and Professional Teacher Development Programs in NOAA's National Estuarine Research Reserve System (2003)".

Graduate Research Fellowship review. One of the largest graduate programs supported by NOAA, the Graduate Research Fellowship (GRF) Program has supported more than 225 students since 1997. Fellows conduct their master's and doctoral research in the 27 NERRS located in 23 states and Puerto Rico. In 2007, the NERRS Strategic Committee and Reserve Managers requested that a review of the GRF Program be undertaken to determine its success in attaining its program objective and to think about strategic direction for the program. This request was discussed with the NERRS Research Coordinators at the 2007 Annual Meeting and it was determined that a workgroup be formed to conduct an integrated internal review of the program. This group would then produce a white paper as a result of their work from which the GRF program could consider and implement program adjustments, as appropriate and recommended. See fuller description under "The Path Ahead" section of this document.

The NERRS Performance Measurement Framework – Education Measures

NERRS PERFORMANCE MEASUREMENT SYSTEM

The National Academies data call requests that information be provided on the type of evaluation done by the NERRS. While we full recognize that the establishment of a performance measurement framework is NOT an evaluation strategy, this is an important requirement that OCRM has defined for the NERRS and, it forms part of a series of actions taken to improve the performance of the program as required by the Office of Management and Budget's (OMB) performance-assessment rating tool (PART). Development and implementation of this Performance Measurement System provides a mechanism for quantifying, through specific indicators, the effectiveness of reserve programs in achieving the objectives of the CZMA. The NERRS Performance Measurement System is part of the large National Coastal Management Performance Measurement System which uses ecological, socio-economic, and management performance information in an adaptive management process. Overall, this system informs both federal and state coastal managers about the effectiveness of program actions.

The NERRS Performance Measurement System collects consistent performance measures and a set of socio-economic and environmental indicators to set the context of reserve programs. A workgroup of NOAA and reserve field staff refined a measurement framework for the NERRS in early 2003. The framework that was chosen by the workgroup and approved by the NERRS is the pressure-state-response model. In this framework, contextual indicators are separated into indicators that track "pressures" effecting the resource and community and indicators that monitor the "state" or natural and social conditions in and around reserves. Performance measures that correspond to the NERRS strategic plan demonstrate reserve progress in responding to important trends in estuaries and coastal communities.

It is important to note that performance indicators track management actions taken to address the pressures on the resources and the condition of the resources. When the reserve system has collected sufficient information about trends in the pressures on estuaries and the condition of the reserves, these trends will be used to set research, outreach, education, and stewardship agendas through strategic planning. The objectives in the strategic plan become the way the system is attempting to respond to environmental and social realities. Performance indicators that report progress toward these objectives and goals become the response indicators of the performance measurement system.

Currently, the NERRS has defined several performance measures (Fig. 3 below) which are collected and reported by reserve staff, some others are collected by ERD, and some are collected and reported by the Centralized Data Management Office (CDMO). Measures that are collected by reserve staff are collected and managed by staff as designated by the manager. There are 14 CTP measures and 4 other measures that will are submitted to ERD as attachments to six-month progress reports. Two measures that reserves are responsible for are not reported in progress reports and instead are reported through the research database. Therefore, measures are reported to ERD in two ways: as attachments to six-month progress reports and as entries into the research database. The first reporting period was FY07.

Several of the performance measures currently listed for the education programs track outputs rather than outcomes. One exception to this statement entails the type of performance indicators captured by the Coastal Training Program. To see a summarized description of the CTP Performance Measurement System, please read the next section in this document. Other outcome oriented measures will be phased in over the next two years.

In response to the question from the National Academies to how information collected is synthesized into reports about portfolio performance, the NERRS has defined that analysis will be made to help to establish a baseline and to be captured in a report that clearly communicates NERRS work to the National Ocean Service, NOAA, Congress.

While this program is still in its infancy, eventually, we hope that NERRS performance measures can demonstrate NERRS contributions to coastal management.

The list of performance measures presented below (Fig. 3) presents only those that are related to the education programs:

Figure 3. List of Performance Measures

Performance Measures	Collection Responsibility
General Education Performance Measures:	
Number of students reached through NERRS education programs	Reserves
Number of K-12 NERRS programs offered	Reserves
Web hits on nerrs.noaa.gov and estuaries.gov education sites	Estuarine Reserve Division
Estuary Live Performance Measures:	
Number of viewers for Estuary Live	Estuarine Reserve Division
Percentage of teachers reporting the intent to incorporate lessons and activities on estuarine ecology taken from the www.estuaries.gov Web site.	Estuarine Reserve Division
Percentage of teachers who are repeat teachers to EstuaryLive.	Estuarine Reserve Division
Number of student and teacher participants in Estuary Live.	Estuarine Reserve Division
Percentage of students who are able to locate an estuary on a map.	Estuarine Reserve Division
Percentage of students who are able to describe two important functions of estuaries.	Estuarine Reserve Division
Coastal Training Program (CTP) Performance Measures:	
Number of Coastal Training Program contact hours delivered	Reserves
Total number of participants involved in distinct Coastal Training Program activities	Reserves
Total number of Coastal Training Program activities	Reserves
Total number and type of organizations, entities represented by participants	Reserves
Percentage of CTP participants reporting an increase in science understanding of NERRS priority issues as a result of CTP	Reserves
Number and percent of CTP participants reporting increased access to resources relevant to their work as a result of CTP	Reserves
Number and percent of CTP participants reporting increased skills relevant to NERRS priority issues	Reserves
Percent of CTP participants reporting the intention to apply science-based knowledge and skills in their work on NERRS priority issues as a result of CTP	Reserves
Percent of respondents reporting that they intend to make new contacts about NERRS priority issues as a result of CTP	Reserves
Percent of CTP respondents reporting that they are more aware of opportunities for collaboration regarding NERRS priority issues as a result of CTP	Reserves
Percent of CTP respondents reporting the intention to apply new perspectives learned through networking and collaborations as a	Reserves

