ANNUAL ADMINISTRATIVE REPORT FOR INVENTORIES AND VITAL SIGNS MONITORING

FY2012

NORTHEAST COASTAL AND BARRIER NETWORK (NCBN)

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Northeast Coastal and Barrier Network FY 2012 Administrative Report

The Northeast Coastal and Barrier Network (NCBN) includes eight parks located along the Atlantic coast from Massachusetts to Virginia: Cape Cod National Seashore (CACO), Fire Island National Seashore (FIIS), Sagamore Hill National Historic Site (SAHI), Gateway National Recreation Area (GATE), Assateague Island National Seashore (ASIS), George Washington Birthplace National Monument (GEWA), Thomas Stone National Historic Site (THST), Colonial National Historical Park (COLO). These parks represent some of the most ecologically similar collections of lands within the National Park Service. They consist of critical coastal habitat for many rare and endangered species, as well as migratory corridors for birds, sea turtles, and marine mammals. They also protect vital coastal wetlands, essential to water quality, fisheries, and the biological diversity of coastal, near shore, and terrestrial environments. All NCBN parks continue to be pressured by encroaching development, intense recreational activity, and now the effects of rapid climate change. Sea level rise, increased storm intensity, amplified variability in surface and groundwater levels, and ocean acidification are expected to be among the most pressing natural resource management challenges in the near future. In addition to the effects of climate change, being within the urban sprawl of the Northeast creates additional management pressure to monitor the condition of these sensitive and often last remaining pristine ecosystems.

The NCBN Inventory and Monitoring Program was developed to provide parks with credible, defensible scientific information that will help managers and scientists track the changes that occur in condition of a park's natural resources. As part of the National Park Service's original effort to "improve park management through greater reliance on scientific knowledge," the Cape Cod Ecosystem Monitoring (CCEM) program, an NCBN park, was established to develop and implement a long-term monitoring program that would serve to aid park managers in making sound stewardship decisions. The program at CACO was established in the early 1990's as one of the few "Prototype" parks tasked with developing a monitoring program for coastal parks. As part of this process, the CCEM program adopted an ecosystem-based, issue-oriented approach for monitoring ecosystem integrity, working closely in partnership with the USGS-Biological Resources Division. CCEM developed monitoring protocols based on the issues identified in Roman and Barrett's 1999 report *Conceptual Framework for the Development of Long-term Monitoring Protocols at Cape Cod National Seashore.* Not long after, in 2000-2001, the NCBN Monitoring Program was established as part of the newly formed and funded NPS Inventory and Monitoring Program (NPS I&M). The NCBN program extended the Cape Cod CCEM program in that the network built on the same approach developed by Roman and Barrett for the additional seven network parks.

The following report provides a summary of accomplishments for FY12 on inventory and monitoring projects being developed and implemented by the NCBN program (including the CACO CCEM). In FY12, the network received a total of $874,200; this includes $790,000 in Vital Signs Monitoring funding, and $84,200 from the NPS Water Resources Division to assist with the network's estuarine water quality monitoring program. Unfortunately due to budget cuts the network did not receive the additional $200,000 that was provided in FY10-11 for implementation of the *North Atlantic Coastal Parks strategy for enhanced monitoring in light of rapid climate change*. Cape Cod National Seashore received $702,375 for the park's CCEM program.

FY12 Summary

Vital Signs Monitoring continued in FY12 with salt marsh vegetation and nekton monitoring occurring at ASIS, GEWA, COLO, and GATE (SHU). Although two seasonal employees were hired to conduct the monitoring, one backed out of the position at the last minute. All monitoring was completed due to the hard work of the NCBN staff who shared the workload and time in the parks throughout the summer. All monitoring was completed on time as usual, despite this hiring set back. Sediment Elevation (SET) data was collected at 120 SET sampling locations, two times at each location during the year by NCBN biologist, Jim Lynch, with the assistance of other NCBN and park staff. Data were collected in nine parks, including 2 parks in the Northeast Temperate Network and 2 parks National Capital Region Network, respectively. In collaboration with NOAA and USGS, the beginning stages of a SET monitoring protocol was also drafted. The three agencies are working together to develop a protocol that can be adopted widely by other agencies, non-profits and institutions interested in monitoring surface marsh sediment elevation.

The network also developed cooperative agreements with the University of Rhode Island (URI) for marsh bird monitoring implementation and protocol development, the Virginia Institute of Marine Science (VIMS) and the Seagrass Ecology Lab at SUNY Stony Brook in New York for implementation of estuarine nutrient enrichment monitoring. SeagrassNet monitoring occurred at ASIS during three sampling periods in 2012 to better evaluate the cause and effect of stressors, especially those related to climate change. Ocean shoreline position monitoring continued during both fall 2011 and spring 2012 at FIIS, GATE, ASIS, GEWA, and CACO, following the network's published protocol. The protocol was implemented for a second year at SAHI by NCBN staff member Dennis Skidds. In collaboration with the NETN, a weather and climate reporting system and associated SOPs were developed in FY 2012. This work was completed by a term data manager, shared by both networks and stationed with the NETN in Vermont.

Reports and protocols continued to be developed and published in FY12. The network's nekton

monitoring protocol was peer reviewed and published this year, as well as the network's coastal topography monitoring protocol, and annual monitoring data reports (see citation section). A prototype ocean shoreline monitoring trend report was completed and published for ASIS this year. In FY12, the vegetation mapping report for THST was formatted for publication in the NPS Natural Resource Technical Report series, and the NCBN data manager delivered all map products to NC State University for uploading to the USGS VCP website (expected in early FY13). NatureServe continued work on the final report and vegetation map products for ASIS. All reports are available on the NCBN website (http://science.nature.nps.gov/im/units/ncbn/). All reports and associated data products have been uploaded and are available to parks on the NPS NRInfo site (http://science.nature.nps.gov/nrdata/index.cfm). Under the guidance of the NCBN data manager, a STEP student also completed the conversion of park natural resource documents to digital records, uploading them to the IRMA database. Over 1,000 records were created on the IRMA database as part of this project.

Vital signs monitoring on nine protocols was also accomplished at CACO by the CCEM team in FY12. Highlights for this year include: publication of two protocols and four monitoring reports, creation of three new resource briefs, and a first year of implementation of citizen science phenology monitoring in four ecosystem types. After extensive internal review and meetings with NCBN staff and cooperators, the estuarine nutrient enrichment (ENE) data collection at CACO was 100% successful and compliant with the calibration and other quality assurance requirements of the protocol. In addition, CCEM staff, in collaboration with Dr. Hilary Neckles from USGS, completed the 10th year of seagrass monitoring at CACO. Finally, the herp inventory reports for NE Region parks continue to be completed and published in the NRTR series, with the MIMA and SARA reports published for NETN. CACO's natural resource management division chief left in mid-August and the wildlife ecologist (primary author on the herp inventories) became acting division chief for the second time in less than a three-year period. It is anticipated that the acting position will only last through November 2012, pending of course, that a new hire arrives relatively soon after being selected. Ecosystem monitoring at CACO is mostly accomplished by Cape Cod Ecosystem Monitoring staff (wildlife ecologist, plant ecologist, aquatic ecologist, aquatic ecology technician, hydrology technician and research and monitoring coordinator) and seasonal technicians and student interns. Other members of the natural resource division act as protocol leads on air quality and shoreline position monitoring, NCBN staff collect the SET and marsh bird monitoring data for the park.

