Rhode Island Environmental Monitoring Collaborative

2012 Summary Report

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Executive Summary

Environmental monitoring guides management and planning, supports innovation in governance and regulation, and fosters technical and science careers, jobs, and development. The 2012 Summary Report of the RI Environmental Monitoring Collaborative (RIEMC) reviews Rhode Island's overall progress toward fulfilling its goals and needs for environmental monitoring. The report highlights several key accomplishments and reflects the on-going collaboration that is occurring among the various entities engaged in environmental monitoring in RI. It is this level of collaboration among partners that is helping sustain many of our long-term monitoring programs in a climate of constrained resources. However, the report also highlights growing concerns that reductions in federal and state funding for environmental monitoring have reduced and continue to threaten our capacity to collect and record biological, chemical, and physical data essential for evaluating environmental health and risk, guiding environmental management, and ensuring economic sustainability and development. Continuing cuts to environmental monitoring will stifle efforts to increase cost-effectiveness and innovation in environmental management. The report identifies a funding shortfall of **$476,000** for state FY14 that reflects the amount of additional funding needed to avert curtailment of data collection in existing priority monitoring programs and eliminate the reliance on stop-gap funding sources. In addition, the report identifies further investment needed to implement the full range of recommended monitoring programs with the annual unmet need for state FY15 being **$2,569,000**.

The introduction to this report reviews the mission of the RIEMC, discusses the serious challenges to national and state funding for environmental monitoring, summarizes 2012 findings and accomplishments, and identifies RIEMC 2013-2014 work priorities. Key accomplishments for 2012 include: Acquisition of statewide LiDAR high resolution elevation data, expanded monitoring of cyanobacteria blooms in freshwaters, completed ground-truthing to update maps of submerged aquatic vegetation in coastal waters and DEM publication of an in-depth statewide assessment of conditions in lakes and ponds as well as the 2012 Integrated Report on statewide water quality conditions.

The heart of the Report consists of one-page summary sheets for each major monitoring priority identified to date by the RIEMC. These summaries provide details on field programs, management and regulatory applications of monitoring data and assessments, sources of funding and program support, and unmet monitoring needs.

Ecosystem-based management requires extensive monitoring and research on the functions and dynamics of complex, inter-related natural and social systems. Monitoring sustains and guides all aspects of environmental management, from air and water quality protection, to fish and wildlife management, to watershed planning and community development. Monitoring generates insight into progress toward environmental protection, conservation, and restoration goals established in federal, state, and municipal law. Without an unwavering commitment to monitor our natural environments and their human uses, we will not be able to accurately characterize and respond to current and future environmental and socio-economic risks to RI's natural environment and resources.

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Introduction

Environmental monitoring is essential to the effective management of our changing natural environment. Through this report the Rhode Island Environmental Monitoring Collaborative highlights both accomplishments and a growing concern that the level of investment in the core monitoring programs is insufficient to meet the information needs of management decision-makers. Reductions in federal and state funding have eroded important data collection efforts as well as constrained our ability to apply data effectively to policy and management. Additionally, programs involving streamflow measurements and river monitoring appear newly threatened with disruption due to federal sequestration. The challenging fiscal climate reinforces the need for the RIEMC to play a strong role in coordinating and optimizing the collective monitoring efforts underway in Rhode Island.

Established by Rhode Island's 2004 Comprehensive Environmental and Watershed Monitoring Act (R.I.G.L. § 46-31), the Rhode Island Environmental Monitoring Collaborative (RIEMC) consists of executive agencies, university-based programs, non-governmental organizations, and other monitoring stakeholders. The RIEMC, through enhanced coordination and collaboration, strives to ensure that needed aquatic and terrestrial monitoring, including long-term programs and targeted or specialized monitoring and research, is implemented through its member organizations and partners. The RIEMC promotes better understanding and greater appreciation of Narragansett Bay and its watershed, and works with the Rhode Island Bays, Rivers, and Watersheds Coordination Team (BRWCT) to support strategic planning and management for Rhode Island's dynamic aquatic and terrestrial environments. The RIEMC reviews major environmental monitoring initiatives, establishes statewide priorities for environmental monitoring, establishes and maintains a Comprehensive Environmental Monitoring Strategy for RI, and supports field program coordination to optimize deployment of staff and equipment.

The RIEMC reports to the BRWCT, a seven state agency commission that sets and pursues overall goals for water management and sustainable water-reliant economic development. As authorized by law, the BRWCT has provided funding for environmental and economic monitoring in its implementation of the Rhode Island Bays, Rivers, and Watersheds Systems-Level Plan, with guidance and review from the RIEMC. However, as noted in prior reports, Rhode Island has many unmet environmental monitoring needs. Concern has grown over the past year that a number of its irreplaceable long-term monitoring programs are threatened with termination. It will be extremely difficult, even with increased input and guidance from the RIEMC, for the BRWCT to allocate sufficient funds to maintain current environmental monitoring programs, address major gaps such as fish tissue contaminant levels, and help Rhode Island take advantage of advances in monitoring technology, data analysis, and public communications. Over the last few years, the BRWCT has been able to provide "stop-gap support" to some environmental monitoring programs, such as the RI Stream Gage Network, large river water quality monitoring, and groundwater level observations. Unfortunately, the BRWCT's ability to support environmental monitoring remains small relative to overall needs. Consequently, the BRWCT is concerned about being relied upon as the funding source for a select number of environmental monitoring programs as that will result in other environmental monitoring needs not being met, as well as reductions in BRWCT's ability to allocate its funds in a strategic, flexible manner, as originally intended.

Greater dialogue between the RIEMC and the BRWCT should stem from continued development of a Comprehensive Environmental Monitoring Strategy, which the RIEMC is mandated to provide under state law. This Strategy would provide a framework to improve coordination of monitoring for water quality protection, water pollution control, fisheries and wildlife management, habitat restoration, coastal zone and watershed management, public health, and natural hazards response and recovery. The Strategy would promote in-depth evaluation of the status and well-being of Rhode Island's natural environment, and establish a unified framework to coordinate monitoring, pursue public education and management support via initiatives such as Watershed Counts, and increase the utility of monitoring data and findings for policy, planning, and management.

Critical Issues Regarding Federal & State Support for Environmental Monitoring

Rhode Island's legislative and executive state budget authorities must grapple with the fundamental policy challenge of replacing federal support for environmental monitoring in Rhode Island that has been and will continue to decline. All states are coping with the many reductions in federal funding contained in the Federal Government's FY 2013 budget, reductions that will likely impact state budgets further in the FY 2014 federal budget. Rhode Island's traditionally heavy reliance on federal funds for many aspects of environmental and natural resources management renders it particularly vulnerable to these federal cutbacks.

There have already been substantial reductions in the support for environmental monitoring previously provided by federal agencies such as the U.S. Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Service (USGS). The federal FY 2013 budget and the expected FY 2014 budget will accelerate cuts to federal funding for marine fisheries monitoring and stock assessments, beach water quality, stream gages, and many other programs. Specific consequences for Rhode Island include:

- Suspension of streamflow measurements by USGS at an important gage on the Pawcatuck River from April through August 2013. (Impact of sequestration)
- Loss of EPA funding to support monitoring of wadeable rivers and streams by DEM. (Impact of sequestration.)
- Reduction in National Marine Fisheries Service support for lobster stock monitoring in southern New England waters.
- Cessation in 2010 of monthly multi-parameter surveys of Narragansett Bay water quality and biology previously conducted by NOAA National Marine Fisheries Service Narragansett Laboratory.
- Continuing limited capacity at RI Department of Environmental Management (DEM) to conduct contaminant sampling of fish tissue, particularly freshwater fish.
- Continuing lack of capacity at DEM to fully implement the State Water Information Management System (SWIMS).

As a result of changes in available funding, the RIEMC has identified several priority monitoring programs at high risk of disruption. These are further described below. The current fiscal environment has spurred deliberations among the involved monitoring partners in an effort to avert or minimize discontinuation of critical monitoring activities. Such discussions are continuing. In addition, the RIEMC has summarized information in Table 1 which reflects the utility and funding status of the environmental monitoring priorities identified to date by the RIEMC. (Other environmental priorities, such as additional fisheries monitoring needs, will continue to be reviewed by the RIEMC and eventually added to its current list of monitoring priorities).

Summary of Critical Funding Needs:

***The RIEMC estimates the immediate fiscal shortfall for FY 2014, i.e. the funding needed to prevent curtailment of monitoring activities in existing core monitoring programs and eliminate continued reliance on stop-gap BRWCT funding to be* $476,000.**

In addition, the RIEMC estimates the additional funding needed in state FY15 to fully implement the recommended environmental monitoring priorities identified to date to be* $2,569,000*. This investment would be in addition to the funds already expected to be expended by the various entities that implement the listed monitoring programs.

The following describes the status of priority monitoring programs deemed at risk of future disruption.

Monitoring of river and stream flows and groundwater levels:
As noted above, in April 2013 sequestration resulted in the suspension of monitoring at a critical stream gage on the Pawcatuck River at Wood River Junction. The gage had been supported 100% by federal funds. Its suspension delayed improved flood forecasting services planned by the National Weather Service for this watershed that was hard-hit by flooding in recent years. Looking ahead, the federal funding reductions threaten to further reduce the number of gages that will operate in RI in FY2014 and beyond. Currently, Rhode Island public and private entities and USGS operate the Rhode Island Stream Gage Network, comprised of 36 gages in the state, that collects, records and distributes water flow data, both quantity and variability of flow, for RI's rivers and streams. This Network is part of a national network of stream gages maintained by USGS, the states, and private partners. Such data are required for floodplain management and emergency management including flood forecasting, as well as drought management, sustainable management of drinking water supplies and protection of freshwater ecosystems including water pollution control programs.

At the recommendation of the RIEMC, in 2008 the BRWCT invested in adding three stream gages to the state network which have been maintained since that time. Funding shortfalls for the network developed in the following years as the cost to the State to sustain the network rose and state agency resources to sustain this long-term monitoring program were reduced. To compensate for reductions in agency (DEM and WRB) operating budgets, the BRWCT agreed to provide "stop-gap" funding which now supports an additional ten gages. While initially intended to serve as an interim

source of funding, the subsequent four years have led instead to increased reliance on BRWCT support for these monitoring programs. Recognizing their fundamental importance to water resources and water supply management, the BRWCT provided up to $91,800 annually to support thirteen stream gages and 19 groundwater level wells over last two years (through June 2013).

Federal budget reductions and rising costs have forced the USGS to seek additional state or local investment of about $51,000 to sustain the current program in Rhode Island for FY 2014, including reactivation of the suspended gage on the Pawcatuck River. ***Without additional BRWCT or other support, monitoring will be curtailed***. Similarly, if previous state agency operations funding for the USGS water monitoring programs are not restored, the BRWCT will be forced to decide whether to continue serving as a funding source of last resort for preservation of the credibility and utility of multi-decadal water monitoring datasets, or terminate or reduce its support in order to help fund other critical environmental monitoring needs, such as monitoring of water quality at RI's freshwater swimming beaches for public health protection and contaminant source identification and remediation.

Note: At the time of publication of this report, federal agencies, state agencies (DEM, WRB and the RI Emergency Management Agency), local governments and the Wood-Pawcatuck Watershed Association, had been in active discussions to develop a funding strategy to restore operation of the streamflow gage suspended in April 2013. A short-term plan was successfully developed and the USGS was able to resume transmitting data from this gage in August 2013. A long-term funding solution is still needed.

RI Department of Health Coastal and Fresh Water Beach Monitoring:

EPA funding was instrumental in expanding saltwater beach monitoring and allowed the RI Department of Health to develop and implement an effective risk-based monitoring strategy to strengthen the protection of public health. While EPA's FY 2013 budget includes some funding for saltwater beach water quality monitoring, it is unclear whether any funding will be included in FY14. For Rhode Island, EPA has previously provided approximately $212,000 annually to the Rhode Island Department of Health (DOH) Beach Monitoring Program. In FY 2013, it will provide DOH with $201,000 and these funds will support the saltwater beach monitoring and notification program through the 2014 beach season. While DOH will be able to continue to monitor saltwater beaches through 2014, there is uncertainty about continued federal funding and continuity of the program moving into the 2015 beach season. Alternative funding sources must be identified for the coming years to replace the potential loss of federal funds. If such funding is terminated, in 2015, saltwater beach operators, including towns, could be burdened with fulfilling the task of monitoring in order to meet license requirements. For obvious cultural, recreational, and socio-economic reasons, Rhode Island simply cannot permit the closure or reduced availability of its world-class saltwater beaches due simply to inadequate water quality monitoring.

