

Great Bay MATTERS

Winter 2014

Volume 21 • Number 2

*Promoting research, education
and stewardship throughout
the Great Bay Estuary*

Great Bay Matters, Matters!



If you felt an unnamed longing this fall, and could not quite place what was missing in your life; let me tell you- it was the fall issue of Great Bay Matters. Instead, I hope you received a postcard encouraging you to fill out a survey about this publication.

Adaptation is a critical survival technique in nature, and we think that adapting is crucial to a strong organization as well. Taking a hard look at programs and products that are loved by staff and partners is helpful not only to see what can change, but to figure out exactly what we are doing well. Our popular school programs are evaluated by teachers and the volunteers that lead them every year, and adjustments are made each season. Our Coastal Training Program workshops collect feedback on everything from how tasty the snacks were to how relevant the content was to participants work. The Stewardship and Research programs adjust where to collect data, how to remove invasive species, and how to study the Bay based on what we see and learn about our instrumentation, about our communities, and about the natural system itself.

The staff at the Reserve, and our partners at the Great Bay Stewards wanted to check in with readers to make sure we are offering the right information, in the right format, and in the most efficient and cost effective way. I want to thank every person who completed the survey, and let our readers know that you may see some changes in the magazine over the next year. As we consider what these changes will be this winter, I wanted to share some of the key results

that were revealed in the survey with all of you. We found that:

- Most of you read Great Bay Matters to learn about the Great Bay Ecosystem and to find out what programs are happening at the Reserve;
- Your favorite parts of the magazine are the Research and Education sections;
- Over 80% of respondents feel that the articles are the right length, and have the right amount of technical information;
- Most people would like us to continue with a printed version of Great Bay Matters, but many suggested providing a choice of receiving information electronically instead.

The survey asked several open ended questions to glean what you like and dislike about the magazine and asked for your feedback on how to make improvements. We heard great suggestions -- including format changes, more emphasis on native wildlife and natural resources and current science, as well as a call to face controversial topics in the region head-on. The survey responses will provide a basis for changes you will see over the next year, balanced with reader preferences, staffing and budgetary resources. I encourage all of you to contact me if you missed the survey or if you have opinions about what you see as we start to implement changes. We want Great Bay Matters to matter. We want it to start conversations, inspire reflection, and motivate action. Our staff and the Great Bay Stewards are excited to start adapting to make sure Great Bay Matters stays relevant, interesting, and at the top of your reading list.

Cory Riley
Reserve Manager, GBNERR



GREAT BAY
NATIONAL
ESTUARINE
RESEARCH
RESERVE

Great Bay National Estuarine Research Reserve (GBNERR) is an estuary comprised of 7,300 acres of tidal waters and 2,935 acres of coastal land. Acquired through land purchases and conservation easements, GBNERR was designated on October 3, 1989 to be preserved for the purposes of education, research, and resource protection.

GreatBay MATTERS

89 Depot Road, Greenland, NH 03840
603-778-0015

Great Bay Matters is published cooperatively by GBNERR and the Great Bay Stewards

Editor: Kelle Loughlin
Design and Composition: Victor Young
Cover Photo: © Beth Heckman

Financial support for this publication was provided by a grant under the Federal Coastal Zone Management Act, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, Silver Spring, MD.

GBNERR

Manager: Cory Riley

Great Bay Discovery Center

Education Coordinator:
Kelle Loughlin

Great Bay Stewards

President: Jack O'Reilly



GBNERR is funded by the National Oceanic and Atmospheric Administration and the New Hampshire Fish and Game Department. The Reserve is supported by its non-profit friends group, the Great Bay Stewards



This publication is printed on FSC certified 50% total recycled content / 25% post consumer content paper.

Two Charlies ROCK!

One of the smallest pieces of conservation land protected by the Reserve is slowly growing into Great Bay's Community Wildlife Garden. Located next to Chapman's Landing on the shore of the Squamscott River, this 1.6 acre property has been the focus of multiple volunteer and generous funding efforts so that it hosts a wildlife viewing platform, a universally accessible trail, a rain garden and now an amazing wildlife pond.

On behalf of the New Hampshire Fish and Game Department and the Great Bay National Estuarine Research Reserve, we extend a huge THANK YOU to Wendy and Charlie Holland of Chester Hollow Water Gardens and the team of professional pond builders that joined them. This October an amazing team gathered from throughout New England, New York, and even Canada to showcase their talents. The group spent two days moving rocks, adding an upper "bog garden" area and native wetland plants to add to the pond. Timberland installed for us last fall. Professionally referred to by Chester Hollow as an "Ecosystem Pond", the water feature will soon become an oasis for native plants and wildlife in

an area already disturbed by development. Water is often the element that best attracts wildlife and is most often missing from a backyard. It can provide drinking, bathing and for some species, breeding opportunities. For this reason the pond is a centerpiece of this property.