Performance Measures	Collection Responsibility
result of CTP	
Percent of CTP respondents that were more than satisfied with the content of the training activity	Reserves
Percent of CTP respondents that were more than satisfied with the format of the training	Reserves
Percent of CTP participants that were more than satisfied with the networking opportunities provided by the training activity	Reserves
Research Outreach	
Number of advisory or outreach activities that serve to transfer technical information about Reserve science to estuarine stakeholders	Reserves
Volunteers	
Total number of volunteer hours	Reserves
- education related volunteer hours	
- research, stewardship and monitoring related volunteer hours	
- administrative and other volunteer hours	
- other volunteer hours	

NERRS Education Programs – Evaluating the Impact

THE COASTAL TRAINING PROGRAM PERFORMANCE MONITORING SYSTEM – DATA & ASSESSMENT

The Coastal Training Program is a *system-wide program* of the National Estuarine Research Reserves (NERRS) providing up-to-date scientific information and skill-building opportunities to individuals who are responsible for making decisions that affect coastal resources. Through this program, the NERRS strive to ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities.

Acting as a bridge between the science, policy and management communities, CTP uses an integrated approach to connecting decision-makers with the information they need. CTP works to provide the best available science, tools, and techniques to those individuals and groups whose actions impact coastal watersheds, estuaries and near shore waters. In addition, CTP strives to increase information exchange and collaboration amongst the many individuals, fields/disciplines, and institutions who affect coastal ecosystems.

The Coastal Training Program requires a systematic program development process, involving periodic review of the reserve niche in the training provider market, audience assessments, development of a three to five year program strategy, a marketing plan and the establishment of an advisory group for guidance, program review and perspective in program development. The Coastal Training Program implements a performance monitoring system, wherein staff report data in operations progress reports according to a suite of performance indicators related to increases in participant understanding, applications of learning, and enhanced networking with peers and experts to inform programs.

A logic-results framework was developed in 2001 to articulate outcome-based goals and objectives for the Coastal Training Program, as well as key results that were intended to show progress towards meeting the goal. The goal and objective statements reflect the behavioral, cognitive and attitudinal results or outcomes from training that the program would be able to and want to measure. The key results statements describing intermediate outcomes that contribute directly to the framework's objective-level results statements provided context for the selection of performance indicators and are finalized in the NERRS CTP Performance Monitoring Manual. It was recognized that the indicators developed were very short-term or formative evaluation metrics, providing a feedback loop for immediate program adjustment.

The **goal** of the **Coastal Training Program** is better informed decision-making by local and regional coastal decision-makers to improve coastal stewardship.

The objectives of the Coastal Training Program are that:

- Local and regional Coastal Decision-makers increasingly apply science-based knowledge and skills in their work related to NERRS priority issues;
- Local and regional Coastal Decision-makers increasingly apply diverse perspectives related to NERRS priority issues.

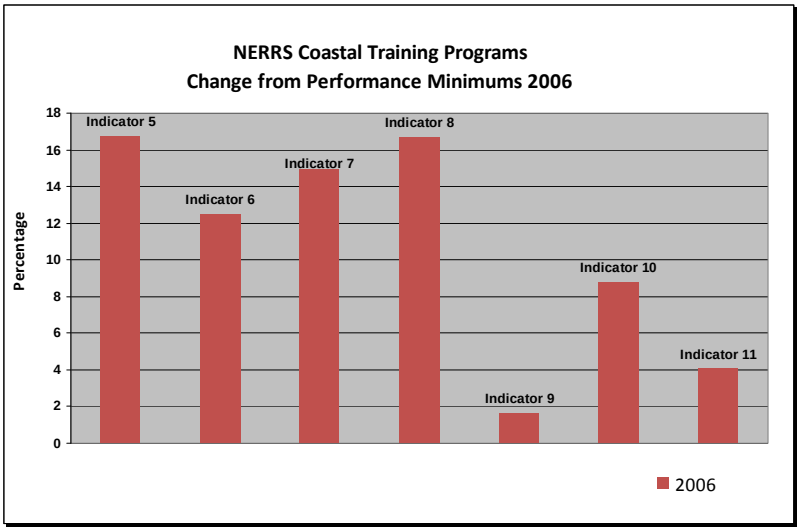
During the FY 04 grant cycle, baseline indicator data was collected. Baseline data consisted of a Reserve CTP's cumulative evaluation results. Based on an analysis of this data from the period June 2004 – July 2005, the minimum performance requirements were established in 2006 and the first set of data was collected with the FY '06 NOAA grant cycle. All performance data is tabulated and reported every six months to NOAA using an Excel

spreadsheet. Performance was measured using a weighted point system. CTPs accumulating more than a certain number of points were found to be underperforming. In order to maintain consistency in collected and reported data, across the reserves, coordinators were given the specific guidance regarding the wording of evaluation questions. All performance data is tabulated and reported to NOAA using a "performance-monitoring tool". This tool is an Excel spreadsheet which is used by all coordinators and is reported to NOAA every six months, along with a narrative of CTP activities during that period that contain program highlights, identify anecdotal outcomes and other CTP activities that were not evaluated.

Currently, of the 14 performance indicators developed under the CTP Logic Model Framework 11 have minimum performance requirements. They are identified in the following chart. Since 2006, 400 evaluated CTP training events were held throughout the NERRS and a total of 13,434 coastal decision-makers were reached during these events.