I. NCBN and CCEM Program Accomplishments

Inventories

- Vegetation mapping report for THST was formatted for publication in the NPS Natural Resource Technical Report series and submitted for publication on the USGS Vegetation Characterization Program (VCP) website. The report can be found in IRMA.
- NatureServe continued work on the final vegetation classification and mapping report and associated products for ASIS; final products are anticipated in FY13.
- NCBN helped support a box turtle inventory being conducted at FIIS (WIFL estate) by University of Rhode Island scientist, Nancy Karraker. Over 150 turtles were captured and marked during a 3-week period during the summer of 2012.
- Inventory of terrestrial reptiles –CCEM staff at CACO conducted inventories for Eastern box turtles, spotted turtles, and eastern hog-nosed snakes through incidental encounters. Inventory work included marking for future recognition, collecting data on size, weight, age, sex, and location, and photo-documentation. In FY12 there were 60 incidental box turtle records, plus 10 encountered during monitoring surveys conducted in collaboration with MA Natural Heritage Program. As a result of this work, CACO region has been designated a "core area" in MA Box Turtle Conservation Plan. In FY 12, seven eastern hog-nosed snakes were also recorded.

Inventory products

- In FY12, the NCBN data manager delivered all THST vegetation classification and mapping products to NC State University for uploading to the USGS VCP website.
- MIMA and SARA herp reports completed and made available on the IRMA website.

NCBN Vital Signs Monitoring

Forest health monitoring (*GEWA, THST, SAHI, COLO*)

- A four-person field crew shared with MIDN implemented the sixth year of forest vegetation monitoring in four NCBN parks (GEWA, THST, COLO, SAHI).
- The NCBN quantitative ecologist collaborated with MIDN to update and refine reference condition criteria for all forest health metrics being monitored in NCBN and MIDN parks.

Ocean shoreline position monitoring (*FIIS, ASIS, CACO, GATE, GEWA, SAHI*)

- Shoreline monitoring (1D) continued with both fall and spring surveys at FIIS, GATE, ASIS, and CACO following the network's NCBN Geomorphological Monitoring Protocol-Phase I Shoreline Position.
- Rutgers cooperators completed 1D, 2D, and 3D surveys at GATE in Fall 2011 and Spring 2012 and maintained survey monuments throughout GATE.
- NCBN cooperators continued to interact with refuges in Region 5 USFWS to apply the

Shoreline Position and Coastal Geomorphological Protocols. They also visited sites to help set up and install monuments and assisted in conducting the surveys. A presentation was made at Waquoit Bay National Estuarine Research Reserve on the NCBN protocols for shoreline monitoring (1D) and Coastal Topography (2D, 3D).

Coastal topography monitoring (FIIS, ASIS, CACO, GATE, GEWA)

- Collaboration continued with scientists from Rutgers University to develop the second phase of protocols for monitoring shoreline and beach and dune topography. Revisions following external peer review were completed, and the protocol was formatted and published in the NPS Natural Resource Technical Report series.
- In FY12, four GeoCorps interns were sited at Sandy Hook to work on aspects of the coastal geomorphological monitoring program conducted throughout the NCBN, one of the interns was on a continuation appointment from the previous year, one of the interns was on a 'diversity appointment'. The interns assisted in conducting 1D, 2D, and 3D field surveys according to established protocols with GPS equipment, and they also assisted in data processing and data analysis in the production of annual and trend reports for Gateway NRA, Fire Island National Seashore, and Assateague Island National Seashore.
- The NCBN data manager continued database development in support of the NCBN Coastal Topography Monitoring program.
- CACO acquired and extracted topo-bathy LIDAR data for 190 profiles including 24 lines proposed in the draft protocol (US Army Corps of Engineers CHARTS/SHOALS LIDAR data - 2007 and 2011).
- CACO conducted pilot field surveys of 20 coastal profiles proposed in the draft 3D topographic monitoring protocol in cooperation with Dr. Mark Borrelli of the Provincetown Center for Coastal Studies and Geologist in the Park Rachael Dye.

Marsh Bird monitoring *(NCBN, NETN, NCRN coastal parks)*

- NCBN continued collaboration with the University of Rhode Island to adapt the USGS marshbird monitoring protocol to the NCBN monitoring program. A completed protocol is due to be published in FY13.
- Marshbird monitoring was conducted by a combination of volunteers, park staff, and partners at ASIS, GATE, FIIS, and CACO sampling sites in conjunction with a regional partnership effort investigating marsh bird populations throughout the northeast (SHARP, http://www.tidalmarshbirds.org/). The NCBN marsh bird monitoring lead completed SHARP training and began collecting the data for the CACO CCEM.
- The NCBN quantitative ecologist worked in conjunction with URI scientists and network staff to develop probability based sampling designs for marsh bird monitoring in future years. These sampling designs are in agreement with current monitoring being conducted

by regional partnership effort investigating marsh bird populations throughout the northeast (SHARP, http://www.tidalmarshbirds.org/). By developing sampling designs that are compatible with work being done by SHARP, the network meets a rigorous peer reviewed standard for sampling and will collect data with inherent added value because of their compatibility with a larger regional dataset.

- The NCBN marsh bird monitoring lead completed ground-truthing sampling points at CACO, ASIS, and COLO in order to complete the sampling designs for these parks.
- The NCBN marsh bird monitoring lead attended the annual SHARP meeting in January 2012. Representing the NCBN, the employee made contacts throughout the region to assure that the NPS I&M program played a major role in the data collection of this region-wide program.

Salt marsh vegetation and nekton monitoring (*ASIS,GEWA,COLO,GATE (SHU), CACO*)

- 2012 was the third year that salt marsh monitoring was conducted at ASIS, COLO, and GEWA (initiated in 2008) and the second year of data collection at GATE-SHU (initiated in 2010).
- One East Carolina University graduate student hired through the Student Temporary Employment Program (STEP) was stationed at ASIS and completed the sampling under the supervision of NCBN staff. Data entry for the 2012 field season has been completed. Data will undergo quality control procedures prior to analysis for the annual data summary reports.
- All data from the 2011 sampling season at FIIS and SAHI have been summarized in the annual data summary reports.
- The network quantitative ecologist greatly improved the efficiency of summarizing annually collected data by writing scripts to automate this process as well as detailed SOPs on how to use these scripts. She also worked extensively with the database manager to improve how annually collected data output from the database. Together, these improvements mean that detailed annual quantitative summaries can now be created very easily and efficiently by both NCBN and CCEM staff.
- CACO nekton sampling was accomplished by the park's CCEM program. CACO estuaries sampled in 2012 included: East Harbor, Moon Pond, Hatches Harbor, Nauset Marsh, and West End Marsh. CCEM staff continues to work with NCBN to analyze Salt Marsh Nekton data and to present and publish the results.

Salt marsh elevation monitoring *(NCBN Parks CACO, GATE, FIIS, ASIS, COLO; NETN Parks ACAD,BOHA; NCRN Parks NACE,GWMP)*

- NCBN SET monitoring lead, James Lynch, continued salt marsh elevation monitoring (accretion and elevation change) and other related activities at salt marsh surface sediment

elevation table (SET) stations at NCBN, NETN, and NCRN sites.