The large and small granite boulders in the pond were all from the Seacoast region of New Hampshire and were provided by Charlie Gonet of CGH Excavation of Newmarket. Everything is in place ready for the waterfall to cascade into the pond where green and pickerel frogs, and a variety of aquatic insects took up residence last year. Part of the appeal of the garden is that there is no electricity on the property. A hand water pump was installed last year to provide water, and work is underway to purchase a solar panel to provide the power for the pond pump.

In addition to the features mentioned, plant life throughout the property is being slowly transformed as many invasive species are replaced



A collection of the best and brightest pond designers in the northeast.

with native plants that provide food, cover or nesting opportunities for multiple species of wildlife. We hope next spring to install multiple garden beds with wildlife-friendly themes such as a monarch butterfly garden and a fern garden. If you are interested in helping out please contact Melissa Brogle at 778-0015 or Melissa.brogle@wildlife.nh.gov. Also check out the facebook page at www.facebook.com/GreatBayNerrCommunityWildlifeGarden.com. It has truly been a community collaboration as we work together to help get growing on the "wild side" and we hope you will join in the effort!

Rachel Stevens,
Stewardship Coordinator, GBNERR



Granite from CGH Excavation is dropped at the site of "Ecosystem Pond".

Stewardship

THE LAND STEWARDSHIP PROGRAM

Nature's Benefits: Salt Marsh

The mat of wrack was 6 - 8 inches thick, and the combination of eelgrass, cordgrass stems and algae from the Bay made an efficient block of sunlight, enough to kill the grasses beneath it. As the participants of a recent salt marsh workshop at the Great Bay Discovery Center looked around, they could see a series of such patches on the marsh ranging from areas with a cover of dead salt marsh plants to areas of bare peat – the soil of the salt marsh. Each patch was noticeable to the eye and in different stages of succession. In some patches you could see the first signs of new life with glasswort plants being the first to colonize the area. Glasswort is very salt tolerant. The bare patches on the salt marsh are very salty due to the quick evaporation of the Bay water from the barren surface. As other plants join the glasswort, evaporation slows down and plants such as spike-grass colonize the patch by sending root runners under the surface of the peat. Soon, the patch that was once devoid of plants, is back again to being a healthy vibrant salt marsh.

Succession is the process of repair in a natural system such as forests, rocky shore, or any other habitat. When that huge old oak in the forest finally succumbs to the scars and injuries of a 150-year life, is knocked down by wind or crushed by ice, the big gap created in the forest canopy allows the plants that

have been waiting on the forest floor to grow for the first time. This process occurs on all scales in natural ecosystems. The organisms are different for each habitat, but each system goes through the same natural successional processes of repair and rejuvenation. The foot-tall grasses in a salt marsh operate under the same natural laws as the 100 - foot tall forest.

Succession in nature restores the equilibrium of a system. It pushes it toward the highest level of efficiency in capturing the available energy and produces the most complex and diverse system possible under the environmental conditions present. A key part of this resilience in a natural system is the species diversity found within it. An ecosystem with a high number of species has an improved ability to repair and restore itself, simply because it has more options – a larger “skill set” to draw upon. A weakened system or one that has fewer species has a diminished capacity to repair itself.

Salt marshes are amazing systems on many different levels. Not only for their expression of natural processes like succession, but also for their sheer beauty and for the benefits of nature that they provide here in New Hampshire and New England. It is always gratifying to have a good enrollment at a workshop, and this recent salt marsh workshop was near perfect with conser-



Dave Burdick (UNH) talks about salt marsh ecology at a recent workshop.

vation commission members from three local municipalities, an environmental consultant, an adjunct professor, citizens and a volunteer naturalist attending. The diversity of participants made for a high energy and interactive workshop full of insightful questions.

I have always felt the important natural service roles that salt marshes play are susceptible to be taken for granted. Not so long ago there was an undertaking to restore local marshes, there was effort to organize a volunteer monitoring system, and there was even a growing dialog from fishermen about the value of marshes to their livelihood. But lately you don't hear much about salt marshes. Maybe this is a good thing, marshes are protected, the restored marshes are bouncing back, and no news is good news. Or maybe this is bad news, out of sight and out of mind and therefore susceptible to neglect and degradation through indifference.

Today there is a growing list of stressors on salt marsh systems – human created stressors like stormwater runoff sending larger volumes of water and more pollution to the marshes, the application of insecticides disrupting the balance of species, and a faster pace of sea level rise and human induced climate change. A healthy awareness of the natural services that salt marshes provide to us could never be more important.