Note that the minimum performance measures were set knowing that the baseline data was collected inconsistently and missing data from about 20% of the reserves. A revision of the indicator and evaluation question language, as well as the minimum performance requirements is planned at the end of 2008. Revisions will be based on the recommendations of the CTP/CSCT External Review and the review of 2006 performance data.

A preliminary review of the 2006 data shows that CTP has overwhelmingly met the minimum performance requirements set in 2006. See Figure below.



Framework	System-Wide Performance Indicators
General Quantitative Measures	Indicator 1 Events Total # of CTP activities (Events & Technical Training) offered during reporting period. Indicator 2 Organizational Diversity & Evenness Total # and type of organizations, entities represented by participants during the reporting period. Organized into 11 defined organizational categories Indicator 3 Participants Total # of CTP participants involved in a distinct CTP activities (Events and Technical Training) over the reporting period. Indicator 4 Contact Hours Total # of contact-hours for reporting period.
CTP Goal: Better-informed decision-making by local and regional Coastal Decision-Makers to improve coastal stewardship.	
CTP Objective 1: Local and regional Coastal Decision-Makers increasingly apply science-based knowledge and skills in their work related to NERRS priority issues.	**Indicator 5** % of CTP participants reporting the intention to apply science-based knowledge and skills in their work related to NERRS priority issues as a result of training event.
Key Result 1.1: Coastal Decision-Makers increase their scientific understanding of NERRS priority issues.	**Indicator 6** % of CTP participants reporting increased scientific understanding of NERRS priority issues as a result of training event.
Key Result 1.2: Coastal Decision-Makers improve their abilities to access science-based resources (e.g., people, information, tools and technologies) related to NERRS priority issues.	**Indicator 7** % of CTP respondents reporting increased access to resources relevant to their work as a result of the training event.
Key Result 1.3: Coastal Decision-Makers increase skills related to technologies and/or best management practices for NERRS priority issues.	**Indicator 8** % of CTP respondents reporting increased skills relevant to NERRS priority issues.
CTP Objective 2: Local and regional Coastal Decision-Makers increasingly apply diverse perspectives across sectors and disciplines related to NERRS priority issues.	**Indicator 9** % CTP respondents reporting the intention to apply new perspectives learned through networking and collaborations at the training event.
Key Result 2.1: Coastal Decision-Makers increase the diversity of their contacts regarding NERRS priority issues.	**Indicator 10** % of respondents reporting that they intend to make new contact about NERRS priority issues as a result of this training event.
Qualitative Measures	**Indicator 12** % of CTP respondents that were more than satisfied with the content of the training activity. **Indicator 13** % of CTP respondents that were more than satisfied with the format of the training activity.

Key Documents for the Coastal Training Program	Available for Distribution to the NAS
▪ **CTP Performance Monitoring Manual**	▪ **Submitted together with this document**
▪ **Trends Analysis of Coastal Training Programs in the National Estuarine Research Reserve System**	▪ **Furnished upon request**
▪ **Charge to the Reviewers (CTP-CSC Training External Review, 2008)**	▪ **Furnished upon request**
▪ **Summary Analysis of CTP Performance, 2006 (January 2009)**	▪ **Available in January 2009. Furnished upon request**

EVALUATION STRATEGY FOR THE ESTUARYLIVE PROGRAM

The EstuaryLive Program is a free interactive field trip over the internet where students learn about estuaries and have their questions answered over the Internet. This program, is considered a *national* program, and has been implemented since 2001 by a variety of individual research reserves coordinated by ERD. The results of an evaluation done by an independent consultant, Pandion System, Inc. estimated that 25,315 individuals participated in the 2006 national EstuaryLive program via the Internet (Fig. 4). An additional 700,000+ individuals had access to the program via various television stations and EstuaryLive events at organizations such as aquariums. Note that efforts have been made to quantify the number of individuals watching via satellite, but we consider this a difficult indicator to effectively measure, so the additional 700,000+ number represents potential participation based on the number of households/schools that could have accessed the program (Fig. 4).

Distance learning is rapidly changing the way that education is viewed in the world today, and for environmental education this method offers an innovative way to bring nature into the classroom. As broadband internet access becomes more widely available and access to internet-based tools and program content expands, techniques to make meaningful connections with educators and classrooms requires a sophisticated, multi-faceted approach. The NERRS participation in the EstuaryLive project began in 2001 as an innovative means to build awareness and provide an exciting web-based educational program for classrooms across the country. Subsequently, the program has grown in scope and depth providing a powerful, interactive tool to introduce students and their teachers to a wide variety of estuary topics and themes. Curriculum, advance training, and refinements based on findings from evaluations of previous EstuaryLive broadcasts have improved the overall value of the effort over the years and expanded the viewership.

The vision of the EstuaryLive program is to increase student's understanding and awareness of estuarine environments and to prompt students to become stewards of the environment. EstuaryLive is developed primarily for a K-12 audience, with an emphasis on middle and high school classrooms (grades 5-10).

There are two **goals** for the **Estuary Live Program**, one for each target audience:

- *Student/Learner Goal:* Students will understand concepts of estuarine ecology and understand the relationships between human cultures and estuarine stewardship.
- *Educator/Program Goal:* Educators will increase their content knowledge, confidence, and technological skills for teaching about estuaries in their classrooms.

There are a series of learning objectives outlined for each goal and target audience. These objectives can be found under the EstuaryLive 2005 Final Report produce by Pandion Systems, Inc.