    - The 80 SET monitoring stations at five NCBN parks (GATE, FIIS, CACO, ASIS, COLO) were sampled in the fall and spring in FY12. At COLO, 12 new SET's were installed in March of 2012 and the first measurements taken in April.
    - The 19 SET stations at two NCRN parks (NACE, GWMP) were sampled in the fall and spring of FY12 in collaboration with NCRN colleagues.
    - The 21 SET stations at two NETN parks (BOHA, ACAD) were sampled in the fall and spring of FY12 with the support of NETN colleagues.
- Water level recorders were deployed at ASIS, GATE, FIIS, and BOHA during FY12. These are used to characterize the tidal patterns and differences in marsh flooding at the various SET sampling stations in each park. The intent is to install these seasonally at all the SET sites at each of the parks.
- Collection of elevation data using network survey equipment occurred at the following parks – ASIS, GATE, FIIS, CACO, BOHA, GWMP, NACE. NCBN Staff also participated in a Height Modernization Survey at ACAD which was used to determine the position of new geodetic benchmarks installed in the park. Four SET benchmarks (one at each of four marshes) were also included in this survey.
- Work on the SET monitoring protocol continued in FY12. The SET lead collaborated with colleagues and co-authors Dr. Don Cahoon (USGS) and Dr. Philippe Hensel (NOAA) via conference call, email, and face-to-face meetings to develop the main narrative of the protocol, completing the first draft in FY12. He also worked closely with NCRN data manager, Geoff Sanders, on improving the SET database and NCBN statistician, Dr. Penelope Pooler, on the development of statistical analyses of SET data.
- An overview of the SET protocol was presented at INTECOL9, the International Wetlands Conference in Orlando, FL in June 2012.
- NCBN SET lead assisted NOAA colleagues with a SET project at Waquoit Bay NERR in Massachusetts. This study is investigating the relative stability of SET benchmarks sunk to different depths. These results will help to provide the first quantitative comparisons on the relative stability of SET benchmarks and will be an important part of the SET protocols currently being developed.
- NCBN SET lead trained Academy of Natural Science of Drexel University, Barnegat Bay Partnership, and Partnership for the Delaware Estuary researchers on collecting accretion samples with the cryogenic coring system at John Heinz NWR in Philadelphia, PA.
- The network quantitative ecologist revised previous analyses of all SET data so that network

analyses are in agreement with methods developed by SET scientists and collaborators. As a product of this work, the quantitative ecologist wrote data summary and analysis scripts that will be included in the final SET monitoring protocol.

- With the assistance of CCEM staff, SET measurements at CACO were collected in fall and spring by NCBN staff. NCBN continued to measure all 22 established SET sites in three CACO estuaries: Hatches Harbor, Herring River/Wellfleet Bay, and Nauset Marsh.

Weather and climate data compilation and synthesis

- A weather and climate project was initiated and a database, analytical procedures, and detailed SOP's for reporting weather and climate status and trends were produced. Reports will be prepared for NETN, NCBN, and selected NCRN parks in FY13.

NCBN Water Quality Monitoring

Funds transferred to the NCBN from the Water Resources Division paid for approximately one third of the NCBN water quality monitoring effort in FY12. CCEM staff continue to collect water quality data at CACO following the NCBN ENE monitoring protocol. NCBN provides equipment support as needed to CACO, and, in return, the park continues to handle the analysis of all NCBN chlorophyll *a* samples.

Estuarine nutrient enrichment (ENE) monitoring (*FIIS, CACO, GEWA, COLO, ASIS*)

- NCBN staff continued work with USGS scientists on a large NCBN estuarine water quality analysis and synthesis project funded through the USGS NPMP. The project working group made significant gains toward certifying all NCBN water quality data to standards specified in the network protocol and developing new water quality data analysis and summary tools.
- As part of the NPMP funded collaboration, the network quantitative ecologist developed statistical trend models for water quality data that provide trend information based on available data at all NCBN parks as well as a standardized methodology that can be used in future years.
- NCBN collaborators from the Virginia Institute of Marine Sciences (VIMS) continued to collect water quality data for the NCBN based on the network's Estuarine Nutrient Enrichment (ENE) protocol. This year the monitoring index period at ASIS occurred during the four week period of August 8 through August 30, 2012. In order to adhere to protocols and due to the large area of Chincoteague Bay, the system had to be sampled over a two-day period each week. All stations were successfully sampled. Chlorophyll samples were sent to Cape Cod National Seashore North Atlantic Coast Laboratory for analyses. Results have been returned to VIMS. Digital copies of all data were created. A continuous water quality monitoring station was also deployed and maintained by the ASIS park staff during this

index period. No data reduction has yet occurred.

- VIMS collected ENE water quality data at COLO, with the monitoring index period occurring during the fourweek period of July 3 through July 26, 2012. A continuous water quality monitoring station (LS), using a NPS-owned YSI 6600 Multi-Parameter Water Quality Logger upgraded with two wiped LiCor PAR sensors, was deployed and maintained by VIMS staff during this index period. This instrument was retrieved, cleaned, calibrated, and re-deployed approximately two weeks after the original deployment. During the cleaning and re-deployment procedure the continuous monitoring station was without an instrument for less than 24 hours. In order to adhere to protocols, monitoring of COLO occurred over a two-day period due to the measurements in two different strata: the estuarine stratum and the tidal creek stratum. All stations were successfully sampled. Chlorophyll samples were sent to Cape Cod National Seashore North Atlantic Coast Laboratory for analyses. Results have been returned to VIMS. Digital copies of all data were created. No data reduction has yet occurred.
- CACO staff conducted the ENE monitoring during four-week index periods for each of three strata within CACO (Pleasant Bay, Nauset Marsh, and salt ponds). All 2012 data were entered into the NCBN database.
- CACO Physical Scientist completed chlorophyll analyses for CACO, as well as NCBN parks ASIS, COLO, and GATE for the ENE protocol in 2012. All data and controls were submitted to the respective cooperators as well as the NCBN Program and Data Managers.
- Additional surface water samples were collected at CACO during each sampling event and will be analyzed by CACO Physical Scientist at the ARC analytical for dissolved and total nutrients (NO3, NH4, PO4, total P, and total N). 2011 water samples were analyzed for nutrients at the North Atlantic Coastal Laboratory's Atlantic Research Center's analytical lab (110 samples).
- With newly QA/QC'd data, CACO Aquatic Ecologist began analysis of CACO water quality data with a focus on relating water column measurements to watershed characteristics. This work is a collaboration with Dr. Hilary Neckles and James Caldwell from USGS, Bill Monahan from NPS, and CACO staff.

Seagrass monitoring *(CACO, ASIS)*

- To better evaluate the cause and effect of stressors, especially those related to climate change, two additional SeagrassNet surveys were sampled by VIMS staff this year. VIMS personnel travelled to ASIS and successfully performed a fall, spring, and summer SeagrassNet survey. The fall survey occurred on October 5, 2011, the spring survey on April 24-25, 2012 and the summer survey on June 25-26, 2012. Biomass samples were

collected and processed. TidbiT (Onset, Inc.) temperature loggers were retrieved and new ones deployed. Sediment and voucher specimens were also collected. An additional trip was conducted on January 26, 2012 in order to switch out the TidbiT temperature loggers. A continuous water quality monitoring station was also deployed and maintained by ASIS staff during each of the survey periods. All data have been added to the SeagrassNet data base.

- Monitoring by CCEM staff in cooperation with Dr. Hilary Neckles continued at CACO in Pleasant Bay and Duck Harbor for the tenth consecutive year following the NCBN protocol. All 2012 data were entered into the NCBN database.

CCEM Vital Signs and Water Quality Monitoring

Note: *The following monitoring protocols and information have been developed by the CCEM. Funding for this work at CACO is solely supported through the CCEM budget.*

Kettle pond monitoring(Water Quality)

- Continued to collect water quality data from 20 kettle ponds, as well as hydrologic measurements of pond stage at 10 primary ponds bi-weekly from March through November and 10 secondary ponds seasonally. Monitored chlorophyll *a* concentrations of surface water grab samples as a means of detecting seasonal and inter-annual changes in trophic status. Processed all 2011 water samples for nutrients (NO3, NH4, PO4, total P, and total N), anions (chloride and sulfate), and chlorophyll *a* in the Atlantic Research Center's analytical lab (160 samples for nutrients, 40 for anions, and 360 for chlorophyll), and sent 2008-2012 water samples for cation analysis (Na, K, Ca, Mg) to outside laboratories (260 samples).
- Worked with USGS Massachusetts Water Resources Center to finalize software developed by USGS (with NPS funds) to analyze water quality data from kettle pond monitoring.
- Conducted an analysis of water clarity data from the 10 primary kettle ponds to better track seasonal and annual trends, and began analysis of long-term dataset using USGS software.
- Continued a comprehensive QA/QC review of kettle pond water quality monitoring data. This included analysis of a multi-decadal long data set, which required several method comparison experiments. Conducted methodology research and testing in support of refining the protocol. Protocol will be sent out for external peer review in FY13.