Enhanced Lobster Monitoring - Ventless Lobster Trap Survey:

Since 2006, the DEM Marine Fisheries Program has participated in a regional monitoring program initiated to support improved estimates of the relative abundance and recruitment of lobsters in their northeast range (New York to Maine). The commercial lobster fishery, the second most

valuable fishery in RI, is in peril given increasing evidence of recruitment failure – insufficient young lobsters surviving to become adults. The ventless trap survey is carried out in collaboration with commercial lobster fishermen and targets rocky and shallow water habitats not sampled through DEM's other fishery surveys; e.g. boat-based trawl survey. After initial investments from federal and restricted sources of funding were depleted, DEM sought and received funding from the BRWCT to support the survey for two years: 2012-2013. Given the importance of maintaining a time-series data set to characterize the health and status of the lobster resource in Rhode Island waters, it continues to be critically important to secure additional funds to sustain this program.

River and Stream Monitoring:

DEM receives Clean Water Act funding to implement a range of mandated activities. Reduced federal funding in FY 2013 forced a reduction in contractual funds of $60,000 available to pay for the laboratory services associated with the ambient monitoring of rivers and streams. Each year DEM targets a portion of the state's rivers and streams for sampling pursuant to a rotating basin monitoring approach. While no disruption during 2013 is anticipated due to prior year funds being available, the federal reduction, if sustained, will jeopardize the DEM's capacity to sustain this key sampling program in the coming year (2014). In addition, DEM has long maintained an agreement with USGS to provide for monthly water quality monitoring of the state's largest rivers: Blackstone, Pawtuxet, Pawcatuck and Branch. Data is important to tracking pollutant loadings. Similar to the Stream Gage Network, federal funding reductions are affecting this program. The projected cost FY14 shortfall with respect to maintaining the current level of monitoring is $85,000.

Dissolved-Oxygen Field Surveys in Narragansett Bay:

Federal funds made available via the NOAA National Marine Fisheries Service previously supported spatial surveys of dissolved oxygen (DO) levels in Narragansett Bay (a critical variable for assessing estuarine water quality) conducted by Brown University, the Narragansett Bay Estuary Program, Save The Bay and partners. This federal support ended in 2011, and in 2012, the BRWCT (as part of its three-year commitment to support the URI Coastal Hypoxia Research Program (CHRP)) agreed to provide $10,000 to for the boat-based DO field survey. Unfortunately, this funding is sufficient only to collect the DO concentration data. Under its CHRP funding agreement, the BRWCT will provide this level of partial support for boat-based monitoring DO through 2014. The program identified a Fy14 shortfall of $36,000 that is stilled needed for data management and mapping. The annual budget and unmet need for the program, as estimated by Brown University, is about $51,000.

Against this background of fiscal challenges, it remains the mission of the RIEMC to foster coordination and collaboration among individual monitoring programs and related initiatives such as Watershed Counts, and to serve as a platform for articulating the importance of environmental monitoring for all facets of environmental management and sustainable economic development, including: water quality management, watershed management, habitat restoration, land-use planning, natural hazards mitigation, outdoor recreation, economic development, transportation infrastructure redevelopment, and public health, safety, and well-being.

The RIEMC will continue to work with researchers, students, and the many beneficiaries of environmental monitoring to improve and expand dialogue with elected leaders and the public regarding the importance of environmental monitoring. The RIEMC must also explore and pursue new sources of local, state, and regional support for environmental monitoring in order to achieve the fiscal sustainability of the programs.

Table 1: Utility and Funding Status of the RIEMC's Environmental Monitoring Priorities

Monitoring Priority	Utility	Status	Current Funding & Program Support	Future Funding Outlook for State 2014
Coastal Water Quality				
Narragansett Bay Dissolved Oxygen (NB Fixed-Site Monitoring Network)	Dissolved oxygen (DO) decline and loss is a major cause of water quality impairment in Narragansett Bay. Water quality impairments (designated by DEM) require additional water quality assessment and planning and wastewater treatment upgrades. Addressing water quality impairments for Narragansett Bay necessitates comprehensive monitoring of DO in relation to improvements in wastewater treatment, nonpoint source pollution controls, and external drivers such as climate change and increasing water temperatures.	Implemented RIEMC recommends adding additional stations in lower Narragansett Bay & Sakonnet River	RI State Revolving Fund (SRF)- federal ; Narragansett Bay Commission (NBC); Narragansett Bay National Estuarine Research Reserve (NBNERR)- federal; URI-GSO	Assumes cuts to federal SRF funding are not significant. Caution: DEM reliance on SRF funding not sustainable; will require diversification in the future. **Annual Unmet Need: $350,000**
Narragansett Bay Dissolved Oxygen (Field Surveys)	Boat-based DO measurements complement the fixed-site network. Identifies Bay areas and embayments at significant risk for low DO. Provides cross-sectional information on hypoxia within the Bay.	Implemented	BRWCT; Narragansett Bay Estuary Program (NBEP); Brown U., Save the Bay, NOAA Coastal Hypoxia Research Program (NOAA-CHRP); as well as NBC	**At risk of disruption.** **FY14 shortfall: $36,000** **Annual Unmet Need: $51,000**
Shellfish Growing Areas	Required to manage commercial shellfishing, allow harvesting, and protect public health.	Implemented	State general revenues	Currently stable.
Rotating Assessment of Coastal Waters	Address major water quality data gaps in coastal coves and embayments. This data is essential to assess point and non-point source pollution controls, such as sewering in the Greenwich Bay watershed, cesspool phase-outs, and stormwater management.	Not implemented. Some data collected by DEM and volunteers.	No funding available	**Annual Unmet Need: $250,000**

Monitoring Priority	Utility	Status	Current Funding & Program Support	Future Funding Outlook for State 2014
Saltwater Beach Water Quality	Saltwater beaches are monitored to protect public health, reduce illness associated with swimming in potentially contaminated bathing waters, and to find and eliminate sources of contamination.	Implemented	EPA Beach Act funding. No federal funding may be available after 2014 field season	**At risk for disruption due to loss of federal funds.** **Annual Unmet Need: $212,000**
Volunteer Monitoring of Coastal Waters	Provides data essential for federal and state agencies to target their monitoring programs.	Implemented	Multiple sources including state and local sponsors	**At risk of disruption** Annual Unmet Need: **$25,000**
Freshwater Quality				
Water Quality in Large Rivers	Long-term monitoring of water quality in major rivers such as the Blackstone, Pawtuxet and Pawcatuck is essential for managing water pollution sources, including evaluating pollutant loadings into Narragansett Bay and coastal waters. Need MA rivers (Taunton, upstream portion of Blackstone) to be similarly monitored to support effective watershed management.	Implemented. Additional stations recommended in Pawtuxet River watershed.	BRWCT, NBC, USGS	**At risk of disruption.** **FY14 shortfall: $163,000** **Annual Unmet Need: $175,000**
Water Quality in Wadeable Rivers and Streams (rotating assessment)	Required for assessing water quality in rivers and streams and guiding water pollution control programs for rivers, streams, Narragansett Bay, and the Salt Ponds.	Implemented	DEM, EPA	**At risk of disruption.** **FY14 shortfall: $85,000** **Annual Unmet Need: $260,000**

Monitoring Priority	Utility	Status	Current Funding & Program Support	Future Funding Outlook for State 2014
Volunteer Monitoring of Rivers and Streams	Supplements data collected by the State to help assess changing conditions in rivers and streams.	Implemented	**URI, DEM, EPA, various local sponsors**	**Annual Unmet Need: $25,000**
Freshwater Beach Water Quality	Freshwater beaches make up nearly half of RI's licensed swimming beaches, but are monitored far less frequently than saltwater beaches. Of particular concern are freshwater swimming beaches at youth summer camps.	Partially implemented by freshwater beach owners and operators.	No funding available to enhance the limited existing program	**Annual Unmet Need: $100,000**
Lakes and Ponds Volunteer Monitoring	26% of the state's total lake acreage remains un-assessed, hindering statewide water quality assessments and management.	Implemented No funding for recommended expansion to unassessed lakes	URI, DEM/EPA, many watershed organizations and other local sponsors	**Annual Unmet Need: $80,000**
Harmful Algal Blooms	More cyanobacteria blooms have been documented in recent years; need to improve understanding of the extent of this public health threat in RI waters.	Partially implemented	DEM- EPA funding provides for minimal amount of sampling	**At risk of disruption** **Annual Unmet Need: $50,000**
Toxic Contaminants in Freshwater Fish: Mercury	Public health risks of toxic contaminants in freshwater fish remain largely un-assessed in RI.	Partially implemented; limited number of samples are processed annually	EPA in-kind services, DEM/EPA , DEM- DFW	**Annual Unmet Need: $105,000**

Monitoring Priority	Utility	Status	Current Funding & Program Support	Future Funding Outlook for State 2014
Physical Conditions				
River and Stream Flows (RI Stream Gage Network) & Groundwater Level Measurements	River and stream flow data is vital for water supply planning and management, flood response and risk mitigation, drought management, and water quality management.	Partially Implemented	RI Water Resources Board (WRB); Providence Water Supply Board; BRWCT	**At risk of disruption** **FY14 shortfall: $140,000** Limited state funding is provided. **Annual Unmet Need: $173,000**
Shoreline Change	Provides data critical to development of CRMC's Shoreline Change Special Area Management Plan and to understand the threat of coastal erosion on public and private infrastructure and natural ecosystems.	Partially Implemented	URI; CRMC; BRWCT	**Annual Unmet Need: $100,000**
Biological Communities and Habitats				
Marine Fisheries Surveys	Data collection to support stock assessments and management decision-making of important commercial fisheries, both finfish and shellfish; Ecological status and trends.	Implemented - Program enhancements recommended	DEM, USFW	Projected as stable for certain programs **Annual unmet need: $200,000**
Enhanced Lobster Monitoring - Ventless Lobster Trap Survey	Improved characterization of the abundance and recruitment of lobster	Implemented	BRWCT	**At risk of disruption** Stop-gap funding for 2013; need to secure alternative funding for 2014 **FY14 Shortfall: $52,000** **Annual Unmet Need: $ 52,000**

Monitoring Priority	Utility	Status	Current Funding & Program Support	Future Funding Outlook for State 2014
Eelgrass Beds	Essential for understanding long -term change in a critical estuarine habitat type critical for finfish, shellfish, and crustaceans. Provides a measure of overall estuarine ecological health and biological diversity.	Partially Implemented	Save the Bay; NBNERR; RI Coastal and Estuarine Habitat Restoration Trust **Fund**	**Annual Unmet Need: $33,000**
Saltmarshes	Essential for understanding long-term change in critical habitats for terrestrial, avian, and estuarine and marine species. Helps to assess climate and SLR risks to the shoreline erosion protection and storm buffer values (ecosystem services) that saltmarshes provide.	Partially implemented	RI Coastal and Estuarine Habitat Restoration Trust Fund; USFWS Coastal Program	**Annual Unmet Need: $28,000**
Arrival and Spread of Marine AIS	Species identification, eradication and management.	Partially implemented	RI Coastal Resources Management Council (CRMC); DEM; RINHS; NBNERR; EPA Atlantic Ecology Division; Roger Williams University (RWU); URI-Watershed Watch (URI-WW)	**Annual Unmet Need: $150,000**
Arrival and Spread of Freshwater Aquatic Invasive Species (AIS)	Species identification, eradication and management.	Partially implemented	US Fish & Wildlife (USFW); Northeast Aquatic Nuisance Species Council (NEANS); DEM; RI Natural History Survey (RINHS);	**Annual Unmet Need: $150,000**

Monitoring Priority	Utility	Status	Current Funding & Program Support	Future Funding Outlook for State 2014
			Univ. of Rhode Island (URI), NBNERR	
Freshwater Wetlands	Provides ecological condition data for freshwater wetlands and the stressors adversely affecting their functions and values; e.g. presence of stormwater discharges, invasive species, etc.	Partially implemented	DEM relies on EPA funding to support this work	Annual Unmet need: Under evaluation
				FY 2014 Shortfall: **$476,000**
				FY15 Estimated Total Annual Unmet Need: **$2,569,000**

2012 Findings & Accomplishments

Despite continuing funding reductions, important work and innovation in environmental monitoring is being accomplished. RI monitoring programs and data users have coped with flat and/or declining budgets for many years, and state and federal agencies and other monitoring stakeholders have long pursued alternative funding sources for monitoring. Squeezing out additional cost savings, pooling resources, coming up with better ways to collect, analyze, and disseminate data have been strategies pursued for years. For example, when faced with the loss of one source of federal funding, in 2012 DEM developed the means to utilize Clean Water Act State Revolving Fund administrative funds to support the Narragansett Bay Fixed Site Monitoring Network for the near-term, noting however that the amount of funds available for this purpose are unlikely to be sustainable in the long-term. What's different and troubling in 2013, and beyond, is that there is much less opportunity for flexibility and adaptation within state and federal environmental monitoring programs already functioning under significant constraints.