To determine whether EstuaryLive is effectively meeting its goals, several evaluation techniques and tools are used. These tools include: a programmatic evaluation conducted by a professional contractor, a compilation of registration information, and a compilation of information collected from questions asked during the program, and information collected by the program streamer.

The registration form is designed to collect a range of background information about EstuaryLive participants. Information collected includes subjects taught, class size, and an indication of which programs teachers anticipated they would participate in. This information, in combination with information collected from submitted questions during the program is used to determine program participation.

The contracted evaluator also conducts the programmatic evaluation of EstuaryLive. An evaluation of the 2006 EstuaryLive program was completed by Pandion Systems, Inc. Pandion Systems, Inc. utilized the same evaluation tools developed and used during the 2005 programmatic evaluation for the 2006 program. This allowed for a direct comparison between the results from the 2005 and 2006 programmatic evaluations. Evaluation tools included asking teachers to complete a post-program questionnaire; having teachers provide pre and post tests taken by students participating in EstuaryLive; one-on-one interviews with participating teachers; one-on-one interviews with participating live sites; as well as collecting evaluation materials from several participating Reserves. The 2006 evaluation was designed to both provide information regarding our participants and how they use the program, as well as to look at how teachers are using technology in their classroom. In order for EstuaryLive to be a truly effective educational program, its delivery must be in a format useable to teachers. Over the course of EstuaryLive, teacher's use of technology in the classroom has increased significantly, but prior to 2006, the EstuaryLive workgroup had not assessed, through evaluation of EstuaryLive, teacher's ability to use and integrate distance learning into their classroom. For more information regarding this evaluation please see the document titled, "EstuaryLive 2006 Evaluation" written by Pandion Systems, Inc.

As a part of the NERRS education portfolio, Estuary Live has proven effectiveness in reaching large audiences of K-12 classes and teachers with introductory information and educational content through a virtual fieldtrip format. Information and data collected through the various means employed to evaluate the program are incorporated into the NERRS Formal Education performance measures. In addition, the results of these evaluations are thoroughly reviewed by the NERRS National Education Coordinator and a group of Education Coordinators to improve the programming year after year, to improve the content offered over the estuaries.gov site, to assess whether it is reaching its goal, and to communicate with NOAA/NERRS about the effectiveness and impact of this program.

The table in the following page is an overview of the statistics generated from the 2006 EstuaryLive programmatic evaluation. These statistics are easily tracked from year to year and can help provide a quantitative assessment of the program's outcomes.

Key Documents for the EstuaryLive Program	Available for Distribution to the NAS
▪ **EstuaryLive Final Reports – include evaluation reports (2006)**	▪ **Submitted with this document**
▪ **EstuaryLive Final Reports – include evaluation reports (2005)**	▪ **Submitted with this document**
▪ **EstuaryLive Final Reports – include evaluation reports (2003, 2004, 2005)**	▪ **Furnished upon request**
▪ **"EstuaryLive 2006 Evaluation" written by Pandion Systems, Inc.**	▪ **Submitted with this document**
▪ **"EstuaryLive 2005 Evaluation" written by Pandion Systems, Inc.**	▪ **Submitted with this document**
▪ **An Analysis of the Estuaries.Gov website usage in September 2004 compared with September 2005**	▪ **Furnished upon request**
▪ **EstuaryLive Proposal to the NERRS Strategic Committee**	▪ **Furnished upon request**

Figure 4. Sample: EstuaryLive 2006 Evaluation Results

Indicators	2003	2004	2005	2006	Data Source
General Quantitative Indicators					
Teacher participation (Internet participants only)	291	257	502	526	2003: Evaluation data, collected by Susan Lovelace, Oct. 2003; server information provided by Multicast Media 2004: Registration data, compiled by Becky Weidman, 2004; server information provided by Globix 2005-2006: Registration data, compiled on www.estuaries.gov and questions database
Average Number of Students for each Registered Teacher (Internet participants only)	49	53	42	48	2003: Evaluation data, collected by Susan Lovelace, Oct. 2003; server information provided by Multicast Media 2004: Registration data, compiled by Becky Weidman, 2004; server information provided by Globix 2005-2006: Registration data, compiled on www.estuaries.gov
Participation by students and teachers (Internet participants only)	18,600	13,600	20,958	25,315	2003: Evaluation data, collected by Susan Lovelace, Oct. 2003 2004: Registration data, compiled by Becky Weidman, 2004 2005-2006: Registration data, compiled on www.estuaries.gov and Questions Database
Potential Viewers (Satellite and Internet Participants)	115,000*	700,000	700,000	700,000	2004: Registration data, compiled by Becky Weidman, 2004; server information provided by Globix; potential viewership via: SCETV, Comcast of Delaware, Wells NERR, South Slough NERR, Padilla Bay NERR, GTM NERR, Mystic Aquarium, and the Alaska SeaLife Center. 2005: Registration data, compiled on www.estuaries.gov; server information provided by Globix; potential viewership via: SCETV, Comcast of Delaware, Old Woman Creek NERR, South Slough NERR, Elkhorn Slough NERR, Dauphin Island Sea Lab, EPA, and NOAA
Number of Questions asked by Participants	1,000	756	1,153	1,398	2003 - 2006: Compilation of questions submitted during the field trips.
Number of hits on www.estuaries.gov Web Site	57,427	146,148	486,512	560,881	2004: NOAA www.estuaries.gov report written by Jin Wang, October 2004 2005: NOAA www.estuaries.gov report written by Jin Wang,