Kettle pond monitoring(Vegetation)

- The kettle pond vegetation monitoring protocol was finalized and published as an official protocol (see section IV).
- Completed draft report analyzing changes in kettle pond vegetation from 1995 to 2010. A NRTR published report is anticipated by the end of FY13.

Hydrology and ground water quality monitoring

- Final draft of the Long Term Hydrologic Monitoring of Coastal Ecosystems Protocol in Oakley et al., 2002 format was published in NRTR format (see monitoring products and full citation in section IV) and incorporated into IRMA.
- Continued implementation of the ground water and pond stage portion of the hydrology monitoring protocol (McCobb and Weiskel 2003), including six wetland observation wells. The wetland wells are instrumented with continuous water level loggers and are monitored on a bi-monthly basis.
- With assistance from an AmeriCorps member, CCEM staff collected streamflow data from eight stream gage sites. Continuous water level loggers were deployed in fall of 2010 to collect continuous stage measurements while collecting streamflow data weekly. Those loggers were removed in fall 2012 and the site locations and recommendations for future monitoring were reassessed by NPS Water Resources Division with the help of staff from the Water Rights Branch in Fort Collins, CO. A final report summarizing WRD recommendations is expected in FY13.
- GIS based analysis of 11 years of groundwater level and pond stage data with respect to surrounding landscape and soils was undertaken. In addition, analysis of correlations between groundwater monitoring data from nearby wells was conducted to assess whether some wells could have reduced monitoring effort based on high correlations with other wells within the same lens. An updated version of the internal report was drafted and will be presented to staff in FY13.
- Continued coordination with NPS WRD to plan migration of CCEM hydrology data to the Aquarius database and data management system.

Vernal pool and dune slack wetland vegetation monitoring

- Results of 2011 forested vernal wetland vegetation surveys were analyzed and summarized in an NRTR formatted report.
- Progress of Gallerucella beetle control of purple loosestrife in Great Pond, Province Lands was re-assessed.
- A draft dune slack wetland vegetation monitoring protocol was produced in FY12 and is expected to be published as an official protocol in FY13.

Amphibian monitoring

- CCEM staff conducted the ninth year of long-term amphibian monitoring.
- Egg masses of spotted salamanders and wood frogs were counted three times at each of 40 vernal ponds over a sixweek period in early spring. Data on within-pond habitat structure were also collected. Adjacent landscape habitat data from within a 1000 m buffer were extracted via GIS.

- Thirty ponds park-wide were sampled for calling anurans one night/week on 16 occasions, from mid-spring until mid-summer.
- Water samples were collected from all 64 amphibian monitoring sites and analyzed at the Atlantic Research Center's analytical lab for pH, alkalinity, conductivity, color, chloride, and sulfate.
- Collected and entered hydrology data (pond stage) monthly at all 40 vernal ponds being monitored.
- Entered and proofed all 2012 data, and performed preliminary tabulation and trend analysis of all long term data on egg mass counts. Calling survey data have been tabulated and files for analysis with program PRESENCE have been created.

Aquatic turtle monitoring

- Continued to monitor spotted turtles through incidental encounters. Four individuals were recorded, including one originally marked in 2005.

Dune grassland vegetation

- A report summarizing 2011 survey data and changes since 2005 is in final review for publication as an NRTR formatted report (see section IV).

Coastal forest vegetation monitoring

- The Forest Vegetation Monitoring protocol was implemented and was the first follow-up survey that tracked the growth and health of individual trees since they were initially tagged in 2003. Data were collected on tree, shrub, and ground-layer vegetation in 42 plots across CACO. A baseline set of soil samples were collected from each site and analyzed for particle size fractionation and organic matter content. Soil subsamples will be sent to an outside laboratory for nutrient analysis in FY13. All plot marker and tree tags were replaced with sturdier, long-lasting materials.

Land bird monitoring

- CCEM staff received a partial report from the University of Massachusetts cooperator on landbird point count surveys; work continued to facilitate completion of report and protocol. A draft is expected by end of CY 2012.

Meteorologic, atmospheric deposition, and air quality monitoring

- CCEM staff continued to implement the meteorologic and atmospheric monitoring program and served as site operators and/or site supervisor for participation by and communication among the following partners and cooperators: USGS, NPS Air Resources Division (ARD), the National Atmospheric Deposition Program-National Trends Network (NADP-NTN) and the University of Illinois for precipitation and wet deposition chemistry, the National Atmospheric Deposition Program-Mercury Deposition Network (NADP-MDN) and Frontier Geosciences for wet mercury deposition, the Interagency Monitoring of Protected

Visual Environments Program (IMPROVE) at UC Davis for aerosols, the Commonwealth of Massachusetts (MA DEP) for ozone and primary pollutants, and UMASS-Amherst for Acid Rain Monitoring (ARM) in surface waters. Weekly precipitation data were also collected at the Belfort rain gage located adjacent to Duck Pond.

- CACO is hosting a year-long deployment of the US Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility. In addition to the standard ARM instrument configuration, a Mobile Aerosol Observing System, and a two column aerosol program (TCAP) are quantifying aerosol properties, radiation, and cloud characteristics on a coastal bluff in the Highlands Center. The TCAP project is also conducting paired flights over land and sea to assess aerosol properties and dissipation in order to fill key knowledge gaps related to understanding of how aerosols and clouds evolve and affect climate. For more information see: http://campaign.arm.gov/tcap/

Cover-type change monitoring

- CACO has been cooperating with U Mass to test methods for creating a repeatable land cover change map. A report on results of supervised classification using the Random Forests method for landcover change analysis was received, reviewed, and is undergoing revision as an NRTR formatted report. A manuscript on this project has been published in the journal "Remote Sensing of the Environment" (see section IV).
- These and other land cover classification methods are being tested in workplans for several 2013-2015 baseline mapping studies for tidal wetland restoration and vulnerability assessments.

NCBN and CCEM Monitoring products

- The NCBN Coastal Topography protocol was finalized and published.
- The NCBN Nekton protocol was finalized and published.
- Annual salt marsh vegetation and nekton monitoring reports were published in the NR Technical Report Series for ASIS, COLO, FIIS, WIFL, and SAHI.
- A prototype trend report was published for ASIS Ocean Shoreline Monitoring.
- Initiated Climate and Weather Data Synthesis and Reporting –a joint effort among NCBN, NETN, and NCRN. A draft ASIS report was completed.
- SET monitoring protocol development was initiated and a draft narrative written by NCBN, NOAA and USGS scientists was completed.
- A Climate Change monitoring resource brief was developed for the network.
- Forest Health monitoring annual report was completed for COLO, GEWA, and SAHI.
- R Scripts were developed to automate synthesis of annual salt marsh vegetation and nekton data.

- The Coastal Forest Monitoring protocol, which builds on historical data at CACO and is similar to other forest monitoring protocols in the NE region, was reviewed and approved by the regional program manager and published.
- The Kettle Pond Vegetation Monitoring protocol, which also builds on some historical monitoring data at CACO, was also reviewed and published.
- A draft dune slack vegetation monitoring protocol for CACO was developed and is expected to be published as an official protocol.
- A report on CACO's dune grassland vegetation monitoring was completed and is being formatted for publication in the natural resource technical report series.
- A draft report analyzing changes in CACO's kettle pond vegetation from 1995 to 2010 was completed. A natural resource technical report is anticipated by the end of FY13.
- Results of 2011 forested vernal pool vegetation surveys at CACO were analyzed and summarized as natural resource technical report.