In 2012, the RIEMC continued to focus on sustaining and coordinating vital environment monitoring activities and program functions. With much effort and creativity, several RI monitoring programs managed to launch enhancements to monitoring fieldwork and data analysis and report out on key environmental events and trends. Some of these accomplishments and findings are summarized below.

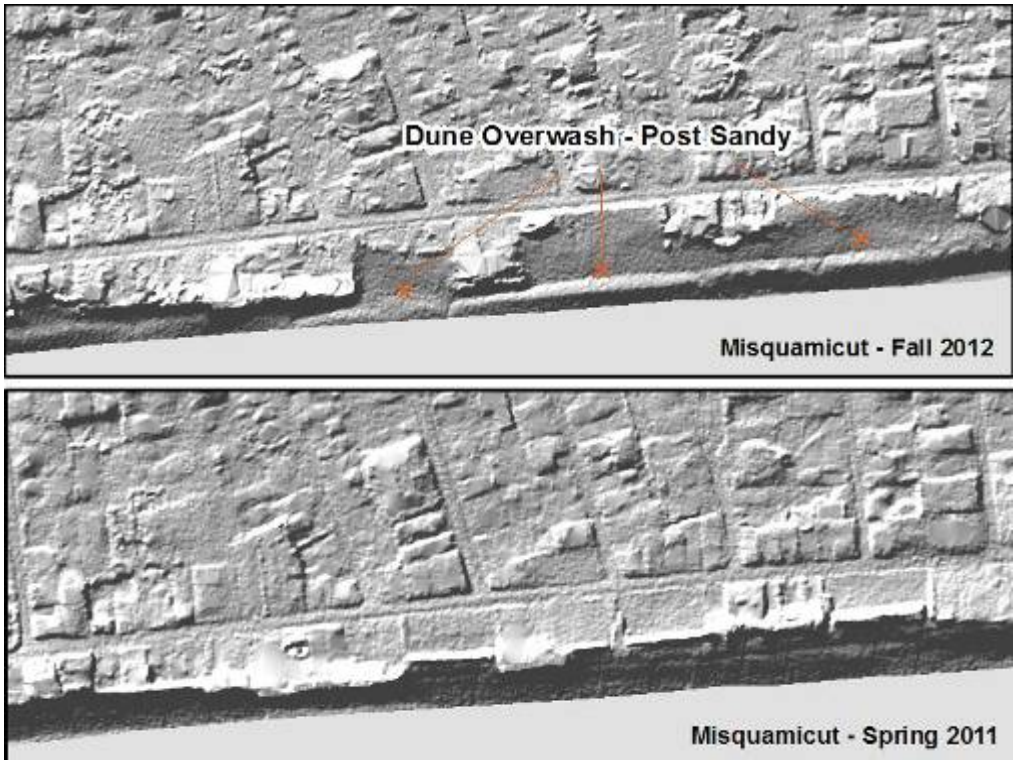
Enhancements to Data Collection and Acquisition

Statewide LiDAR (elevation data)
In April 2012, Rhode Island took delivery of its LiDAR-based statewide high resolution digital elevation model. LiDAR is a remote sensing technology utilizing a laser to measure distances between aircraft and the ground surface and is highly accurate. The data are accessible through the RIGIS website and are being used extensively in a variety of applications including sea-level rise evaluations, storm surge mapping and vulnerability assessments, mapping of wind and solar energy potential, ecological mapping and transportation planning among others. The RI product was developed as part of a larger Northeast LiDAR Project organized by six states in 2010 and made possible by $1.4 million in American Recovery and Reinvestment Act (ARRA) funding provided via the United States Geological Survey. Matching contributions from a number of partners, including governmental entities and The Nature Conservancy, resulted in a total project cost of about $3.4 million. The RIEMC played an important role by providing a statewide platform from which to articulate local, state and regional applications that would benefit from high resolution elevation data. RI contributed sufficient funds to extend the acquisition of LiDAR statewide and enhance the sampling density to produce a higher quality and more useful digital elevation model.

FOCUS: Monitoring Changes Due to Superstorm Sandy

In the aftermath of Superstorm Sandy, a number of data collection activities were conducted to assess the coastal environment impacts. Several long-term beach monitoring profiles were measured by Jon Boothroyd and Brian Oakley of URI GeoSciences showing significant post-storm loss of beach berms and foredunes and the formation of large overwash fans along the back barriers. Post-storm LiDAR elevation data was collected by the US Army Corps of Engineers along the south shore of Massachusetts and Rhode Island to facilitate restoration activities. Additionally, as part of the CRMC Shoreline Change (Beach) Special Area Management Plan, shoreline erosion data was collected post-storm for Block Island and the south shore by URI GeoSciences.

The CRMC has issued over 1,500 Emergency Permits since last November for the reconstruction of storm-damaged coastal residences and businesses, public recreational facilities and infrastructure, and dune and beach restoration projects. Additionally, the DEM issued 37 permits for the repair of damaged onsite wastewater treatment systems. The data collected as part of these state permits is helpful in assessing the type of storm damage sustained along the coast and provides a comparison for future storm events.



Source: P. Jordan, DEM
LiDAR images demonstrate changes in the shoreline as a result of Superstorm Sandy.

Cyanobacteria – Blue-Green Algal Blooms
Growing awareness of the presence of blue-green algae in RI freshwaters prompted DEM and DOH to continue their limited, targeted monitoring program aimed at confirming the presence of cyanobacteria and issuing public health advisories when appropriate. Explosive growth of cyanobacteria, which are naturally occurring, produces algal blooms which pose a public health threat due to the release of natural toxins. Using federal funds, DEM collected samples from targeted lakes as well as from other water bodies in response to public complaints. Where warranted, samples were processed at an out-of-state laboratory in order to identify the algal species, quantify cell counts and assess the natural toxin concentrations. Twenty-four (24) waterbodies had cyanobacteria blooms confirmed over last three years.

Part of the reason for the monitored increase in bloom occurrences is that a progressively larger number of waterbodies are being surveyed. But this also leads to concerns that blue-green algal blooms occur more frequently than available data indicate. With continued nutrients inputs and increasing temperatures in freshwater bodies, DOH and DEM are concerned that blue-green algal blooms are emerging as a serious public health concern. Additional funding will be needed to expand the current effort to fulfill an anticipated increase in public demands for assessment of possible blue-green algal blooms. For more information see**:**
http://www.health.ri.gov/healthrisks/poisoning/cyanobacteria/index.php

Narragansett Bay Phytoplankton Communities
With funding from the BRWCT and in collaboration with URI's Graduate School of Oceanography (URI-GSO), the Narragansett Bay Commission (NBC) began to characterize the phytoplankton species composition and abundance at the Bullock's Reach station in the Providence River. Phytoplankton samples are collected twice a month (May – October) and at least monthly for the remainder of the year, weather permitting. Water quality data are used to target sampling of phytoplankton during major bloom events. The goal of this monitoring program is to monitor temporal changes and shifts in the species composition of upper Narragansett Bay phytoplankton communities. To gauge biological and ecological responses to the continuing nutrient removal upgrades at upper Bay wastewater treatment facilities, it will be important to track how plankton community structure and function changes over time. Phytoplankton, and the zooplankton which graze upon them, represent key biological variables governing the relationship between nutrient inputs into the Bay and DO concentrations. The data collected from this initiative is available via NBC's water website, *Snapshot of the Upper Narragansett Bay* (http://snapshot.narrabay.com/app/).

Large Rivers (Non-wadeable)
In 2013, given strong interest in how much and what types of nutrients in the Blackstone River flow from Massachusetts to Rhode Island (and eventually to Narragansett Bay), the USGS expanded the water quality monitoring conducted at the river gage station at Millville on the Blackstone River as part of a project funded jointly by the Massachusetts Department of Environmental Protection (MADEP). This targeted monitoring program is aiming to improve characterization of nutrient pollutant concentrations and loadings among other objectives. Additionally, the NBC has added to their river monitoring program a new sampling station on the Ten Mile River near the Rhode

Island/Massachusetts border. NBC reports this station consistently reports elevated nutrient concentrations when compared to other NBC river stations.

Wadeable Rivers and Streams – Additional Biological Data
DEM continued the collection of biological data from wadeable rivers and streams to fill critical data gaps related to the development of refined nutrient water quality criteria. Sixteen stations were sampled for benthic chlorophyll a, diatom taxonomic composition and algae (macroalgae and microalgae). This multi-year effort involves evaluating various field methods, including the viewing bucket and pebble count, to determine the approaches most suitable to RI stream conditions.

Marine Invasive Species
CRMC's recently launched marine larval settlement plate project is revealing that numerous tunicate (sea squirts) species are spreading through Narragansett Bay and RI's salt ponds. Comparison of 2012 data with previous years indicates that aquatic invasive species (AIS) are appearing at locations where they were previously unobserved. The population density of some invasive species in comparison to native species suggests that in some locations invasive species are becoming the dominant species.

Enhancements to Monitoring Methods

Eelgrass Beds
Eelgrass is a type of submerged aquatic vegetation (SAV) that grows in quiescent embayments along the northeast and northwest coasts of the United States. Eelgrass plays a crucial role in the health of coastal systems because it provides critical habitat for juvenile marine life, stabilizes surface sediments, and aids in filtering particles from the water column. Eelgrass grows in shallow areas of Narragansett Bay and south shore salt ponds. It provides critical nursery habitat for species such as quahogs, lobster, tautog, and bay scallops. Eelgrass beds enjoy special protections under the U.S. Clean Water Act and the RI Coastal Resource Management Plan. Widgeon grass is another SAV species found in more brackish RI waters. Anecdotal information suggests that several beds of widgeon grass have been expanding in recent years, which may be explained in part by improving water quality.

Mapping the distribution and extent of eelgrass beds is a crucial first step for understanding, managing, and protecting shallow subtidal estuarine habitats. Beginning in 2006, the RI Eelgrass Mapping Task Force developed and has been implementing a long-term, three-tiered monitoring protocol to comprehensively assess eelgrass bed areal extent, cover, and condition in Narragansett Bay and other RI coastal waters. Tier 1 involves a remote sensing technique that utilizes true-color aerial photography whereby photo signatures of SAV are interpreted and delineated. Tier 1 mapping efforts were conducted in Narragansett Bay in 1996, and again in 2006. The Task Force's goals for 2012 were to: (1) conduct a complete and comprehensive statewide survey of marine SAV (primarily eelgrass and to a lesser extent widgeon grass); (2) examine trends of SAV from 2006, 2009, and 2012; and (3) to review the recommendations with respect to Tier 1 mapping efforts. To address the second goal, two previous Tier 1 mapping efforts have been used for comparative purposes: the Narragansett Bay and Block Island project that was conducted in 2006, and an effort

focused on the coastal ponds (Quonochontaug, Ninigret, Green Hill, Potters, and Point Judith ponds) conducted in 2009.

Over 800 field surveys were conducted during the fall of 2012 to 'ground-truth the area mapping data, identifying a total of 1,385 acres of SAV. (A map of all the delineations can be found at http://tinyurl.com/aff8fcw.) Most of the SAV surveyed (89.4%) was eelgrass with 146.5 acres of widgeon grass occurring in Greenwich Bay, Ninigret and Green Hill Ponds, and Briggs Marsh in Little Compton. The majority (38%) of SAV acreage occurred in RI's south shore coastal ponds. The least amount of SAV occurs along the west shore of the west passage of Narragansett Bay (2.8%). The site with the largest overall increase in SAV acres was Conanicut Island (59.8 acres). The site with the largest overall decline in SAV was Green Hill Pond (-47.2 acres). Due to a new, 28.5 acre widgeon grass bed, the site with largest overall change was Greenwich Bay with a 100% increase. Interestingly, both Prudence and Conanicut Islands had almost identical increases (36.6% and 36.8%, respectively). Overall, The Eelgrass Mapping Task Force calculated a 23.6% increase in eelgrass acreage for Narragansett Bay when comparing the data and mapping from 2006 and 2012 (408 acres and 504.2, respectively).

Salt Marshes

Saltmarshes represent another vital habitat component of our coastal ecosystem. Building from initial mapping work completed by the Narragansett Bay Estuary Program, in 2012, a monitoring protocol was created by the Narragansett Bay Estuarine Research Reserve (NBNERR), Save the Bay, and other experts in order to systematically assess Rhode Island salt marshes. Implementation began in 2012. The protocol entails a 3-tiered approach. Tier 1 is a landscape scale, GIS based assessment (which will be completed in 2013), Tier 2 is a fairly rapid field-based assessment, and Tier 3 is a more intensive assessment encompassing ongoing research. The first Tier 2 assessment will be implemented statewide in 2013.