Indicators	2003	2004	2005	2006	Data Source
					October 2005 2006: NOAA www.estuaries.gov Web site statistics
Total number of requests for assistance by participating teachers	N/A	75	83	98	2004: Personal communications, Becky Weidman, 2004 2005- 2006: Registration Database
Teachers Access to Resources about Estuaries					
Percentage of teachers reporting the intent to incorporate lessons and activities on estuarine ecology taken from the www.estuaries.gov Web site.	N/A	92%	86%	61%	2004: Teacher Questionnaire implemented by Becky Weidman, Sept.-Oct. 2004 2005: Post Participation-Teacher Questionnaire implemented by Pandion Systems, Inc., Sept.-Oct. 2005 2006: Post Participation-Teacher Questionnaire implemented by Pandion Systems, Inc., Oct. 2006
Percentage of teachers reporting the intent to incorporate lessons and activities for comparing estuaries taken from the www.estuaries.gov Web site.	N/A	90%	70%	52%	2004: Teacher Questionnaire implemented by Becky Weidman, Sept.-Oct. 2004 2005: Post Participation-Teacher Questionnaire implemented by Pandion Systems, Inc., Sept.-Oct. 2005 2006: Post Participation-Teacher Questionnaire implemented by Pandion Systems, Inc., Oct. 2006
Teachers increasingly use the telecast as the highlight of their teaching					
Percentage of teachers who plan to participate in EstuaryLive again in the future.	N/A	87.3%	94.9%	92.0%	2004: Teacher Questionnaire implemented by Becky Weidman, Sept.-Oct. 2004 2005: Post Participation-Teacher Questionnaire , Pandion Systems, Inc., Sept.-Oct. 2005 2006: Post Participation-Teacher Questionnaire, Pandion Systems, Inc., Oct. 2006
Percentage of teachers who registered for more than one field trip.	53%	69%	59%	56%	2003: Evaluation data, collected by Susan Lovelace, Oct. 2003 2004: Teacher Questionnaire implemented by Becky Weidman, Sept.-Oct. 2004 2005: Registration Database 2006: Registration Database

EXAMPLES OF SPECIFIC RESEARCH RESERVE EDUCATION PROGRAM EVALUATIONS - OTHER THAN THOSE FROM THE COASTAL TRAINING PROGRAMS

Following this data call from the National Academies, the NERRS National Education Coordinator put a call to all the research reserves to submit available evaluation reports and documents, both formative and summative from all individual formal, informal or community education programs. Unfortunately, very few research reserves could submit a report. Several of the research reserves currently employ a variety of evaluation tools to measure the effectiveness or impact of their programs (an example of the kind of tools used can be found in Fig. 5), but have not yet taken the next step in synthesizing the information into reports.

This data call, as well as, other similar data calls, the National Education Coordinator had produced in the past , corroborate the reasons for the lack of formal evaluation done by Reserve educators of their own research reserve education programs (Padion System, Inc., 2003):

- Evaluation takes time away from other education responsibilities
- Education Coordinators indicate that they do not have a lot of experience evaluating programs (72% rated this skill a 5 or less on a 10 point scale.)

Most Education Coordinators are interested in strengthening their capabilities in the area of evaluation. In 2003, the most common forms of evaluation were *staff observation and tracking participant attendance counts*. In the past 4 years, this has started to change and many reserve educators are now implementing different type of evaluation tools (see Fig. 5). Efforts by a small group of research reserves have even focused on methods to evaluate outcomes rather than only outputs. An example of this kind of effort can be seen by the work done by two research reserves who submitted reports of the evaluations they have conducted, and have the data to prove their success.

Waquoit Bay NERR (WBNERR - Massachusetts)

Waquoit Bay NERR has made a discreet effort over the years to design and implement full evaluations of their individual K-12 and community education programs. Among some of the tools they have used we find:

- A report of a pre and post test taken by teachers for a climate course taught in 2007
- A copy of a pre and post test given to grade 6 students who visit WBNERR for day – long programs on estuaries
- Teacher training program evaluations
- Post evaluations from solar hot water installation course
- Sample evaluation from community education course – answers collated and summarized
- Sample short evaluation/commitment form from community education course
- Summary of numbers of people who attended programs since November, 2004 when they started using this database for the state to almost the present.

Waquoit Bay was one of the research reserves which submitted a final report on an evaluation done of a workshop that was offered called “Towards Zero Energy Homes”. In this case, the evaluation was meant, not only to evaluate the impact of the workshop, but also to gather feedback on several other professional development opportunities in high performance green building that had been offered to design and building professionals on Cape Cod in Massachusetts. The evaluation was funded by a grant from the Massachusetts Technology Collaborative and coordinated through Waquoit Bay National Estuarine Research Reserve.

The primary focus of the evaluation was “Towards Zero Energy Homes (ZEH),” a full day workshop for architects, engineers and homebuilders that took place at the Woods Hole Research Center Gilman Ordway Campus on January 6, 2006. The workshop was intended to provide participants with:

• an understanding of the basic design considerations for achieving homes that require little or no non-renewable energy to power them;

• opportunities to network with other architects, homebuilders, engineers, renewable energy consultants and regional organizations; and

• resources on sustainable building, including information on tax credits and other incentives.

Sixty-five architects, builders, consultants, students and others attended the workshop. The evaluation was carried out by conducting phone interviews with individuals who participated in the workshop. Evaluations of the workshop were very positive. To review the results of this evaluation, please review the document titled" "**Evaluating Usage and Impact -** The "Towards Zero Energy Homes" Workshop and Other Professional Development Opportunities in High Performance Green Building on Cape Cod (Waquoit Bay NERR)".