NCBN Data Management, Information Transfer, and Support to Park Management and the Public

- NCBN internet and intranet websites were updated and revised. NCBN data manager began collaboration with WASO staff to convert the network website to the new NPS branding template. Final conversion expected in FY13.
- A STEP student from the University of Rhode Island was managed by the NCBN Data Manager to aid NCBN and MIDN parks in entering reference records into the NRInfo portal using current IRMA standards. The student 1) created reference records for documents pertaining to park natural resources; 2) verified the records' relevance to the park; and 3) communicated with park staff to obtain/scan/upload digital versions of reports. Over 1000 IRMA records were successfully added by this project.
- The NCBN Data Manager and NER GIS Coordinator co-taught a graduate-level course, "Advanced Spatial Analysis," for the University of Rhode Island's Natural Resources Science Department. The course culminated with a multi-day "SWAT Team" event at Fire Island National Seashore, during which the class collected actual data in support of the park's natural and cultural resource monitoring programs.
- In Jan. 2012, the NCBN Data Manager was chosen to represent the NPS Inventory and Monitoring Program on the NPS GIS Council (GISC). His role will be to represent the geospatial needs of the 32 I&M Networks to the council and provide insight on the needs and direction of Network monitoring activities.
- The NCBN Data Manager served as a collaborator on a USGS Park Monitoring Project initiated by USGS Cooperator Hilary Neckles and NCBN Quantative Ecologist Penelope

Pooler to synthesize all NCBN water-quality data into information relevant to NPS management and decision making at local and regional scales. The Data Manager designed database utilities for enhanced data export, synthesis, and reporting.

- The NCBN quantitative ecologist taught a graduate level statistics course at the University of Rhode Island in the spring of 2011 that focused on statistical methods for ecological research.
- The NCBN network quantitative ecologist taught a two day intensive workshop at CACO on how to use R, a free and very powerful language and environment for statistical computation and analysis. This workshop was very positively received by CACO staff.
- The NCBN network quantitative ecologist completed worked with Eva DiDonato of the NPS Water Resources Division to provide a detailed review of water quality data collected by Dowling University at FIIS.

II. Public Interest Highlights

VITAL SIGNS MONITORING OF ESTUARINE CONDITIONS OVER MULTIPLE SCALES

In collaboration with the Virginia Institute of Marine Science (VIMS), a research paper was presented at the 21st Biennial Conference of the Coastal and Estuarine Research Federation, 6-11 November 2011, entitled "Vital signs monitoring of estuarine conditions over multiple scales at three Virginia national parks in the National Park Service Northeast Coastal and Barrier Network", by B.B. Neikirk, K.A. Moore, H.A. Neckles, J. M. Caldwell, D. Skidds, and S. Stevens. The analyses concluded that implementation of Vital Signs Monitoring at ASIS, COLO, and GEWA is providing a useful tool for assessing system conditions. Initial monitoring results indicate: daytime near-bottom dissolved oxygen concentrations were good at all three parks; chlorophyll *a* exhibited high concentrations throughout most of the estuaries, suggesting eutrophic conditions exist; Water clarity in these shallow water systems is problematic for submersed benthic plant growth during summer monitoring periods. Seagrasses at ASIS showed a decreased in biomass and abundance between 2010 and 2011 possibly reflecting the effects of unusually high summertime water temperatures in 2010. Estuarine systems in all three monitored areas appear under stress related to high phytoplankton levels and low light availability. Climate effects may be exacerbating these stresses especially in the ASIS coastal seagrass habitat where the submersed plants dominated by eelgrass (*Zostera marina*) in this Chincoteague Bay region are very sensitive to high summertime water temperatures and elevated turbidities.

NCBN AND NER STAFF OFFER ADVANCED SPATIAL ANALYSIS COURSE

The NPS's NCBN Data Manager and NER GIS Coordinator developed and co-taught a graduate-level course on the theory and application of Global Positioning System (GPS) technology for the University of Rhode Island's Natural Resources Science Department during the spring 2012 semester. The course offered a hands-on introduction to the use of GPS for navigation and data-collection and culminated with a multi-day "SWAT Team" event at Fire Island Natural Seashore, during which the class collected actual data in support of the park's natural and cultural resource Monitoring programs.

NCBN STAFF WORK WITH LOCAL HIGH SCHOOL STUDENTS TO DEVELOP A VOLUNTEER MARINE INVASIVE SPECIES MONITORING PROGRAM

The presence of non-native, aquatic invasive species or "bioinvaders" has emerged as a major environmental and economic threat to coastal areas. Staff from the Northeast Coastal and Barrier Network are working with local Rhode Island high school students to develop a marine aquatic invasive species monitoring program that will be implemented as part of a citizen-science program in NCBN parks. The program will first be implemented at Cape Cod National Seashore and eventually expanding to other parks in the network. The project will include curriculum for high school students that can be made available to park interpreters and teachers based on existing curriculum developed by Cape Cod NS.

NEW COURSE CURRICULUM FOR UNIVERSITY FRESHMAN ON THE ECOLOGY OF THE NATIONAL PARKS

The Northeast Coastal and Barrier Network program manager has teamed up with professors from the University of Rhode Island, Natural Resource Science department to develop a new course curriculum called Ecology of the National Parks. Much of the curriculum involves real-life examples from the Inventory and Monitoring Networks from around the country, including the Northeast Coastal and Barrier Network. The plan is to take students to visit one of the coastal parks in the Northeast Region to experience field monitoring and its implementation.

MULTIPLE AGENCIES COLLABORATE ON THE DEVELOPMENT OF A PROTOCOL TO MEASURE AND MONITOR SALT MARSH SEDIMENT ELEVATION

Scientists from the Northeast Coastal and Barrier Network are working collaboratively with scientists from the USGS, USFWS, and NOAA to develop a monitoring protocol that measures surface elevation in tidal wetlands. These data will be key to understanding how coastal park

lands are keeping up with sea-level rise. Sediment elevation data (SET) have been collected by many groups both nationally and internationally, but no single monitoring protocol has been used or developed collectively. This partnership will assure data collected by all parties will be standardized as closely as possible, allowing for data comparisons both locally, regionally, and nationally.

SYNTHESIS AND ANALYSIS OF ESTUARINE WATER QUALITY DATA AND THE DEVELOPMENT OF A DATA PRESENTATION TOOL

NCBN staff are currently collaborating on a two-year, NPMP-funded project with USGS and EPA scientists to synthesize and analyze 10 years of NCBN estuarine water quality data collected in six parks. Part of this project includes the development of a data presentation tool in Excel that can be easily used and incorporated into the NCBN water quality monitoring program as well as individual park water quality monitoring programs. All NCBN water quality data are being analyzed on a park-by-park basis, but also on a region-wide basis as part of the EPA National Coastal Assessment.

GEOCORPS AMERICA PROGRAM PROVIDES VALUABLE ELEVATION SURVEYS FOR RESOURCES AT RISK

CACO has a need for extensive amounts of coastal surveying as part of testing the NCBN coastal topography protocol as well as assessing elevation loss in salt marshes that are experiencing severe vegetation dieback. Using funds provided by the NCBN, CACO has been able to host a GeoCorps intern for the second consecutive year. The interns have been trained in surveying with both real time kinematic and total station equipment. The 2012 GeoCorps intern will present results from coastal topography surveys at a scientific meeting and plans to present dieback survey results at the Geological Society of America meeting next spring. A comparison of detailed elevation surveys of a marsh dieback area from 2011 and 2012 has revealed hotspots of substantial erosion and a landward retreat of Spartina patens, a species that is typically only found at higher elevations. Importantly, these back to back surveys will provide a basis for accuracy comparison between real time kinematic, total station and LiDAR elevation data in a rapidly eroding salt marsh. Evaluating and quantifying elevation changes in salt marshes is a vital information need for coastal parks as managers continue to assess the vulnerabilities of their natural and cultural resources due to sea-level rise.