A typical salt marsh in Rhode Island (and throughout southern New England) is predominantly comprised of high marsh meadow. But recently, RI salt marshes have become dominated by short-form *Spartina alterniflora*, signaling that a major ecological transition is occurring in RI salt marshes, likely due to accelerated sea level rise and several consecutive years of higher than average tides. In addition, continuous large open water areas have appeared on some high marshes resulting in the loss of vegetation and saltmarsh degradation. Saltmarshes not only provide critical ecosystem habitat, but also serve to protect coastal properties from coastal flooding, storm surge and damaging waves.

Accomplishments in Data Assessment, Synthesis, and Communications

Statewide Water Quality Assessment

DEM released its 2012 Integrated Water Quality Monitoring and Assessment Report which provides information and statistics to characterize water quality conditions across the state. RIDEM, 2012) Prepared in accordance with federal Clean Water Act guidance, the report summaries the assessments of individual waterbodies and whether they support desired designated uses including recreation, fish consumption and healthy aquatic life. The report reveals the following about gaps in available data:

- Data on fish tissue contamination remains the largest gap for both freshwater rivers and lakes. (96% of river miles lack data; 83% of lake acres lack data).

- While the adoption of the rotating basin strategy for ambient monitoring of rivers and streams has reduced the portion of rivers categorized as lacking data from priori assessment, 35% of river miles still lack data.

- Twenty-six percent (26%) of the acreage of lakes and ponds in Rhode Island are unassessed due to a lack of data.

The report further describes whether surface waters are known to have an impairment – a condition that prevents the designated use from being achieved. Stressors known or suspected of contributing to the impairments are described and include various water pollution sources as well other problems such as invasive species and habitat modification. For more information: http://www.dem.ri.gov/programs/benviron/water/quality/pdf/iwqmon12.pdf

Assessment of Conditions in Lakes and Ponds

In response to a state legislative mandate, in February 2012, DEM released a report that used available data to review the conditions in lakes and ponds statewide. (RIDEM, Feb 2012) It concluded that 63% of the lakes and ponds for which data was available experienced one or more water quality impairments. The largest cause of impairments was invasive aquatic plants which were documented in 80 lakes. Fifty-nine (59) lakes covering about 24% of the total lake acreage in RI had an impairment associated with pollutants. The report can be viewed at: http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/lakes012.pdf

Watershed Counts

Watershed Counts is a collaborative initiative facilitated by the URI Coastal Institute in its role as Chair of the RIEMC and the Narragansett Bay Estuary Program. Working with a large number of partners, Watershed Counts develops environmental indicators based upon monitoring data to foster public communications and educational offerings for policy-makers, management agencies, educators, and the public. It will work to develop indicator assessments and guidance for the entire Narragansett Bay watershed drawing data and insights from Massachusetts and Rhode Island.

Watershed Counts completed a successful year with forty-eight partners working together to evaluate the conditions and trends of the land and waters of the Narragansett Bay Region. The Watershed Counts 2012 Report, issued in April 2012, included information on marine water quality, freshwater quality, open space , freshwater invasives and resource economics. For freshwater quality, the program developed assessments of four watersheds: Blackstone River, Woonasquatucket River, Wood-Pawcatuck Rivers and Taunton River. See http://www.watershedcounts.org/ for more information.

Focus on Upper Narragansett Bay Water Quality

The 2012 Watershed Counts Report noted about 32% of Narragansett Bay is categorized as impaired due to low dissolved oxygen levels, also referred to as hypoxia. While this percentage, which is based on periodic state assessments, remained essentially unchanged in 2013, managers are anticipating positive changes in the coming years due to significant investments in controlling nutrient pollutant loadings, primarily nitrogen discharged from wastewater treatment facilities, as well as reduction in stormwater inputs, as a result of Rhode Island's new Stormwater Design and Installation Manual. Researchers have found that the data reveal the frequency and duration of hypoxia varies year to year and as a result data collection will need to continue in order to support trend analysis. In any given year, hypoxia in the bay is influenced not just by pollutant loadings (nitrogen) but may also be affected by factors such as precipitation, river flow, wind and circulation. Researchers associated with the multi-institutional Coastal Hypoxia Research Project, led by the University of Rhode Island's Graduate School of Oceanography have established correlations between higher river flows driven by rainfall events and poorer water quality conditions. It is believed the higher river flows both increase the delivery of nutrients to the bay and intensify stratification of the water column. (Codiga,D. et al 2009) An analysis by NBC for the bottom water quality at its Bullocks Reach station yielded similar results - showing that in years of increased precipitation, there is a corresponding increase in the percent of days there are low dissolved oxygen conditions in the Providence River (Figure 1). Continued bay and river monitoring will be essential to tracking expected water quality improvements and determining the most appropriate future management actions.

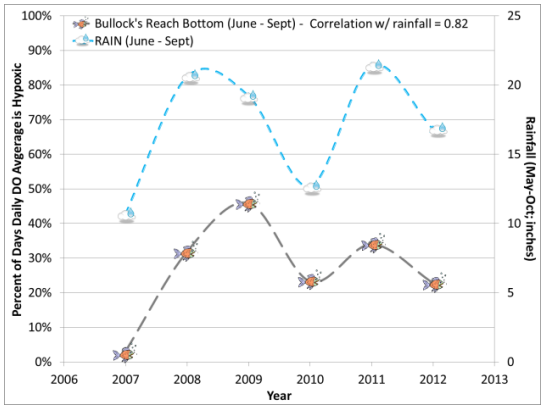


Figure 1. Correlation between increased rainfall and percent of days the daily dissolved oxygen concentration is considered hypoxic at NBS's Bullock's Reach Station in the Providence River. Source NBC, 2013

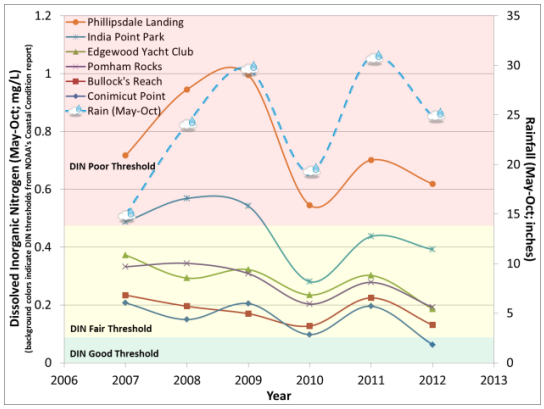


Figure 2. NBC's dissolved inorganic nitrogen (DIN) levels in the Providence River in relation to NOAA's Coastal Condition thresholds for a good, fair or poor estuary, as well as rainfall totals for the season. Source: NBC, 2013

Certain preliminary data analyses have indicated signs of progress in upper Narragansett Bay.
An NBC analysis of dissolved inorganic nitrogen (DIN) data it collects revealed that the Providence River experienced some of the lowest concentrations since 2007 (Figure 2). In 2012, the stations south of Field's Point WWTF recorded DIN concentrations equal to or lower than those observed in previous years for which data is available. At the Conimicut Point station, the seasonal DIN average concentration fell within the EPA National Coastal Condition's nutrient threshold for an estuary in good condition for the first time since 2007. These reductions in DIN may be due in part to enhanced nutrient removal processes at NBC's Bucklin Point and Field's Point WWTF's.

RIEMC Work Priorities: 2012-2014

Update of the RIEMC's Environmental Monitoring Priorities
In 2005, the RIEMC first established ten environmental monitoring priorities based upon their importance to understanding key environmental trends in Rhode Island, and the relative lack of active monitoring data collection and assessment being conducted for them. Since 2006, the RIEMC has reported on implementation of these monitoring priorities (see the BRWCT website for previous RIEMC Annual Reports). In 2012, based on a review of state monitoring priorities, the RIEMC expanded the list to provide a more complete listing of essential environmental monitoring priorities for Rhode Island. The priorities reflect long-term programs that provide data about the ambient environment that is or should be collected on an ongoing basis with the sampling frequency tailored to each program's information need. The list is not intended to reflect the complete universe of monitoring activities, which would include other activities such as pollution source monitoring, targeted short-term studies or assessments as well as various research efforts. The expanded list of 21 environmental monitoring priorities is:

- Narragansett Bay Water Quality – Fixed-stations
- Narragansett Bay Dissolved Oxygen – Spatial Surveys
- Shellfish Growing Areas
- Large River Water Quality
- Wadeable Rivers and Streams – Rotating Assessments
- Arrival and spread of Marine Aquatic Invasive species
- Arrival and spread of Freshwater Aquatic Invasive species
- River and Stream Flows
- Rotating Assessment of Critical Coastal Waters
- Freshwater Beach Water Quality
- Saltwater Beach Water Quality
- Volunteer Water Quality Monitoring
- Toxic Contaminants in Freshwater Fish: Mercury
- Shoreline Erosion, Accretion, and Sediment Transport
- Eelgrass Beds
- Salt Marshes
- Harmful Algal Blooms
- Freshwater Wetlands
- Marine Fishery Surveys
- Ventless Lobster Trap Surveys

The RIEMC will review and report annually on the status of its environmental monitoring priorities. It will partner with key initiatives such as Watershed Counts to support and improve environmental indicator development and application, and public communications. Finally, it will continue to develop and refine a Comprehensive Environmental Monitoring Strategy for Rhode Island. Additional details on the RIEMC's 2013-14 work priorities will be provided in the summer of 2013.

Progress Toward the RIEMC's Environmental Monitoring Priorities

The following one-page summary sheets for each of the 21 RIEMC environmental monitoring priorities review specific monitoring programs, data applications and on-line locations, the government agencies and programs performing the activities and utilizing data, and program funding information.

Narragansett Bay Water Quality (Fixed-Site Monitoring Network)

It's important because . . .
This system provides a real time data assessment of water quality impairments in Narragansett Bay, quickly alerts regulators to water quality changes and is used to make sound environmental management decisions.

Description: The Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) is a multi-agency collaborative established to equip, operate, and conduct data analysis and reporting on a multi-station monitoring network. The system simultaneously collects data on fundamental water quality parameters across the upper Bay every year primarily from May to October. During 2012, the NBFSMN operated with a total of 13 locations: eight buoys and five shore-based sites. The Network measures water quality parameters every 15 minutes, 24 hours per day, with three stations providing near real-time data on the web. Four land-based stations and one buoy operate year-round. Monitored parameters include**:** temperature, salinity, dissolved oxygen (DO), turbidity and chlorophyll.

Implemented by: DEM, URI GSO, NBC, NBNERR, URI-CI, EPA, NOAA

Used by: DEM, URI, NBC, NBNERR, NBEP, environmental managers, researchers

Management Values:

- Track Bay water quality throughout the bay providing high resolution data, temporally and spatially.
- Track improvements to upper Bay water quality during warm weather months that are anticipated as wastewater treatment upgrades are implemented and pollutant loadings reduced.
- Provide early warning of hypoxia (low dissolved oxygen) events.
- Provide critical data for the state assessment of water quality impairments in upper and mid-Narragansett Bay. In 2008 DEM designated an additional 7.62 square miles of mid-Narragansett Bay as impaired due to low DO.
- Researchers and managers use these data with other physical, chemical, and biological data to improve understanding of the causes of eutrophication and hypoxia in upper and mid-Narragansett Bay.

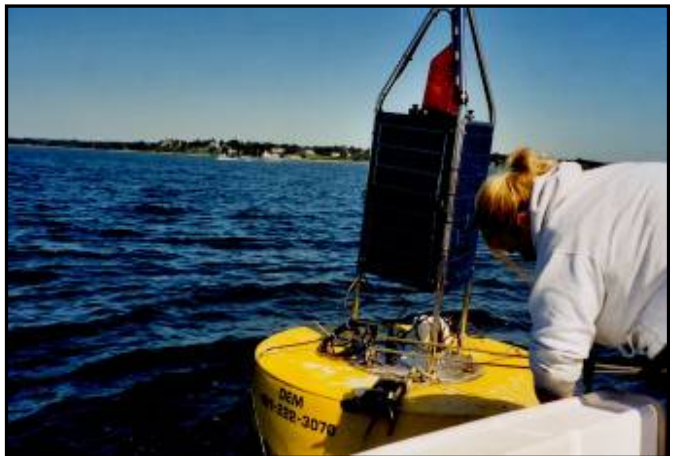


Photo: DEM

Data at:

http://www.dem.ri.gov/bart/stations.htm
http://snapshot.narrabay.com/app/ (raw near real-time data)
http://nerrsdata.org/get/realTime.cfm?stationCode=NARTBWQ (raw near real-time data)
http://www.dem.ri.gov/bart/netdata.htm (processed datasets 2003 – 2010)

Narragansett Bay Dissolved Oxygen (Boat Surveys) DO Field Surveys

Description: To evaluate hypoxia, the Narragansett Bay Estuary Program (NBEP), Brown University and Save the Bay have conducted boat-based surveys since 1999 in cooperation with additional partners. These surveys occur every summer during neap tides when DO is expected to be lowest, collecting water column profile data (temperature, salinity, and DO) as well as chlorophyll and turbidity at about seventy-five stations throughout the Providence and Seekonk Rivers, Greenwich Bay, and the East and West Passages of Narragansett Bay. Due to budget limitations in 2012, staffing was reduced for this effort, as well as the processing of the collected data. The future of this program is at risk. The Narragansett Bay Commission (NBC) collects similar data at five Providence
River and upper bay monitoring stations (Bullock's Reach, Conimicut Point, Edgewood Yacht Club, Pomham Rocks, and India Point). NBC sampling occurs year round, weekly during the summer and twice per month for the remainder of the year. The NBC data set consists of DO, temperature, salinity, density, depth, and photosynthetic active radiation (PAR).