Jacques Cousteau NERR (JCNERR - New Jersey)

The Jacques Cousteau NERR has also been at the forefront of all research reserves in designing and implementing formative and summative evaluations of the K-12 education programs. The Jacques Cousteau NERR submitted an final report of the evaluation done on the MARE program which they implement. The MARE program (Marine Activities, Resources and Education) is a K-8 school wide, interdisciplinary curriculum designed to integrate the marine sciences via hands-on and inquiry-based learning into school curricula in accordance with state and national education standards. MARE (for short) has been in the New Jersey schools since 1996. Hundreds of teachers have experienced the weeklong summer training session, various workshops and in-service training sessions. Tens of thousands of students have participated in MARE at their schools. Over those ten years the MARE staff at Rutgers has seen some schools, school districts and communities embrace MARE and watched the program at other schools languish and even die on the vine.

As a result of teacher interviews during a 2003 MARE student impact evaluation JCNERR learned that teachers and schools vary greatly in their implementation of MARE. That raised a question about measuring the program's success: How could we measure the impact of MARE on New Jersey students when the program was different in each school? It was recognized that implementation was an issue that hadn't reviewed beyond anecdotal accounts and study needed to be made to ensure MARE's continued success. To review the results of this evaluation, please consult the document titled MARE Program Implementation Evaluation Report (Jacques Cousteau NERR) which has been submitted to the NAS as part of this data call.

Key Documents for the Specific Research Reserves	Available for Distribution to the NAS
▪ **MARE Program Implementation Evaluation Report (Jacques Cousteau NERR)**	▪ **Submitted with this document**
▪ **Evaluating Usage and Impact -** The "Towards Zero Energy Homes" Workshop and Other Professional Development Opportunities in High Performance Green Building on Cape Cod (Waquoit Bay NERR)	▪ **Submitted with this document**

Figure 5. Examples of Tools Used by Specific Research Reserves to Evaluate Different Education and Outreach Related Programs

Tool	Reserve	Title
Participant Survey	North Inlet-Winyah Bay Reserve	Participant Survey
Participants Participation Evaluation Tool	Wells	Interpretive Education Program Attendance
Distance Learning Evaluation Tool	Old Woman Creek	"What is Plankton?" Distance Learning Presentation
Distance Learning Evaluation Tool	Old Woman Creek	"What Makes Old Woman Creek "Green" Distance Learning Presentation
Distance Learning Evaluation Tool	Old Woman Creek	Distance Learning Presentation Evaluation
Participants Reaction Evaluation Tool	Wells	Program Evaluation for Chaperones
Student Evaluation Tool	GTM	School Group Evaluation Form
Participants Reaction Evaluation Tool	Delaware	Survey Activity Evaluation
Participants' Learning Evaluation Tool	Jobos Bay	Evaluation - (En Espanol)
PTD - Participants' Reaction Evaluation Tool	Wells	Evaluation for Teachers – Exploring Estuaries
PTD - Participants' Reaction Evaluation Tool	Old Woman Creek	On-site Program Evaluation
Tool to Evaluate the Facilitator	North Carolina	Participant Evaluation of the Staff Development Activity
Student Evaluation Tool	Apalachicola	Portfolio Review Guide
PTD - Pre-Workshop Assessment Form	North Carolina	PTD - Pre-Workshop Assessment Form
PTD - Participants' Reaction Evaluation Tool	Sapelo	PTD Sea Turtle Workshop Evaluation
PTD - Participants' Reaction Evaluation Tool	Sapelo	PTD Survey for Coastal Ecology

The Path Ahead – Building Out & Improving the NERRS Education Evaluation Strategies

EXTERNAL REVIEW OF THE COASTAL TRAINING PROGRAM

Since the 1990's, the National Oceanic and Atmospheric Administration (NOAA) has been building its capacity to address the training needs of decision-makers and resource professionals in the coastal zone. Examples of this capacity can be found in two programs. The National Estuarine Research Reserve System's (NERRS) Coastal Training Program (CTP) provides science-based information to targeted coastal decision-maker audiences in the communities and regions near reserves. The goal of the program is to improve decision-making related to coastal resources management at local and regional levels. The Coastal Services Center (CSC) provides training on geospatial technology, process skills, and coastal issues. The goal of the program is to build the capacity of organizations involved with managing and protecting coastal resources. Neither program has undergone an external review since their inception six and nine years ago respectively. **This external review will assess system-wide program effectiveness and identify ways to enhance or refine CTP and CSC goals.**

The primary objective for this review is to gather recommendations from a team of external experts on how to improve CTP/CSC's:

- Overall program structure, function, delivery, and promotion;
- Evaluation and performance measures;
- Internal and external partnerships.

The review team discussion will:

- assess system-wide program effectiveness (including evaluation methods);
- identify ways to further enhance achievement of CTP and CSC training goals;
- identify ways for the CTP and CSC training programs to build upon and strengthen their unique niches.

We anticipate having **a** Final Report of Team Findings and Recommendations completed by January 2009.

INTERNAL REVIEW OF THE GRADUATE RESEARCH FELLOWSHIP PROGRAM

An internal review of the Graduate Research Fellowship Program is being undertaken to determine the how effective the program has been in achieving its stated objective, to support management-related projects that will enhance scientific understanding of the reserve ecosystem, provide information needed by reserve management and coastal management decision-makers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues (15CFR § 921.50*).* A committee consisting of 8 members from the education, research, stewardship, and coastal training program communities within the reserve system will conduct the review. Two co-chairs from NOAA's Estuarine Reserves Division will facilitate the review's discussion. The review framework consists of four overarching questions related to program effectiveness in achieving the program's objective. Data for the Internal Review has been gathered using a document review process by which key program documents as well as Fellows' semi-annual and final performance progress reports have been summarized and synthesized for the committee's discussions. The Fellows' semi-annual and final performance progress reports follow the Graduate Research Fellowship Program Reporting Guidelines so data can be analyzed or summarized in a consistent manner. From these reports we are able to report on our program performance measures such as 'Number of Graduate Research Fellow applicants completing a graduate thesis program that focuses on the NERR priority areas for research'.