CONTINUOUS NITRATE MONITORING TECHNOLOGY USED IN FRESHWATER KETTLE POND AND ESTUARINE SALT POND

In fall of 2012, CCEM had the opportunity to field test a newly developed continuous, unattended nitrate sensor. This tool can be used in either freshwater or saltwater ecosystems and has demonstrated its utility for water quality applications in both systems. For one month, the SUNA instrument was deployed in one of the most populated and heavily used kettle ponds, Gull Pond. Later, it was placed in Salt Pond, site of the main CACO visitor center, and an area that is characterized by high visitor use, excessive nutrients, and harmful algal blooms. The data from the SUNA sensor will be compared to values derived from traditional nutrient analysis methods (water column and sediment samples) to test correlation. If comparable values are obtained, CCEM will explore the feasibility to incorporate continuous nitrate monitoring into the kettle pond monitoring protocol. Additionally, potential to add this sensor to the estuarine nutrient enrichment monitoring protocol will be explored in conjunction with NCBN and protocol authors.

III. Staffing

NCBN Board of Directors

Trish Kicklighter, ASIS
George Price, CACO
P. Daniel Smith, COLO
Chris Soller, FIIS
Linda Canzanelli, GATE
Lucy Lawliss, GEWA/THST
Tom Ross, SAHI
Sara Stevens, NCBN Program Manager
Mary Foley, Chief Scientist Northeast Region
John Karish, I&M Program Manager Northeast Region

Northeast Coastal and Barrier Network Staff

Sara Stevens-NCBN Program Manager,
Dennis Skidds-NCBN Data Manager
Kevin Morris-Term Data Manager (Position shared with NETN-Currently vacant)
Penelope Pooler-NCBN Quantitative Ecologist
Erika Nicosia-NCBN Biologist (Salt Marsh)
James Lynch-NCBN Biologist (SET)

Dana Filippini-NCBN Biological Science Technician (Marsh birds)
Joshua Borgoyne, NCBN Biological Science Technician (STEP student)
Casey Nolan, STEP student-seasonal (Marsh monitoring)
GeoCorp Interns: Monica Patel, Michael Towle, William Schmelz

Cape Cod National Seashore CCEM Staff

Shelley Hall, Natural Resource Management Division Chief (position currently vacant)
Megan Tyrrell, Research and Monitoring Coordinator*
Robert Cook, Wildlife Ecologist, Acting Natural Resource Management Division Chief*
Stephen Smith, Plant Ecologist*
Sophia Fox, Aquatic Ecologist*
Kelly C. Medeiros, Hydrology technician*
Lisa Nicholson, Budget technician
Krista Lee, Physical Scientist
Judith Oset, Physical Science technician
Holly Bayley, Aquatic Ecology technician*
Mark Adams, GIS Specialist
Mary Hake, Natural Resource Specialist
Nuray Taygan, Shorebird technician
Seasonal technicians for: Vegetation monitoring*, Amphibian monitoring* and Science Communication (1 each)
Student Conservation Association interns* for: Vegetation monitoring, Amphibian monitoring (2), Kettle Pond Water Quality and Salt Marsh Nekton monitoring (3)
GeoCorps Intern*, Rachael Dye
French Volunteer, Anne Ribereau-Gayon

** majority of salary funded by Cape Cod Ecosystem Monitoring funds*

NCBN Technical Steering Committees

Note: The original NCBN Technical Steering Committee has been disbanded and new "protocol" specific technical steering committees are being developed for: shoreline monitoring, salt marsh monitoring, and water quality monitoring.

Estuarine Water Quality Monitoring Members:
Sophia Fox, CACO (Lead)
Kelly Medieros, CACO
Penelope Pooler, NCBN
Sara Stevens, NCBN
Dennis Skidds, NCBN
Hilary Neckles, USGS
Kenneth Moore, VIMS
Brad Peterson, SUNY
Brian Sturgis, CACO

SET Monitoring
James Lynch, NCBN (Lead)
Sara Stevens, NCBN
Geoff Sanders, NCRN
Tony Curtis, SECN
Phillipe Hensel, NOAA
Don Cahoon, USGS
Charles Roman, NPS CESU
Bill Thompson, USFWS
Sue Adamowicz, USFWS
Bill Crouch, USFWS
Laura Mitchell, USFWS

Salt Marsh Vegetation and Nekton Monitoring (initial invitees)
(Group has not met yet)
Erika Patenaude, NCBN (Lead)
Sara Stevens, NCBN
Charles Roman, NPS CESU
Mary-Jane James-Pirri, URI
Megan Tyrell, CACO
Cathleen Wigand, EPA

Key NCBN Contractors and Cooperators

Rutgers University, Dr. Norbert Psuty, Institute of Marine and Coastal Sciences
USGS, Dr. Don Cahoon, Patuxent Wildlife Research Center, Laurel, MD.
USGS, Dr. Hilary Neckles, Patuxent Wildlife Research Center, Augusta, ME
University of Rhode Island, Natural Resources Science Department (NRS), Dr. Nancy Karraker and Research Associate Carol Trocki, Research Assistant Robin Baranowski
University of Rhode Island, URI Environmental Data Center, Dr. Peter August (NRS faculty), Research Associates Charles LaBash, Roland Duhaime, and Greg Bonynge.
State University of New York, Stony Brook, Dr. Brad Peterson, School of Marine and Atmospheric Science
Virginia Institute of Marine Science-Dr. Kenneth Moore

Key CCEM Contractors and Cooperators

Dr. Donald Anderson, Woods Hole Oceanographic Institution (harmful algal blooms)
Rachel Bolus, University of Massachusetts, Amherst (common yellowthroat communication)
Dr. Mark Borrelli, Provincetown Center for Coastal Studies (geomorphology and sea floor mapping)
Dr. Barbara Brennessel, Wheaton College, (diamondback terrapin ecology and genetics)
Scott Buchanan, Montclair State University (hog-nosed snake ecology)
Dr. Raymond Clarke, Sarah Lawrence College, (box turtles)
Dr. John Colman, US Geological Survey (nutrient loading to estuaries)
Richard Couse, Antioch College of New England (hog-nosed snake behavior and ecology)
Dr. Julie Ellis, Tufts University Veterinary School (common eider die-off)

Lori Erb, Massachusetts Natural Heritage Program (box turtle monitoring and radio- telemetry)
Mark Faherty, University of Massachusetts, Amherst (landbird point-count protocol)
Gwen Gerber, NPS Water Rights Branch (hydrology monitoring)
Dr. Graham Giese, Provincetown Center for Coastal Studies (geomorphology and tides)
Dr. Howard Ginsberg, USGS, PatuxentWRC (lyme disease ecology and vectors)
Dr. Curtice Griffin, University of Massachusetts, Amherst (landbird point-count protocol)
Dr. Mary Jane James-Pirri, URI (horseshoe crab ecology)
Larry Martin, NPS Hydrogeologist (hydrology monitoring)
Agnes Mittermayr, visiting PhD student, GEOMAR, Germany (seagrass food web study)
Dr. Hilary Neckles, USGS (seagrass surveys)
Dr. Allan O'Connell, USGS, Patuxent WRC (meso-mammal protocol)
Jane Rose, MA Dept. Environmental Protection (monitoring mercury in fish)
Carol Trocki, URI-NCBN (marsh bird monitoring)
Dr. Rachel Thiet, Antioch College of New England (soft-shell clams, salt marsh vegetation. ant-*Corema* interactions)
Brad Timm, University of Massachusetts, Amherst (spadefoot toad ecology, landcover change)
Dr. Todd Tupper, Northern Virginia CC (chytrid fungus surveys)
Dr. Marcus C. Waldron, USGS (Kettle pond trend analysis)
Dr. Betsy Von Holle, Univ. Central Florida (coastal heathland vegetation)

IV. Reports, Publications, and Presentations (FY12)

NCBN

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Tyrrell, M.C. 2012. Ecads: overlooked ecosystem engineers of north temperate salt marshes. Brown University coastal ecology class. Atlantic Research Center classroom, Cape Cod National Seashore.