The NBEP, Brown University, and URI lack funds or staff to adequately cover this monitoring need.

Implemented by: NBEP, Brown University, Save the Bay, DEM, URI_GSO and NBC

Used by: DEM, NBC, EPA, academic researchers

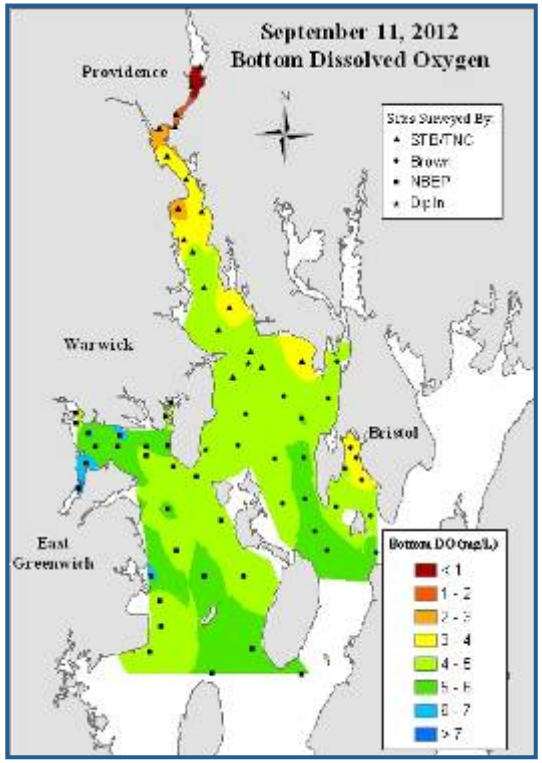
Management Values:

- Presents cross section of the water column to determine periods of high stratification which can lead to low DO.
- Provides a comprehensive temporal and spatial dataset that complements the time-series dataset generated by the NBFSMN system.
- Provides information on the inter-annual variability and severity of hypoxic and anoxic events in the Bay.

Data at: http://www.geo.brown.edu/georesearch/insomniacs/index.html
http://snapshot.narrabay.com/app/WaterQuality/Profiles

FY 2014 Funding: NBC funding stable. Remaining funding is vulnerable to disruption.
NBEP/Brown University/STB lack operations funds with the FY14 shortfall estimated at $36,000.

It's Important because . . .
The DO field surveys are essential to characterizing the extent of low dissolved oxygen events occurring in Narragansett Bay and to assessing management efforts.



Source: Brown University

Shellfish Growing Areas – Coastal Waters

It's important because. . . *This monitoring ensures shellfish are harvested from waters with acceptable water quality. It's required for the commercial shellfishing industry to operate in RI.*

Description: About 85% of Rhode Island's coastal waters (excluding RI and Block Island Sounds) are designated for shellfishing uses. The DEM Shellfish Growing Area Monitoring Program provides an extensive dataset on pathogens in these waters. The program assures compliance with the USDA National Shellfish Sanitation Program (NSSP), collects samples from 17 shellfish growing areas and analyzes these for total and fecal bacteria. The growing areas include most of Narragansett Bay, its shellfish harboring tributaries, all of the south shore coastal salt ponds, Little Narragansett Bay, and Block Island. The frequency of sampling varies with the management status of the growing area with all open and conditional areas sampled at least six times per year. There are 3030 fixed stations with 9 to 39 stations sampled in each growing area.

More information at: http://www.dem.ri.gov/programs/benviron/water/shellfsh/index.htm

Photo: DEM

Implemented by: DEM, DOH Laboratory

Used by: DEM, CRMC, USDA-FDA

Management Values:

- Provides data necessary to manage shellfish growing areas, permit harvesting and the interstate sale of shellfish.
- Protects public health by ensuring shellfish are harvested from areas with acceptable water quality.

Data at: Upon request from DEM Office of Water Resources

FY 2014 Funding: DEM state funds.

Large River Water Quality

Description: The data from these stations enable the assessment of water quality in rivers with large watersheds or drainage areas, and support trends analysis. DEM partners with USGS on the program in which over a dozen water quality parameters are sampled, including nutrients and pathogens using equal width increment, regardless of weather conditions at five stations in RI. Metals are sampled quarterly. Analysis for pathogens (enterococci bacteria) will be discontinued at all stations. These data are critical to tracking long-term trends in river flow and riverine pollutant loading to coastal waters, including upper Narragansett Bay. USGS is also monitoring at greater frequency at a station in Millville, MA in collaboration with MA DEP. In addition, NBC conducts water quality monitoring in the river tributaries entering upper Narragansett Bay. Samples are analyzed for the full suite of nitrogen parameters, orthophosphate, total suspended solids and dissolved organic carbon.

It's important because . . .
The state's largest rivers systems receive wastewater and stormwater discharges and are known to experience water quality issues. They also are a significant source of nutrients, chemical and biological contaminants to Narragansett Bay.

RI's cooperative agreement with USGS is subject to annual renewal and correspondingly annual review of continued BRWCT support. Note: As this report was developed, the BRWCT authorized use of funding to sustain the program for FY 2014 with a directive to continue to seek alternate sources of funding including restoration of state funds to support this long-term program.

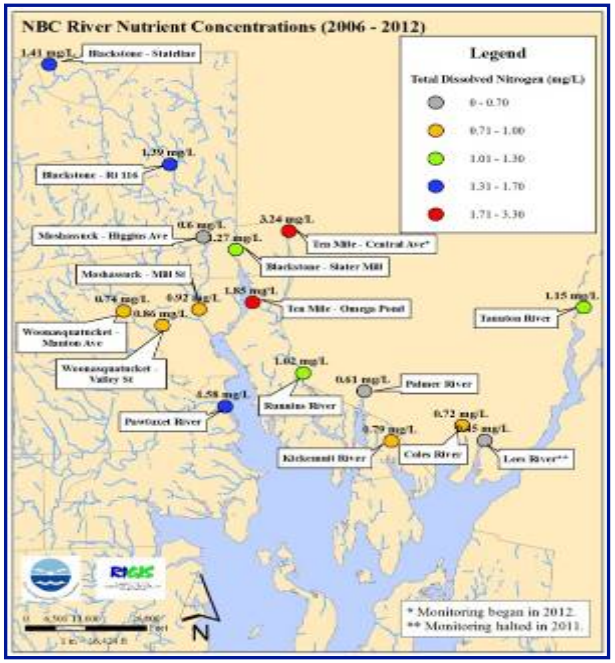
Implemented by: USGS, DEM, NBC

Used by: DEM, USGS, EPA, NBC, researchers, watershed organizations

Management Values:
- Evaluate long-term trends in riverine water quality
- Track pollutant loadings into the Upper Bay from large rivers
- Determine pollutant loadings from MA portion of watershed (Blackstone, Runnins, Palmer, Kickemuit, Cole, Lees and Taunton)
- Determine pollutant loadings to coastal waters (Blackstone, Pawtuxet, Pawcatuck)
- Development of discharge permit limits and water quality modeling

Data Available at:
http://waterdata.usgs.gov/ri/nwis/current/?type=quality&group%20Key=basin%20cd
http://snapshot.narrabay.com/app/WaterQuality/NutrientMonitoring

FY 2014 Funding: BRWCT, USGS, NBC



Source: NBC

Wadeable Rivers & Streams –Rotating Assessments

Description: DEM conducts monitoring for wading rivers and streams via a rotating basin monitoring strategy. A portion of the state is monitored each year. Improvements continue to be made in field techniques, station selection, documentation, quality assurance, and safety. Parameters are tailored at each station to meet management needs. In 2012, sampling occurred at 66 stations in the Pawtuxet, Pocasset, Hunt, and Moosup River Basins and included chemical, physical and biological (macroinvertebrates) parameters.

Funding is vulnerable to disruption. Reductions in federal funding may adversely affect continuation of this program following 2013.

Implemented by: DEM, NEIWPCC, DOH, ESS Group

Used by: DEM, EPA, watershed organizations, researchers

Management Values:
- Assessment of water quality in wading rivers and streams
- Data to support permitting decisions
- Data to support development of water quality bio-criteria
- Water quality restoration planning (TMDL development)

Data at: Please contact Connie Carey at the DEM Office of Water Resources

FY 2014 Funding: DEM, EPA. Continuity of Federal funding is uncertain.

It's important because . . .
This monitoring enables Rhode Island to reduce the percent of un-assessed rivers and streams and identify river segments that exhibit poor water quality or degraded aquatic habitat so management and restoration plans can be initiated.

Figure 9. Map of 2012 Ambient River Monitoring Stations in the Pawtuxet River, Upper Moosup River and Hunt River Watersheds

Source: DEM

Arrival & Spread of Freshwater Aquatic Invasive Species (AIS)

It's important because . . .
Controlling and eradicating invasive species is easier and costs less when rapidly identified and addressed. Rapid detection and response to invasive species require monitoring programs capable of promptly detecting their appearance in RI.

Description: Aquatic invasive species (AIS) are a widespread management concern in RI freshwaters. DEMcontinued its seasonal surveys of lakes and ponds with a goal of detecting aquatic invasive species. Data available for 130 lakes and ponds indicated the presence of one or more aquatic invasive plants in 59% of the surveyed waterbodies. Variable milfoil and fanwort were the most commonly detected of the 13 aquatic invasive plants species found. (See DEM report on lakes and ponds for more detail.) DEM also continued to screen rivers and streams for AIS as part of the Rotating Basin Water Quality Monitoring program.

Funding is vulnerable to disruption. Unstable funding has hampered development of an effective surveillance, preparedness and rapid response program.

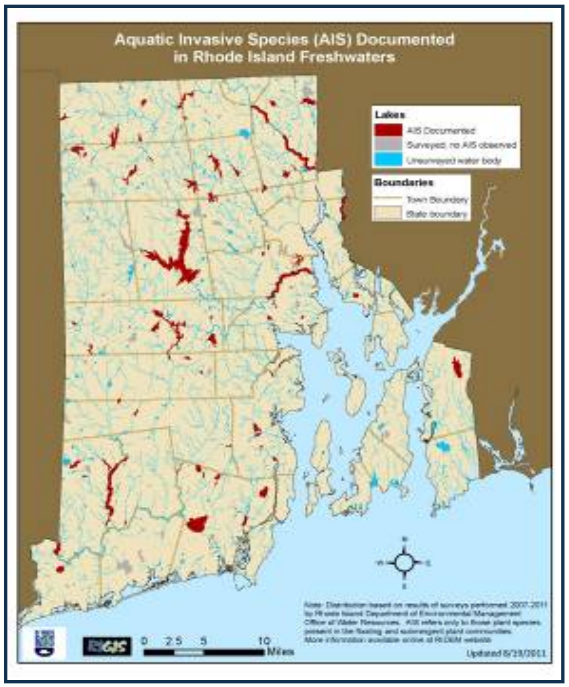
Implemented by: DEM, RINHS, and URI-WW

Used by: DEM, RINHS, URI-WW, USFW, Lake associations, researchers

Management Values:
- Characterize the nature and extent of freshwater AIS infestation
- Continue surveillance at select freshwater sites that were of concern the previous year

Data at: http://www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/invasive.pdf
http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/lakes012.pdf

FY 2014 Funding: DEM, RINHS, URI, US FW/Northeast Aquatic Nuisance Species Council (NEANS)
Source: DEM



Source: DEM

Arrival & Spread of Marine Aquatic Invasive Species (AIS)

It's important because . . .
Controlling and eradicating invasive species is easier and costs less when rapidly identified through monitoring. Rapid detection and response systems for invasive species require monitoring programs capable of promptly detecting their appearance in RI.