DESIGN AND DEVELOPMENT OF AN EVALUATION STRATEGY FOR SPECIFIC COMPONENTS OF THE NERRS K-12 ESTUARINE EDUCATION PROGRAM

Since the Coastal Zone Management Act (CZMA) was passed in 1972, the National Estuarine Research Reserve System (NERRS) has linked estuarine research, education and stewardship. By 2002, a vast majority of Reserves were offering education programs for some segment of school aged audiences and professional teacher development (PTD) for grades kindergarten through high school (K-12). In FY03, the NERRS identified a priority action item and allocated funds of the CZMA for an inventory and assessment of K-12 and PTD programs offered at NERRS sites (Padion Systems Inc., 2003). The inventory found, that of the 25 Reserves that existed at that time, 23 offered programs for K-12 students and 21 offered professional teacher training programs. Reserve educators began planning and in FY06 the Reserve System, as a whole, made a major decision to support the implementation of a *system-wide* K-12 Estuarine Education Program (KEEP). Through such expanded and integrated offerings, Reserve educators hope to increase knowledge about estuaries among K-12 teachers and students. Such increased knowledge will promote the growth of public awareness about the importance of ocean and coastal resources and their connection to humans' well-being, and will provide a basis for citizens to make informed decisions about managing and protecting such resources.

The approach agreed on would help integrate all research reserve efforts and follow a sequence model that would require all participating research reserves to do a market analysis and needs assessment (front-end evaluation), before they started fully implementing the program. This approach will help improve the quality and consistency of programs offered at all Reserves sites. Development and implementation of KEEP includes:

- continued implementation of the EstuaryLive Program (discussed in the previous section)
- development of new system-wide educational resources (i.e. the Estuaries 101 Curriculum and a SWMP Education Interface on estuaries.gov)
- implementation of a series of activities by individual Reserves (i.e. professional teacher workshops called Teachers on the Estuary, distance learning programs, or field-based opportunities)

While no funding has yet been provided to research reserves to implement any activities, progress has been made in the implementation of two assessments done at the national level and in the development of the educational resources that will be adopted and adapted by all participating research reserves.

- Specifically, a front-end evaluation (Parsons, C. 2006) was designed to investigate the ways by which kindergarten through 12 grade (K-12) teachers and students can use real-time data (RTD) and associated education products to understand and appreciate the role that the environment, in particular the ocean, plays in their lives. This assessment has been key in the design of educational products that would build off from the work done by the NERRS scientists in monitoring the health of the NERRS estuaries.
- Secondly, and as part of its efforts to develop K–12 curriculum materials on estuaries, the NERRS contracted with TERC, a non-profit educational research and development firm, to design and conduct a nation-wide needs assessment survey of the state of estuarine education (ETRC, 2007). This assessment has been instrumental in the design of K–12 curriculum materials on estuarine content, and in planning professional teacher training opportunities led by the different reserve educators.
- Another accomplishment to date has been the actual development of the first part of an Estuaries 101 Curriculum, focused on high school students which will be adopted and adapted by all research reserves who will want to participate in the KEEP program (this is a voluntary program, research reserves are not required to participate if they don't want to or target that particular audience). It is important to note that NERRS education coordinators defined a set of "core principles", as embodied in *Principles and Concepts for Estuaries 101,* which guided the design of the Curriculum.
- An enhanced estuaries.gov allows any teacher to find relevant information about the NERRS education programs and offerings.
- Other educational resources, like a data education Interface are currently in development.

In addition, Education Coordinators are currently discussing the design and development of a full evaluation strategy specifically for teacher training workshops that would be offered across all research reserves participating in the KEEP program.

Measuring Increased Estuarine Literacy through the Use of the Estuaries 101 Curriculum and Teacher Trainings Offered by Research Reserves

Research reserves that offer teacher training workshops, under the KEEP program, will adopt and adapt the Estuaries 101 Curriculum recently developed. The evaluation strategy currently discussed by the NERRS education coordinators will provide a series of outcome oriented indicators to be collected in a consistent and systematic way across all research reserves. Each research reserve will use their own data from the Reserve-specific objectives to demonstrate how the national objectives were being met. A draft version of this strategy is currently captured in a document titled the "Teachers on the Estuary Description Document" and it includes suggested tools for the implementation of front end evaluations, summative and formative evaluations. A large part of these evaluations will be used continually to assess and fine tune ways in which the teacher trainings will best meet the needs of teachers.

The evaluation strategy for the teacher training component of KEEP will outline processes, timeframes, and responsibilities for measuring the objectives and collecting the data. Unfortunately, a big challenge that research reserves face are the need to have sufficient resources allocated to effectively implement a full evaluation strategy. The evaluation strategy developed for the EstuaryLive Program (discussed in the previous section of this document) will remain the same during FY08 and FY09.

Part of the consideration in the design of the NERRS education evaluation strategy lies on the fact that, by having an Estuaries 101 Curriculum developed, specific learning objectives have already been defined. These list of learning objectives will thus provide the framework for a series of expected outcomes.

The Estuaries 101 activities are scaffolded and supported by:

- background information for both the teachers and students, since there is a role for reading and direct delivery of content in learning, as part of the overall process;
- by student sheets, which provide guidance through the experiences and ask both specific response and reflection questions to ensure that students are on track and are thinking about what they are doing and why;
- by assessment pieces for individual activities and for entire Modules, providing a means for both grading, as appropriate, and checking in with student advances in understanding; and
- finally by optional extension inquiries, which provide suggestions on how the concepts, skills, data, and questions addressed in the activities can be pursued in more depth by classes or individuals interested in taking their explorations to the next level.