V. Status of monitoring protocols being developed by the Northeast Coastal and Barrier Network (see table following budget page)

VI. Connect the Dots – Vital Signs Supporting Table for each Park

The "Connect the Dots" effort is a strategic, long-term framework (over a period of years to decades) for coordinating the efforts of the I&M Networks, Park Natural Resource Condition Assessments, park planning (e.g., Foundation Statement, General Management Plan, Resource Stewardship Strategy), park-funded monitoring and research relevant to assessing natural resource condition, and other research and monitoring efforts. As part of this effort, a Natural Resource Summary Table will eventually be developed for each park as part of the park's Resource Stewardship Strategy document. The Natural Resource Summary Table framework demonstrates the connection of science to management through the planning process. See Connect the Dots Memo and the Connect the Dots Intranet Website for more information and example documents.

Each I&M network is required to develop a Vital Signs Supporting Table for each park, which will feed into the larger Natural Resource Summary Table. The spreadsheets listed for each park at the link below summarize the key measures of resource condition that the NCBN will routinely provide data for as part of core duty of measuring the condition of selected park resources. If a park Superintendent or Chief of Natural Resources requests assistance from network staff to populate additional rows and columns of the Natural Resource Summary Table,

network staff will contribute data and expertise to the extent that data and staff time are available.

The NCBN has spent a great deal of time and effort to revise and update these tables for each of the parks. Thresholds for each measure were carefully researched in the literature and discussed among experts in that particular field.

Link to NCBN park specific tables:
http://science.nature.nps.gov/im/units/ncbn/annual_report_FY12.aspx

VII. Budget - FY2012 Annual Report Narrative

This year the NCBN received a total of $874,200; this includes $790,000 in Vital Signs Monitoring funding and $84,200 from the NPS Water Resources Division to assist with the network's estuarine water quality monitoring program. Approximately 16% of this funding was used to develop partnerships (via cooperative agreement/contracts) with a number of CESU universities for the development and implementation of monitoring protocols. Permanent and seasonal NPS personnel expenses constituted approximately 72% of the budget in FY12. Travel (4 %) and general operations, equipment purchases, and administrative/office support (8 %) rounded out NCBN expenditures for FY12.

In addition, the Cape Cod National Seashore CCEM program received their annual base of $702,375. This funding was transferred directly to the park's base account for regular program expenses and operations. In FY12, 81% of these funds were used to support permanent and seasonal staff of the CCEM in addition to stipends for student conservation association interns. Expenses that fell into the operations and equipment category composed approximately 5.5% of the budget. Approximately 2.0% of the budget was used for a contract with the University of Illinois for support of air quality monitoring and to the University of Massachusetts for cation analysis of water samples. Travel to scientific meetings, workshops, and training accounted for <1% of the budget. Other expenditures totaled 10.8% of the budget.

Budget Summary Northeast Coastal and Barrier Network

FY12 Admin Report Network: 02 Northeast Coastal and Barrier

Category: 1_Income

Description	*$ Amount*	*$$ Source*	*Where $ Went*	*Comments*
	$84,200.00	WRD - WQ Monitoring		
	$790,000.00	I&M - VS Monitoring $$		
Subtotal	***$874,200.00***			

Category: 2_Personnel

Description	*$ Amount*	*$$ Source*	*Where $ Went*	*Comments*
NCBN Staff Salaries	$629,181.00	I&M - VS Monitoring $$	NPS	
Subtotal	***$629,181.00***			

Category: 3_Coop. Agreements

Description	*$ Amount*	*$$ Source*	*Where $ Went*	*Comments*
University of Rhode Island	$47,566.00	I&M - VS Monitoring $$	University-CESU	Technical Report Support
StonyBrook University	$8,445.00	I&M - VS Monitoring $$	University-CESU	FIIS/GATE WQ monitoring
StonyBrook University	$26,992.00	WRD - WQ Monitoring	University-CESU	FIIS/GATE WQ monitoring
Virginia Institute of Marine Science	$3,500.00	I&M - VS Monitoring $$	University-CESU	COLO/ASIS WQ monitoring
Virginia Institute of Marine Science	$54,708.00	WRD - WQ Monitoring	University-CESU	COLO/ASIS WQ monitoring
Subtotal	***$141,211.00***			

Category: 5_Operations/Equipme

Description	*$ Amount*	*$$ Source*	*Where $ Went*	*Comments*
WQ Monitoring Equipment	$3,493.00	WRD - WQ Monitoring	Other non-Federal	
Monitoring Equipment/Office Supplies	$64,079.00	I&M - VS Monitoring $$	Other non-Federal	
Subtotal	***$67,572.00***			

Category: 6_Travel

Description	*$ Amount*	*$$ Source*	*Where $ Went*	*Comments*
	$34,236.00	I&M - VS Monitoring $$	NPS	

Subtotal	*$34,236.00*	

Category: 7_Other

Description	*$ Amount*	*$$ Source*	*Where $ Went*	*Comments*
NER Assessment	$2,000.00	I&M - VS Monitoring $$	NPS	
Subtotal	*$2,000.00*			

Budget Analysis

Analysis of Expenses by Where $ Went

Funding Source	*Total $$*	*NPS*	*USGS*	*Other Federal*	*Univ.-CESU*	*Univ_Non-CESU*	*Other non-Federal*
I&M - VS Monitoring $$	$789,007	$665,417			$59,511		$64,079
WRD - WQ Monitoring	$85,193				$81,700		$3,493
Totals	**$874,200**	**$665,417**			**$141,211**		**$67,572**

Analysis of Expenses by Category

Funding Source	*Total $$*	*Personnel:*	*Coop Agree.*	*Contracts*	*Operations/Equip*	*Travel*	*Other*
I&M - VS Monitoring $$	$789,007	$629,181	$59,511		$64,079	$34,236	$2,000
WRD - WQ Monitoring	$85,193		$81,700		$3,493		
Totals	**$874,200**	**$629,181**	**$141,211**		**$67,572**	**$34,236**	**$2,000**

Expense Totals By Category

Category	*SubTotal*	*Percent*
2_Personnel	$629,181	71.97%
3_Coop. Agreements	$141,211	16.15%
5_Operations/Equipment	$67,572	7.73%
6_Travel	$34,236	3.92%
7_Other	$2,000	0.23%
	$874,200	

Budget Summary Cape Cod National Seashore CCEM Program

Category: 1_Income

Description	$ Amount	$$ Source	Where $ Went	Comments
	$702,375.00	Prototype $$ - Park Base		
Subtotal	*$702,375.00*			

Category: 2_Personnel

Description	$ Amount	$$ Source	Where $ Went	Comments
Student Conservation Assoc. Interns	$27,618.00	Prototype $$ - Park Base	Other non-Federal	
CCEM staff salaries	$540,570.00	Prototype $$ - Park Base	NPS	
Subtotal	*$568,188.00*			

Category: 4_Contracts

Description	$ Amount	$$ Source	Where $ Went	Comments
U MA Amherst WQ analysis	$3,900.00	Prototype $$ - Park Base	University-CESU	
Natl Atmospheric Deposition Program	$9,876.00	Prototype $$ - Park Base	Other Federal	
Subtotal	*$13,776.00*			

Category: 5_Operations/Equipme

Description	$ Amount	$$ Source	Where $ Went	Comments
Equipment/Operations	$39,000.00	Prototype $$ - Park Base	Other non-Federal	
Subtotal	*$39,000.00*			

Category: 6_Travel

Description	$ Amount	$$ Source	Where $ Went	Comments
Travel	$5,421.00	Prototype $$ - Park Base	Other non-Federal	
Subtotal	*$5,421.00*			

Category: 7_Other

Description	$ Amount	$$ Source	Where $ Went	Comments
Other, inc. salary lapse	$75,990.00	Prototype $$ - Park Base	NPS	
Subtotal	*$75,990.00*			

Status of monitoring protocols being developed by the Northeast Coastal and Barrier Network (as of October 2012).