Description: The CRMC began investigating the impact of AIS on coastal resources in 2000 in partnership with the Massachusetts CZM program under a regional rapid assessment survey (RAS). Since that time the CRMC, with partners, has continued to conduct the RAS every 3 years. In 2009 the CRMC implemented its marine Invasive Species Monitoring Project when monitoring began for AIS at 5 floating dock sampling sites. In 2012, the CRMC initiated a larval settlement plate monitoring project at 13 sites within Narragansett Bay and some coastal salt ponds to measure the impact of AIS on native species. It is intended to be a continuing element of the CRMC's Invasive Species Monitoring Project CRMC began 2 pilot AIS monitoring projects in 2012: eelgrass beds in collaboration with EPA Atlantic Ecology Division; and commercial vessel ballast water in collaboration with RWU. Finally, CRMC in collaboration with Massachusetts CZM program and Northeast Aquatic Invasive Species Panel are monitoring for invasive grass shrimp species. SCUBA will be used to conduct additional surveys at an increased number of eelgrass beds.
CRMC will continue to expand the invasive grass shrimp survey. In addition, CRMC plans to investigate the feasibility of monitoring Chinese Mitten crabs within various coastal rivers and the use of plankton tows in the estuarine portions of these coastal rivers.

Carry over federal funds through the RI AIS Management Plan are available to support the current level of monitoring activities through FY 2013.

Implemented by: CRMC, DEM, NBNERR, RINHS, EPA AED, RWU and URI-WW

Used by: NBNERR, RINHS, CRMC, DEM, EPA, RWU, NOAA, USFW, National Park Service

Management Values:
- Characterize the nature and extent of marine AIS infestation
- Continue surveillance at select marine or estuarine sites that were of concern the previous year

Data at: http://www.crmc.ri.gov

FY 2014 Funding: No state funding is currently available. Federal Funding is vulnerable to disruption.

Photo: CRMC

River & Stream Flows

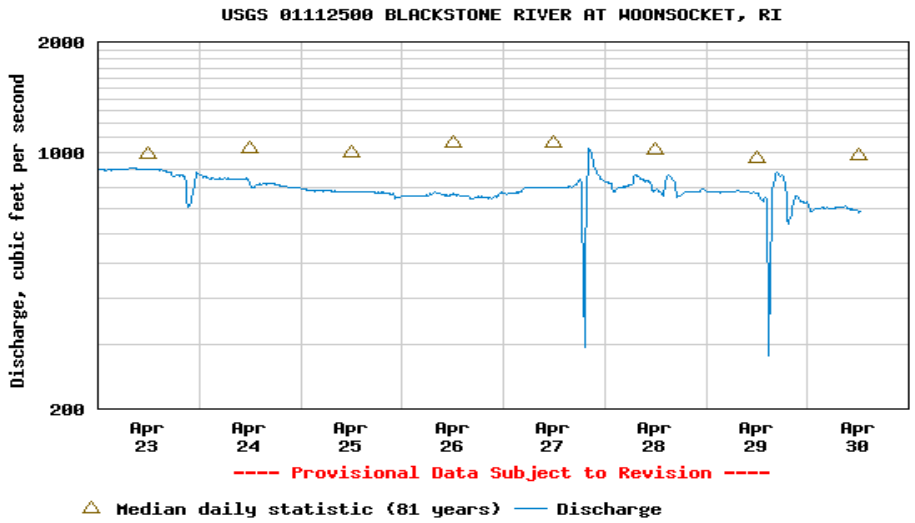
It's important because . . .
Data on river and stream flows is essential for preparing for and managing droughts, responding to flood events, establishing minimum stream flow standards, and managing floodplains.

Description: The Rhode Island Stream Gage Network is comprised of 36 stream gages and provides continuous river and stream flow data. USGS operates and maintains under contracts with the DEM (using BRWCT funding), WRB, and other entities. Data include long-term statistical analyses specific to data generated by each gage in the network. The data are among the most widely used in water programs including emergency resposne and floodplain management, dam management, water pollution contorl, drought management and water supply management.

USGS has recently altered its cost share arrangement with RI. In 2013, RI is being asked to be responsible for 70% of the network's operating costs (an increase from the previous 50% cost share requirement). See discussion on page 3 of the funding concerns regarding the network.

Implemented by: USGS, DEM, WRB, PWSB

Used by: DEM, WRB, USGS, PWSB, NBC, researchers, RIEMA, FEMA, Local Emergency Managers, EPA, NRCS, ACOE



Management Values:
- Development of minimum flow standards
- Pollutant loading calculations
- Development of water quality restoration plans
- Water quality & quantity modeling
- Drought management
- Emergency (e.g., floodplain) management
- Basin planning related to water supply
- Water supply development planning in Big River Watershed

Data at: http://waterdata.usgs.gov/ri/nwis/current/?type=flow

FY 2014 Funding: Current state and local sources: BRWCT, WRB, PWSB, RIEMA, Ocean State Power, Local Sponsors.
Reductions in federal USGS funding may require cuts in this program.

Critical Coastal Waters - Rotating Assessment

Description: The RI Water Monitoring Strategy recommends sampling RI's coastal waters on a rotating basis, similar to the program design DEM utilizes to monitor RI's smaller rivers and streams. Narragansett Bay-wide monitoring strategies do not collect data on the conditions in coves and embayments. DEM's Shellfish Water Quality Monitoring Program collects bacteriological data throughout RI coastal waters, including the Salt Ponds, but it does not collect data on other important water quality parameters. On a more limited basis, URI-Watershed Watch volunteers, and applied researchers collect monitoring and other types of data on coastal embayments and coastal ponds. The Narragansett Bay National Estuarine Research Reserve (NBNERR) is able to provide some water quality data collection for critical coastal waters utilizing its boat-based DATAFLOW monitoring system. The Narragansett Bay Commission also operates a DATAFLOW monitoring system weekly in the coastal waters of Providence and Seekonk Rivers. The Coastal Waters Rotating Assessment Program would complement other core monitoring programs and research efforts by generating water quality data for coastal waters of critical concern, such as Greenwich Bay and the Salt Ponds. Data gaps regarding the southwestern coastal ponds are considered a priority due to worsening or vulnerable water quality and potential for future aquaculture development in that region.

It's important because . . .
Coastal embayments and lagoons have unique circulatory regimes, biota, and watersheds that create management challenges distinct from those of the entire Narragansett Bay. Targeted water quality monitoring of these coastal waterbodies is essential for managing their diverse resources and high productivity, and ensuring the continuation of their many socio-economic values.

Not Implemented.

Used by: DEM, CRMC, NBC, watershed organizations, researchers, EPA, NBNERR

Management Values:
- Track changing conditions in the Bays coves, embayments and coastal ponds.
- Track effects of wastewater and stormwater management efforts currently underway.
- TMDL development.
- Possible areas of aquaculture expansion.

FY 2014 Funding: No state funding is currently available to implement this recommended program.

Photo: DEM

Freshwater Beach Water Quality

Description: The RI Department of Health (DOH) Beach Program oversees monitoring and public health notifications for 43 freshwater beaches. Sources of contamination at freshwater beaches include outdated septic systems, cesspools and holding tanks, wildlife and waterfowl, and stormwater runoff. The DOH Beach Program uses the indicator bacteria *Enterococci* to determine safe water quality conditions in Rhode Island swimming waters. These pathogens can cause a wide range of health problems including ear, nose, and throat infections, gastroenteritis, hepatitis, and respiratory illness. Because there are so many potential pathogens and testing for all of them is not feasible, *Enterococci* are used as an indicator of the potential presence of these pathogens.

It's important because . . .
Children are at highest risk for contracting water-borne illness from swimming in contaminated bathing waters. 51% of all licensed freshwater facilities are children's summer camps and recreational facilities.

DOH's Beach water quality monitoring program is currently dedicated entirely to saltwater beaches. Yet RI's freshwater beaches account for about one-third of the state's beach closures.

Photo: RI DOH Beach Program

The recommended enhanced program for monitoring of freshwater beach water quality has not been funded. An estimated $100,000 annually is required to monitor RI's freshwater beaches for public safety.

Implemented by: Partially implemented by freshwater beach facility owners and operators

Used by: DOH, DEM, town beaches, EPA, other public recreation facilities, municipalities

Management Values:
- Find and eliminate sources of contamination at licensed freshwater facilities.
- Develop preemptive closure protocols to better protect public health.
- Evaluate monitoring and notification methods currently in place.
- Incorporate cyanobacteria advisories and education to freshwater facilities.

Data at: http://www.ribeaches.org (saltwater beaches only)

FY 2014 Funding: Expansion of the DOH Beach Program to include apply a risk-based approach to monitoring of freshwater beaches has not been funded.

Saltwater Beach Water Quality

Description: The RI Department of Health (DOH) Beach Program oversees monitoring and public health notifications for RI's 71 saltwater beaches. Sources of contamination at beaches include outdated septic systems, cesspools and holding tanks, wildlife and waterfowl, and stormwater runoff.
The DOH Beach Program uses the federal indicator organism, Enterococci, to determine safe water quality conditions at Rhode Island swimming waters. Beach water quality monitoring efforts are dedicated entirely to saltwater beaches because the state's only available source of funding for this monitoring requirement is EPA's National Beach Water Quality Monitoring program, which requires that its funds be dedicated to saltwater beaches. In addition to samples collected by beach facility operators, DOH applies a risk-based monitoring assessment to enhance public health protections.

Funds are available to sustain monitoring through 2013. However, unlicensed urban beaches in upper Narragansett Bay will not be monitored. Future federal funding is uncertain.

Implemented by: DOH Beach Program

Used by: DOH, DEM, EPA, Municipalities, and the general public

Management Values:
- Find and eliminate sources of contamination at licensed saltwater facilities.
- Develop preemptive closure protocols to better protect public health.
- Evaluate monitoring and notification methods currently in place.

Data at: http://www.health.ri.gov/beaches/
http://beaches.health.ri.gov/swim/

FY 2014 Funding: No state funding currently available. FY 2014 federal funding is uncertain.

It's important because . . .
Beachgoing is an integral part of Rhode Island's tourism economy. Our saltwater beaches cannot operate without being certified for safe swimming conditions.

Summer 2012 Beach Closure Summary . . .
49 saltwater beach closure days
29 saltwater beach closure events
17 saltwater beaches closed to swimming

Volunteer Monitoring – Surface Waters

Description: Volunteer –based monitoring makes important contributions to the overall monitoring effort in RI waters. The University of Rhode Island Watershed Watch Program, the state's largest volunteer-based monitoring program, has grown to over 300 stations sampled in both fresh and salt waters. The program monitored 65 lakes and ponds in 2012 seasonally from May through October and continues to be the primary source of water quality data for this resource. Parameters measured include water clarity, algal density, dissolved oxygen, water temperature, alkalinity and pH, nutrients and bacteria. With almost 150 lakes covering over 20 acres located throughout RI, there remains a need to expand the program to address those lakes that are currently unassessed. Rivers and streams are also monitored by URI-WW and a volunteer –based program operating in the Blackstone River watershed. Volunteer data generated on rivers and streams provides information on water conditions between the State's periodic rotating assessments. Finally, volunteer-based monitoring of coastal waters also provides additional data to characterize water quality conditions including sampling for pathogens at saltwater beaches that continue to be popular recreational choices beyond Labor Day.

It's important because . . .
Volunteer-based monitoring is the primary source of information on water quality in RI lakes and ponds. Volunteer monitoring helps track conditions at beaches and in rivers at times when no other monitoring is occurring.

Implemented by: URI – Watershed Watch, Blackstone River Coalition, watershed & conservation organizations, volunteers

Used by: DEM, DOH, EPA, watershed organizations, researchers

Management Values:

- Monitor and assess water quality in lakes and ponds for which there is little other water quality data.
- Provide data to supplement state watershed assessments and allow tracking of changes
  in-water quality as pollution management actions are implemented.
- Identify new water pollution problems.
- Refine and update nutrient water quality criteria and standards.
- Support municipal and state TMDL implementation.

Data at: http://www.uri.edu/ce/wq/ww/Data.htm

FY 2014 Funding: URI, DEM/EPA, Various sources including local sponsors.

Lake Monitoring Volunteer Program
Photo: URI Watershed Watch

Toxic Contaminants in Freshwater Fish: Mercury

It's important because . . .
Expanding this monitoring program would allow identification of those waters in which fish tissue contamination presents a public health risk and allow Rhode Island to better inform the public of such risks through fish consumption advisories.

Description: One of RI's largest environmental data gaps is with regard to toxic contaminant concentrations in freshwater fish tissues. RI has yet to establish a fully supported program to assess fish tissue and the public health risks they may pose. In the interim, a collaboration by the DEM Office of Water Resources and Division of Fish and Wildlife with a researcher at the USEPA Atlantic Ecology Division continues to allow certain waterbodies to be sampled with the resulting data on fish tissue contamination used to identify those that require fish consumption advisories to protect public health. The available data indicates that mercury levels in freshwater fish tissue are often elevated. DEM has made a commitment to sample a subset of Rhode Island lakes and ponds – those publicly accessible to boats –for fish tissue contamination. The sampling program design will be implemented over a five-year time frame. Additionally, DEM is collaborating with the New England Interstate Water Pollution Control Commission on plans for regional monitoring of mercury in fish tissue aimed at evaluating progress on implementation of the regional mercury TMDL.