Each Module concludes with an assessment piece, designed for use after completion of all the activities within that Module. These assessments, which overarch all the activities within a Module, provide a means for both grading, as appropriate, and checking in with student advances in understanding.

Complementary to the assessment tools that have been included in the Modules, NERRS has started to evaluate the use and effectiveness of the Curriculum by:

- Inviting educators to complete a feedback form which asks about what works well and what can be improved about the materials. This form will remain available for a full year to give educators the opportunity to use the materials in the classroom and then complete this form.
- Evaluating the use of the curriculum by educators participating in NERRS led professional teacher training workshop. This evaluation will include not only an analysis of whether teachers find the products useful and effective, but whether they were able to guide their own students in inquiry. In other words, the evaluation will consist of two phases: on e at the time of delivery of the training and one after the teachers have been able to use the training in their classrooms. Data will be collected during these two phases.

In addition, and as part of the overall evaluation strategy, the NERRS is currently working to develop an assessment package focusing on change in students' conceptual understanding, thinking skills and attitudes toward estuarine science. Some of the summative evaluation techniques we might develop include:

- Teacher training program implementation and success.
- Coastal science knowledge and estuarine literacy gains among teachers who participate in the training and/or use the curriculum and website.
- Coastal science knowledge, analytical skills and estuarine literacy improvements among students in classrooms using Estuaries 101. These assessments will be coordinated with classroom teachers to relate to the specific concepts and skills presented.

As part of the design of this evaluation strategy, NERRS is assessing how the "Targeting Outcomes of Programs" (TOP) model, developed by Claude Bennet and Kay Rockwell in 1994, can be used and adopted to fit the NERRS model. This model as been suggested for adoption by NOAA Office of Education and the National Marine Sanctuaries Program. The NERRS expects to have a draft version of this evaluation strategy developed by the Summer of 2009.

Clearly, there is work to be done in the area of evaluation, specifically for the K-12 education programs. Nonetheless, progress has been made and will be captured in a description document which will be reviewed and vetted by all NERRS Education Coordinators.

Key Documents	**Available for Distribution to the NAS**
K-12 Estuarine Education Program Description	Furnished upon request
The State of Estuarine Education: K–12 Needs Assessment (TERC, 2007)	http://www.estuaries.gov/estuaries101/Resources/Default.aspx?ID=138
SWMP/IOOS Real-Time Data in K-12 Classrooms: A Front-end Evaluation (Parsons, C. 2006)	http://marine.rutgers.edu/outreach/rtd/files/rtd_exec_sum.pdf
Inventory and Assessment of K-12 and Professional Teacher Development Programs in NOAA's National Estuarine Research Reserve System (2003)	http://www.estuaries.gov/estuaries101/Doc/PDF/InventoryK12Report.pdf

Appendix. Synthesis of Documents

Document	Type	Available for Distribution to the NAS
OCRM Strategic Plan	Planning Document	Furnished upon request
NERRS Strategic Plan (2005-2010)	Planning Document	Submitted with this document
NERRS Action Plan	Planning Document	Furnished upon request
Reserve Site Specific Management Plans	Planning Document	Furnished upon request
NERRS Research and Monitoring Plan (2006-2011)	Planning Document	Furnished upon request
K-12 Estuarine Education Program Description	Planning Document	Furnished upon request
Teacher on the Estuary Description Document	Planning Document outlining an evaluation strategy for teacher training	Furnished upon request
Report to Congress On National Coastal Management Performance Measurement System. December 2003 U.S. Department of Commerce. NOAA/NOS/OCRM	Performance	Furnished upon request
CTP Performance Monitoring Manual	Performance	Submitted with this document
Trends Analysis of Coastal Training Programs in the National Estuarine Research Reserve System	Performance	Furnished upon request
Charge to the Reviewers (CTP-CSC Training External Review, 2008)	Performance	Furnished upon request
Reserve Site Specific Market Analysis and Needs Assessments done for CTP	Needs Assessment & Market Analysis	Furnished upon request
EstuaryLive Evaluation Reports (2003, 2004, 2005, 2006)	Evaluation	2005 & 2006 Submitted with this document 2003/2004 Furnished upon request
How Learning about Estuaries meets State and National Science Education Standards	Needs Assessment	Furnished upon request
The State of Estuarine Education: K–12 Needs Assessment	Needs Assessment	http://www.estuaries.gov/estuaries101/Resources/Default.aspx?ID=138
SWMP/IOOS Real-Time Data in K-12 Classrooms: A Front-end Evaluation	Needs Assessment	http://marine.rutgers.edu/outreach/rtd/files/rtd_exec_sum.pdf
Inventory and Assessment of K-12 and Professional Teacher Development Programs in NOAA's National Estuarine Research Reserve System (2003)	Needs Assessment	http://www.estuaries.gov/estuaries101/Doc/PDF/InventoryK12Report.pdf
National Estuarine Research Reserve System Graduate Research Fellowships, 1997-2007. 10 Years of Research, Training and Policy	Report	http://www.nerrs.noaa.gov/pdf/grfcelebration.pdf
MARE Program Implementation Evaluation Report (Jacques Cousteau NERR)	Evaluation Report	Submitted with this document
Evaluating Usage and Impact - The "Towards Zero Energy Homes" Workshop and Other Professional Development Opportunities in High Performance Green Building on Cape Cod (Waquoit Bay NERR)	Evaluation Report	Submitted with this document