Name of Protocol	Protocol Status – Dates for Actual/Expected Milestones			Comments on Protocol Status
	Draft Available	Submitted for Review	Approved by Regional Mgr.	
Coastal topography			Published/Approved 2012	Psuty, N. P., T. M. Silveira, A. J. Spahn, and D. Skidds. 2012. Northeast Coastal and Barrier Network geomorphological monitoring protocol: Part II - coastal topography. Natural Resource Report NPS/NCBN/NRR—2012/591. National Park Service, Fort Collins, Colorado.
Estuarine nutrient enrichment			Published/Approved 2009	Trend report due to be completed in FY13. Resource Briefs for each park in development as part of USGS NPMP funding .
Forest vegetation			Published/Approved 2009	(Adopted MIDN protocol [1].) Final peer review complete. Annual reports available.
Invasive species detection	May 2013 (anticipated)			Currently adapting ERMN protocol (Keefer et al., 2010 [2]). Draft NCBN protocol anticipated FY13. Protocol being developed by University of Rhode Intern.
Ocean shoreline position			Published/Approved 2010	Final peer review complete. Annual reports available. ASIS 5-yr trend report 2012.
Salt marsh birds	October 2012 (anticipated)			Currently adapting Saltmarsh Habitat & Avian Research Program (SHARP) North American Marsh Bird Monitoring Protocols [3]. Draft NCBN protocol anticipated February 2013 first draft from University cooperators.
Salt marsh sediment elevation	March 2013 (anticipated)	May 2013 (anticipated)		Protocol under development-first draft of narrative completed Sept 2012. This is a collaborative effort and dependent on other agencies. Expected completion of full draft, FY13.
Salt marsh nekton			Published/Approved 2012	Published 2012 Annual reports available.
Salt marsh vegetation		May 2011	Jan 2013 (anticipated)	Currently undergoing revisions by the authors. Completed revisions anticipated in January 2013 with anticipated final approval and publication in Feb 2013. Annual reports available.

[1] Comiskey, J. A., J. P. Schmit, and G. Tierney. 2009. Mid-Atlantic Network forest vegetation monitoring protocol. Natural Resource Report NPS/MIDN/NRR—2009/119. National Park Service, Fort Collins, Colorado.

[2] Keefer, J. S., M. R. Marshall, and B. R. Mitchell. 2010. Early detection of invasive species: surveillance, monitoring, and rapid response: Eastern Rivers and Mountains Network and Northeast Temperate Network. Natural Resource Report NPS/ERMN/NRR–2010/196. National Park Service, Fort Collins, Colorado.

[3] Conway, C. 2007. SHARP Avian Point-Count/Callback Survey Protocol: Summary of the Standardized North American Marsh Bird Monitoring Protocols. Modified From Wildlife Research Report #2007-04. Saltmarsh Habitat & Avian Research Program (SHARP).

Status of monitoring protocols being developed by the CCEM program (as of October 2012).

Name of Protocol	Protocol Status – Dates for Actual/Expected Milestones			Comments on Protocol Status
	Draft Available	Submitted for Review	Approved by Regional Mgr.	
Meterologic and Atmospheric air quality			September 2001	Implementation is continuous; resource brief available on CCEM website.
Coastal Forests			2011	Implemented every 10 years, 2012 was second year of data collected under final protocol. Data pre-dating the protocol was used in development and these plots continue to be monitored as well as new plots. Monitoring report will be written in FY13. Resource brief available on CCEM website.
Hydrology			Dec 2011	Finalized in May 2012 as Medeiros, K.C. (editor) 2011. 2 resource briefs: 1) groundwater level and 2) stream gage monitoring available on CCEM website.
Kettle Pond WQ		Spring 2013 (anticipated)		Data collection ongoing with peer reviewed protocol but substantial revisions needed to update actual procedures. Expected to be submitted for review in spring 2013. Resource brief reporting on climate change trends available on CCEM website.
Kettle Pond Vegetation			Spring 2012	Finalized as Smith, S.M. 2012. Resource brief summarizing monitoring data from 1995-2010 available on CCEM website.
Dune Slack Wetland Vegetation		Winter FY13 (anticipated)		Protocol implemented every five years. Smith, S.M., J. Wheeler, and A. Thime. 2010. Dune slack wetlands vegetation monitoring , Cape Cod National Seashore, 2009. Technical Report NPS/NER/NRTR—2010/150. National Park Service. Philadelphia, PA. Dune Slack Wetland Vegetation Monitoring draft protocol in internal review; resource brief available on CCEM website.
Forested Vernal Wetland Vegetation		Winter FY13 (anticipated)		Protocol implemented every five years. Smith, S.M., M. Esposito and M. Cox. 2012. Forested vernal pond vegetation monitoring in Cape Cod National Seashore: summary of 2012 field work and comparisons with data collected in 2006. Technical Report NPS/NER/NRTR—. National Park Service. Philadelphia, PA. Forested vernal wetland vegetation draft monitoring protocol in revision after internal review.

Pond breeding amphibians			2003	Protocol completed and implemented yearly; resource brief summarizing six years of data available on CCEM website.
Dune grassland vegetation			Spring FY13 (anticipated)	Protocol being implemented every five years; resource brief available on CCEM website. Smith, S.M. 2012. Dune grassland vegetation monitoring: analysis of 2011 survey data and changes in plant communities since 2005. Natural Resources Report NPS/NER/NRR—2012/XXX. National Park Service. Philadelphia, PA. Final draft of protocol anticipated ready for internal review winter FY13.
Coastal Heathlands	Spring FY13 (anticipated)			Draft protocol available; Gwilliam, E. and T. Husband. 2008. Monitoring Protocol for Coastal Sandplain Heathlands and Grasslands of the Cape Cod National Seashore, Massachusetts. Re-surveys and updates to protocol will be accomplished in FY13.
Landbirds, point counts	Winter FY13 (anticipated)			Protocol is being written by Mark Faherty and Curtice Grffin, University of Massachusetts, Amherst. Draft due by end of CY12.
Meso-mammals	Winter FY13 (anticipated)			Protocol is being written by Allan O'Connell, USGS. Draft anticipated by end of CY12.
Cover type mapping	Fall 2013 (anticipated)			Report on methods and pilot results published (Timm and McGarigal 2012). In FY13, further method development and application in various ecosystems will continue along with work on full draft protocol.

Note: The following NCBN protocols are being implemented at CACO either by CCEM or NCBN staff or cooperators. Estuarine Nutrient Enrichment-WQ, Salt marsh vegetation, Salt Marsh Nekton, Coastal Topography, Salt Marsh Sediment Elevation (SET), Ocean Shoreline Position, Marsh Birds