Photo: Wood Pawcatuck Watershed Association

Partially implemented. While a subset of lakes has been targeted for sampling, there continues to be a large monitoring gap. There is presently no routine monitoring in the state to evaluate freshwater fish tissue for toxic contaminants.

Needed by: DEM, DOH, EPA, Local Officials, Researchers

Management Values:
- Assess waters for suitability for fish consumption
- Determine whether or not public health advisories regarding fish consumption are needed
- Track trends in concentrations of mercury in fish tissues over time

Data at: http://www.health.ri.gov/healthyhousing/mercury/fish.php
http://www.neiwpcc.org/mercury/mercurytmdl.asp

FY 2014 Funding: No state funding is currently available; DEM conducts some work with very limited federal funding.

Shoreline Erosion, Accretion, & Sediment Transport

It's important because . . .
In RI coastal communities, shoreline erosion and inundation, are compromising the integrity of major portions of the natural and developed coast.

Description: The current CRMC Shoreline Change Maps document changes from 1939 to 2006. These maps are available online as noted below. Updated maps covering the entire RI shoreline are planned for 2013 using 2011 ortho-photos, 2011 LiDAR data, 2012 eelgrass aerial photo images and new post-Sandy aerial photo images and LiDAR. Updated Shoreline Change maps will be prepared as part of the upcoming CRMC Shoreline Change (Beach) Special Area Management Plan (SAMP). See: http://www.beachsamp.org/

As a result of Hurricane Sandy in October 2012, significant shoreline erosion occurred along the Rhode Island coast, especially along the southern shore from Westerly to Narragansett. Shoreline erosion processes will be characterized as part of the CRMC Shoreline Change SAMP. Sea level rise and flood inundation scenarios will also be analyzed to inform planning efforts and decision-making regarding public and private infrastructure and natural resources.

Implemented by: CRMC, URI Coastal Resources Center, URI Dept. of Geosciences

Used by: CRMC, DEM, Municipalities, Beach Managers, Army Corps of Engineers, Coastal Property Owners

Management Values:

- Shoreline change maps allow the CRMC to track ongoing erosion and determine needed setbacks from the shoreline based on measured historic erosion rates.

Data at: http://www.crmc.ri.gov/maps/maps_shorechange.html

FY 2014 Funding: CRMC, BRWCT. BRWCT support provided via funding for the Shoreline Change SAMP.

Comparison of shoreline erosion at the same Green Hill Beach property (Photos: RI CRMC).

Eelgrass Beds

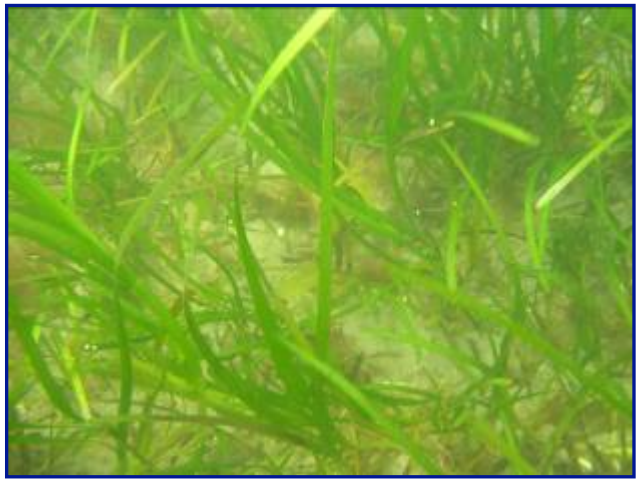
Description: Eelgrass grows in shallow areas of Narragansett Bay and south shore salt ponds. It provides critical nursery habitat for species such as quahogs, lobster, tautog, and bay scallops. A three tiered-monitoring effort is required to comprehensively assess eelgrass bed areal extent, cover, and condition. Tier 1 uses aerial photography and remote sensing to map eelgrass distribution (presence/absence) throughout Rhode Island coastal waters. Tier 2 monitoring provides estimates of eelgrass bed in specific areas such as a salt pond. Tier 2 is a rapid assessment technique and can be performed annually. Tier 3 monitoring entails measuring eelgrass biomass and other eelgrass bed properties over multiple time scales for a specific bed or coastal waterbody.

It's important because . . .
Eelgrass provides critical habitat for important fish and shellfish species, stabilizes sediments, and filters particles from the water column. It functions as an excellent indicator of water quality due to its rapid response to both nutrient concentrations and in situ light levels.

Tier One monitoring requires $85,000 every 3 years for aerial photography statewide.
Tier Two and Three monitoring require $3,500-5,000 annually.

Implemented by: NBNERR, Save the Bay, URI Environmental Data Center

Used by: CRMC, DEM, ACOE USFW, NOAA, NRCS, EPA, NBNERR, NBEP



Management Values:
- Eelgrass bed extent and well-being is a critical indicator of estuarine ecosystem health and habitat quality.

Data at: www.edc.uri.edu/rigis

FY 2014 Funding: No state funding currently available.

Salt Marshes

Description: In 2012 a monitoring protocol was created by the Narragansett Bay Estuarine Research Reserve, Save the Bay, and other experts in order to systematically assess Rhode Island salt marshes. Implementation began in 2012. The protocol entails a 3-tiered approach to salt marsh assessment. Tier 1 is a landscape scale, GIS based assessment (which will be completed in 2013), Tier 2 is a fairly rapid field-based assessment, and Tier 3 is a more intensive assessment encompassing research being conducted by many institutions including NBNERR, URI, EPA, and USFWS. The Tier 2 assessment protocol was developed and implemented with input from local, state and federal experts, and the implementation will be completed in 2013. A typical salt marsh in RI is predominantly comprised of high marsh meadow. Recently, RI salt marshes have become dominated by short-form *Spartina alterniflora*, signaling that a major ecological transition is occurring in RI's salt marshes, likely due to accelerated sea level rise and several consecutive years of higher than average tides.

It's important because . . .
Salt marshes are often the first lines of defense against the effects of increasing sea level and tidal inundation on coastal habitats. In order to support long-term adaptation planning, accurate and quantitative monitoring of marsh habitats is required in order to predict how these systems will change over time.

Initial funding for development and implementation of the assessment was provided by the RI Coastal and Estuarine Trust Fund, as well as US Fish and Wildlife Service Coastal Program. The current assessment and the goal is to conduct the assessment on a three year cycle.

Implemented by: Save the Bay and NBNERR

Used by: CRMC, DEM, NBEP, NBNERR, NOAA, USFW, researchers, restoration programs

Management Values:

- Saltmarshes provide valuable habitat for wildlife and protect shorelines from erosion.

Data at: 2012 Tier 2 assessment data available mid-2013. NBNERR and Save the Bay will provide summary report on-line.

FY 2014 Funding: No state funding is currently available. Funding will be requested in FY 2015.

Photo: Save The Bay and Narragansett Bay National Estuarine Research Reserve.

Harmful Algal Blooms and Cyanobacteria

It's important because . . .
Cyanobacteria blooms can release natural toxins that pose a serious health threat to humans and their pets.

Description: Growing awareness of presence of cyanobacteria, also known as blue-green algae, in RI waters prompted DEM and DOH to continue their limited monitoring program to both screen for and confirm the presence of cyanobacteria, and issue public health advisories where appropriate. Cyanobacteria blooms can result in the release of natural toxins at levels that are of a concern for public health. While samples are screened internally by DEM, taxonomic confirmation of the species present and the quantification of toxicity is accomplished by analyses done at an out-of-state laboratory.

Implemented by: DEM, DOH, consulting services

Used by: DOH, DEM, EPA, municipalities and other facility owners, veterinarians

Management Values:

- Provides data that allows public health advisories to be issued when harmful cyanobacteria blooms are detected.

Data at: Available from DEM

FY 2014 Funding: No state funding is currently available. DEM uses limited federal funding to support this work.

Photo: DEM

Freshwater Wetlands

Description: Since 2005, DEM, in partnership with the RI Natural History Survey, have developed and refined a rapid assessment method (RAM) which has been applied to assess the condition of freshwater wetlands. T Through field inspections, information is collected that is used to characterize the ecological condition of the wetland and identify stressors to the functions of wetlands. The work, funded to date primarily by EPA, as part of continuing development of the overall state wetland protection and restoration program.

It's important because. . .
This data helps characterize the condition of our freshwater wetland resources and identify and quantify the major stressors to this resource.

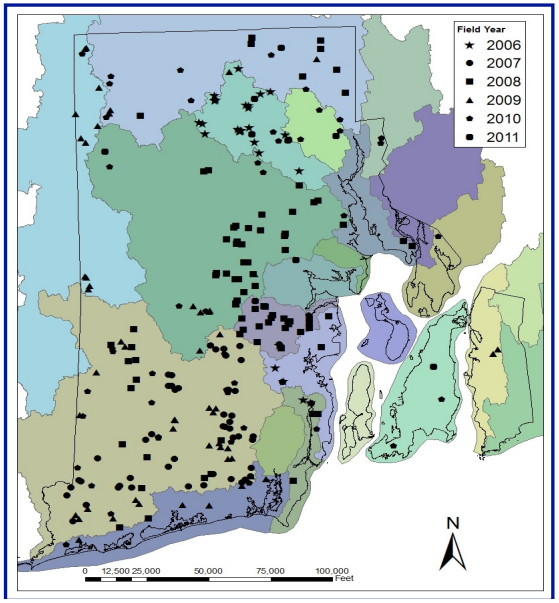
Implemented by: DEM, RINHS

Used by: DEM, EPA, USFW, researchers

Management Values:
- Characterize wetland condition
- Status and trends reporting
- Identification of stressors and refinement of management strategies
- Prioritize wetland restoration projects

Data at: Reports available at http://www.dem.ri.gov/programs/benviron/water/wetlands/wetldocs.htm

FY 2014 Funding: EPA competitive funding - state wetland program development grants.



DEM Wetland Monitoring Locations
Source: DEM

Coastal Fisheries - Trawl Surveys

Description: The RI DEM Division of Fish and Wildlife, Marine Fisheries Section, began a comprehensive fishery resource assessment program in 1979 encompassing Narragansett Bay and Rhode Island and Block Island Sounds. The Marine Fisheries Section collects, summarizes and analyzes trawl data for biological and fisheries management purposes and to provide seasonal and monthly identification of finfish and crustacean assemblages occupying Rhode Island coastal waters. Since the inception of the Rhode Island Seasonal Trawl Survey (April 1979) and the Narragansett Bay Monthly Trawl Survey (January 1990), 5,546 tows have been conducted within Rhode Island territorial waters with data collected on 132 species. The research vessel used in the Coastal Trawl Survey is the R/V *John H. Chafee* built in 2002.

It's important because. . .
The data collected by the Department's Coastal Research Trawl Survey is vital to assessing the health of the Marine Fisheries resources of the State of Rhode Island as a measure of the performance and effectiveness of the strategies used to manage recreationally important finfish

Implemented by: DEM Marine Fisheries Program

Used by: DEM, URI GSO, NOAA Fisheries, ASMFC, NEFMC, Fisheries managers and researchers

Photo: DEM Marine Fisheries

Management Values:
- Supports local and regional fisheries stock assessments.
- Tracks the relative abundance of finfish and shellfish assemblages in Narragansett Bay, Rhode Island and Block Island Sounds.
- Provides stock and recruitment information on key commercial and recreational species.
- Tracks changes in fishery dynamics as is relates to environmental changes.
- Collects local fish species for DEM aquariums and events offered by the Fish & Wildlife Division's Aquatic Education Program.

Data at: Available upon request from DEM Marine Fisheries Fort Wetherill Marine Lab, Jamestown, RI 02835 (401)423-1934

FY 2014 Funding: US Fish and Wildlife, Federal Aid in Sportfish Restoration

Lobster - Ventless Trap Surveys

Description: Since RI's Marine Fisheries Program, in cooperation with commercial lobstermen, has been participating in a regional- ventless lobster trap survey that provides important data on the lobster population in shallow and rocky bottom habitats not sampled by the Program's trawl surveys and fisheries dependent surveys. The commercial lobster fishery, Rhode Island's most valuable in in terms of landed value, is in peril due to declining recruitment in southern New England stocks (insufficient young lobsters are surviving to adulthood). This survey was implemented to improve the characterization of the lobster stock and
provide data to improve understanding of the lobster population.

It's important because . . .
This initiative provides information that improves our understanding of the status of our second most valuable commercial fishery- lobsters.

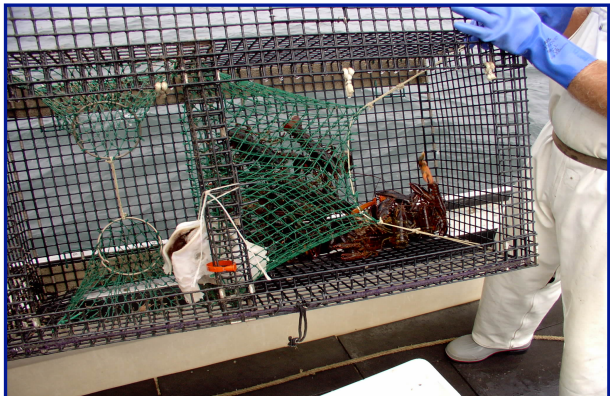
Implemented by: DEM and commercial lobstermen

Used by: DEM, researchers

Management Values: Improved assessment of lobster stocks

Data at: Available from RIDEM Marine Fisheries upon request.

FY 2014 Funding: Interim funding provided by the BRWCT.
Other sources will need to be secured to sustain the program, beyond state FY14.



Photos: DEM Marine Fisheries

Appendix A – RI Environmental Monitoring Programs & Initiatives

The mission of the **Narragansett Bay Commission** (NBC) is to protect and sustain water quality in Narragansett Bay and its tributaries by providing safe and reliable wastewater collection and treatment services at a reasonable cost. NBC's water quality monitoring programs are essential to this mission. The NBC maintains two fixed water quality monitoring stations that collect data continuously as part of the NBFSN, conducts year round nutrient and bacteria monitoring in the upper Bay and tributary rivers and conducts vertical profile monitoring of several water quality parameters, including DO, density and PAR. NBC also initiated surface water quality mapping as a new monitoring initiative in late 2010, benthic video monitoring of the upper Bay and phytoplankton monitoring in 2012. Surface mapping involves the collection of high-resolution water quality data in coordination with geographical positioning data. In 2011, NBC launched a new web site for accessing monitoring data and other information on Narragansett Bay conditions, *Snapshot of the Upper Narragansett Bay*. The *Snapshot* website represents a comprehensive look at water quality in upper Narragansett Bay by providing the general public with near real time data and a wide range of information regarding water quality in upper Narragansett Bay.

http://snapshot.narrabay.com/app/

The **Narragansett Bay Estuary Program** (NBEP) conducts several marine monitoring efforts, and provides assistance to state agencies and the RI Bays, Rivers, and Watersheds Coordination Team in developing and implementing marine monitoring plans. Summer dissolved oxygen distributions are measured by NBEP in a collaborative effort to map the extent and severity of hypoxia (low oxygen) in upper Narragansett Bay. The NBEP also previously helped to conduct aerial summertime macroalgae surveys using monthly high resolution, GPS stamped, digital photography along the western Bay lower intertidal-subtidal zone. Surveys are conducted monthly during low spring tides from June-September (when algal biomass is at its peak) each year. This project provided baseline conditions of macroalgae location and biomass, important indicators of Narragansett Bay's ecological health. GIS macroalgae distribution maps are provided on the NBEP web site.

www.geo.brown.edu/georesearch/insomniacs
www.nbep.org/

The **Narragansett Bay National Estuarine Research Reserve** (NBNERR) collects a comprehensive suite of abiotic and biological monitoring data. Water quality data are collected continuously from four locations around Prudence Island as part of the national System-wide Monitoring Program. These data are complemented by continuous monitoring of meteorological data at our weather station near Potter Cove and by monthly nutrient and chlorophyll sampling at the four water quality sites. The Reserve is also building a Sentinel Site monitoring program at two of its most pristine salt marshes on Prudence Island in order to track changes in marsh structure and function in response to climate change and sea level rise. Finally, the Reserve regularly monitors an array of biological parameters (summarized under a new Biological Monitoring Framework report). Some of these parameters include eelgrass and macroalgae distribution and cover, benthic infauna, invasive crabs, and nekton in estuarine habitats; and songbirds and ticks in upland habitats.

www.nbnerr.org
www.nbnerr.org/Content/NBNERR_Monitoring_Plan_2011.pdf

The **Rhode Island Coastal Resources Management Council** is the State's federally-designated coastal zone management agency. The CRMC has been delegated by the RI General Assembly to manage and plan for the preservation of the coastal resources of the state including but not limited to submerged lands, and is responsible for the management and permitting of all activities within tidal waters of the state, including dredging, and along shoreline features and their contiguous areas. The CRMC also implements federal consistency reviews for direct federal activities, federal permits and funding throughout the state and in offshore waters. The CRMC in collaboration with the URI Department of Geosciences maintains shoreline change maps depicting erosion and accretion along the coast and is assessing the impacts of sea level rise along the RI coastline. The CRMC in collaboration with many partners manages the state marine and estuarine aquatic invasive species program consistent with the Rhode Island Aquatic Invasive Species Management Plan which was federally approved in 2007.

www.crmc.ri.gov/maps.html
http://www.crmc.ri.gov/invasives.html

The **Rhode Island Department of Environmental Management's** Bureau of Environmental Protection, the **Office of Water Resources** (DEM-OWR) monitors, protects and restores rivers, lakes, wetlands, groundwater and coastal waters in order to support healthy communities of fish, plants, and other aquatic life, as well as sustain ecosystem services such as fishing, swimming, and drinking water supplies. DEM OWR is responsible for using water quality monitoring data to assess the conditions of Rhode Island's surface waters in accordance with the federal Clean Water Act. The results of the assessments of the condition of surface waters are available online and specific data can also be requested from the Surface Water Quality Assessment Program.

Monitoring activities are outlined in the 2005 publication: the Rhode Island Water Quality Monitoring Strategy. Environmental indicators monitored include physical, chemical and biological parameters related to water quality. Several programs are involved in the collection of data including:

- **Ambient River Program**: Collects water quality data from rivers and streams on a rotating basis throughout the state monthly from May-October.
- **Wade-able Stream Macroinvertebrate Program:** Collects macroinvertebrate data from wade-able streams on a rotating basis throughout the state August – September to assess the health of streams and the ability to support aquatic life.
- **Aquatic Invasive Species Surveys**: Monitors lakes and streams on a limited basis in the summertime to map the distribution of aquatic invasive species (presence/absence). Results of monitoring surveys are available online.
- **Narragansett Bay Fixed-Site Network:** DEM, URI, NBC and NBNERR operate a network of fixed sampling stations that provide continuous monitoring of water quality in Narragansett Bay.
- **Shellfish Resource Program:** Monitors shellfish areas in Narragansett Bay to determine which are safe for harvesting shellfish for human consumption.

http://www.dem.ri.gov/programs/benviron/water/quality/index.htm

The mission of the **Rhode Island Department of Health** (DOH) Beach Program is to protect the public from illness associated with swimming in contaminated bathing waters. The Beach Program achieves this goal by licensing recreational bathing beaches throughout the state. We further this mission by assisting beach owners and managers with finding and eliminating sources of contamination. The Beach Program collects various types of environmental data including Enterococci levels, water temperature, bather load, beach conditions, precipitation, seaweed load, illness complaints, etc.

http://www.health.ri.gov/
www.ribeaches.org

The **Rhode Island Natural History** Survey (RINHS) collects and distributes information on the location and viability of animal and plant species and natural communities in Rhode Island. Ongoing monitoring focuses on rare species and natural communities and invasive species. Data reports are available by request.

http://www.rinhs.org/what-we-do/data/
http://www.rinhs.org/resources

Save the Bay conducts monitoring at two natural eelgrass bed sites in the bay, Ft Getty in Jamestown and T-Dock on the south end of Prudence Island. It sends its data to the SeagrassNet database, a world-wide monitoring database and web site. Save the Bay uses data from natural eelgrass sites to compare with monitoring data conducted at transplant bed sites.

www.seagrassnet.org/research#percentcountry

The **University of Rhode Island Environmental Data Center** (URI EDC) operates within the Department of Natural Resources Science, College of the Environment and Life Sciences at the University of Rhode Island. The URI EDC is staffed with a critical mass of research scientists that specialize in 1) the collection, storage, analysis, display, and distribution of geospatial data and 2) teaching, instruction, and training in the use of geospatial technologies. The URI EDC works closely with the Rhode Island Geographic Information System (RIGIS) Consortium and regional entities on the coordination of geospatial data acquisition and distribution that supports environmental monitoring efforts throughout Rhode Island. During 2010 and 2011, URI EDC through the URI Coastal Institute along with RIGIS represented Rhode Island in the Northeast LiDAR Project whereby a consortium of Northeastern States, led by the Maine Office of GIS and the USGS Geospatial Liaison Network, secured ARRA funding (with contributing funds from RI Statewide Planning Federal Highway, RI Chapter of The Nature Conservancy, and USDA Natural Resources Conservation Service RI) through USGS to collect high resolution elevation (LIDAR) data covering all of Rhode Island. These data are immediately applicable in flood hazard mapping, sea level rise modeling, ecological climate change habitat assessments, and alternative energy siting.

www.edc.uri.edu

The **University of Rhode Island Watershed Watch** (URIWW) program works with DEM, watershed organizations & local communities to assess water quality, and provide information for more effective management of critical water resources. The URIWW produces quality data for a broad range of parameters for over 250 monitoring sites on lakes, ponds, reservoirs, rivers, streams, salt ponds and marine waters statewide. Field monitoring is conducted by trained volunteers typically from May through October either weekly or bi-weekly following well established and documented methods. Field parameters include temperature, dissolved oxygen, clarity and depth. Water samples are collected monthly and processed in a state certified laboratory for nutrients, bacteria, pH, alkalinity, chlorides/salinity and chlorophyll. Data are summarized in tables and charts on the URIWW website with additional formats available upon request.

www.uri.edu/ce/wq/ww/Data.htm

Appendix B – References and List of Acronyms

References

Rhode Island Department of Environmental Management, (RIDEM). 2012. 2012 Integrated Water Quality Monitoring and Assessment Report. State of Rhode Island and Providence Plantations. 66 pp and appendices.

Rhode Island Department of Environmental Management (RIDEM). February 2012. Rhode Island Freshwater Lakes and Ponds: Aquatic Invasive Plants and Water Quality Concerns. State of Rhode Island and Providence Plantations. 147 pp.

Narragansett Bay Commission. 2013. Personal communication.

List of Acronyms

AIS	Aquatic Invasive Species
BRWCT	Bays, Rivers and Watersheds Coordination Team
CRMC	Coastal Resources Management Council
CZM	Coastal Zone Management
DEM	Department of Environmental Management
DIN	Dissolved Inorganic Nitrogen
DO	Dissolved Oxygen
DOH	Department of Health
EBM	Ecosystem-Based Management
EPA	Environmental Protection Agency
GSO	University of Rhode Island Graduate School of Oceanography
NBC	Narragansett Bay Commission
NBEP	Narragansett Bay Estuary Program
NBFSMN	Narragansett Bay Fixed Site Monitoring Network
NBNERR	Narragansett Bay National Estuarine Research Reserve
NEANS	Northeast Aquatic Nuisance Species Council
NEIWPCC	New England Interstate Water Pollution Control Commission
NGOs	Non-Governmental Organizations
NOAA	National Oceanic and Atmospheric Administration
CHRP	NOAA-URI Coastal Hypoxia Research Program
PWSB	Providence Water Supply Board
RIEMA	Rhode Island Emergency Management Agency
RIEMC	Rhode Island Environmental Monitoring Collaborative
RINHS	RI Natural History Survey
RWU	Roger Williams University
SAMP	Special Area Management Plan
TMDL	Total Maximum Daily Load
URI CI	University of Rhode Island Coastal Institute

URI-WW	University of Rhode Island Watershed Watch
USFW	US Fish and Wildlife
USGS	US Geological Service
WRB	RI Water Resources Board
WWTF	Wastewater Treatment Facilities

The Rhode Island Comprehensive Environmental Monitoring Strategy consists of:

- ***An inventory of existing monitoring programs;***
- ***An outline of additional monitoring programs the state needs;***
- ***A list of indicators that will be used to measure the health of the marine habitats of the state;***
- ***A list of data standards and protocols that will be used on a reasonable and consistent basis by monitoring programs that contribute data to the state monitoring system;***
- ***A mechanism for data sharing among all monitoring programs that enables both monitors and users to securely access monitoring data via the Internet and to retain the integrity of such data;***
- ***A plan to provide data from the state marine monitoring system for disaster prevention, preparedness, response and recovery efforts in the marine environment;*** **and**
- ***A communications strategy to provide for public access to monitoring data.***

(RIGL 46-31)