Steve J. Miller
CTP Coordinator, GBNERR



The Power Nap of a Winter Estuary

As the last few leaves fall from the trees and the cobalt skies of autumn fade into a cooler gray, winter lurks just around the corner in Great Bay. After months of long sunny days when the plants and animals of the estuary worked to produce an abundance of “biomass”, it is time for the estuary to take a nap. And like humans, sleep is often when we recharge, settle and get organized for the next day ahead. During the winter in Great Bay, this quiet action happens under the frozen wedges of ice and snow that blanket the estuary, from the very beginning of its capillary-like tributaries to the edge of the Gulf of Maine.

As the sun reaches its southernmost point about December 21, the Bay is getting the least amount of sunlight. We usually think of this as the shortest day, or the longest night. Growing has long ceased for plant species such as *Spartina alterniflora* (cordgrass) and *Spartina patens* (salt hay). The critical processes of break down and decay has already begun, releasing this vital organic mass into the detrital food web of Great Bay. Organisms such as ribbed mussels, mud snails and mummichogs will be among the first to consume this rich estuary soup.

Most animals within the estuary are either buried deep in the mud, or have moved into the open waters of the Piscataqua River and beyond. Waterfowl congregate in the few open patches of unfrozen water, becoming literal sitting ducks for hungry bald eagles. Coyotes and other predators use the frozen surface of the estuary as brand new real estate for catching unlucky prey. The leftovers of the kill become a perfect meal for the opportunistic population of wintering eagles.

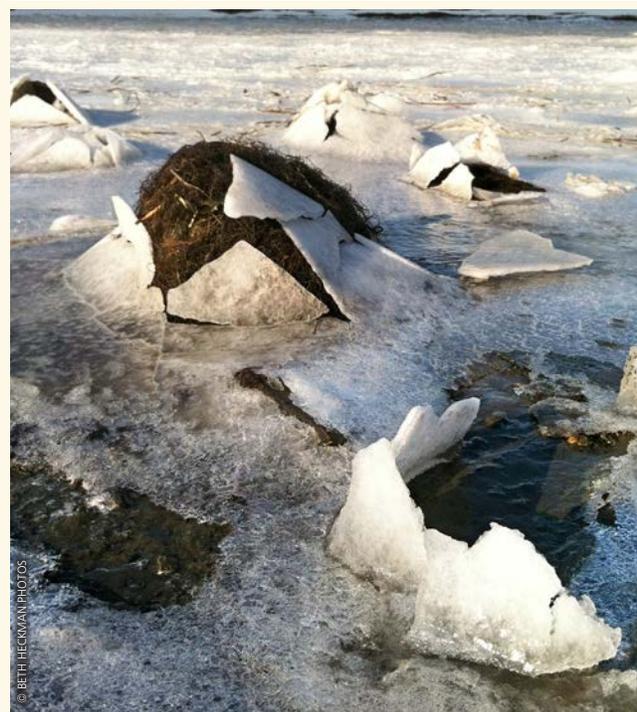
Throughout the winter thaws, high volumes of freshwater inflow from the

Winnicut, Squamscott, Lamprey, Oyster, Bellamy, Cocheco and Salmon Falls Rivers sweep into the estuary, carrying with it an increased load, rich in an overabundance of nutrients, toxins and sediments. The barely awake estuary sputters under this harsh slap of turbidity, struggling already to capture what little sunlight penetrates the Bay. Any photosynthesis that is begging to happen is thwarted by this invisible blanket.

Unlike most estuaries in the country that do not freeze, Great Bay can only sit and wait for the thaw to allow the contaminated runoff to at least wash over the salt marsh, settling out some of the toxins and sediments. This burst of toxic waters is one of Great Bay’s greatest challenges, just as the estuary is beginning to wake up.

But wake it does, and slowly the ice begins to melt, carving huge chunks of peat from the edges of the salt marsh, moving and depositing brand new pieces of land to places in the estuary that once had only mud. Osprey will return, and shorebirds will scour the mudflats looking for food. Schools of fish will move back into the estuary, eager to consume those who dared to stay and weather the frozen storm. The ancient horseshoe crab too will return, seeking habitat to spawn and continue its inspiring fecundity. Spring will arrive, like morning, as it always does with a fresh new opportunity for life.

Kelle Loughlin
Education Coordinator, GBNERR
Director, Great Bay Discovery Center



GREAT BAY DISCOVER WINTER BAYV

CHILDREN'S WINTER

Once Upon an Winter Estuary for ages 2-5

9:45 am-11:00 am on select Thursdays in January and February

Come dressed ready for some winter wonderland fun outdoors! We'll start each program outside with activities, games and wintery walks. Following our outdoor exploration, we'll move inside our pavilion to warm up with a story, craft and hot cocoa! This program is ideal for youngsters, ages 2-5. Each participant may sign up for two of the four dates. \$2 per child participant. Pre-registration required.

JANUARY 9th

IN THE SNOW: WHO'S BEEN HERE?

BY LINDSAY BARRETT

Who's out and about looking for food this winter? Bundle up for a nature walk as we search for signs of animal activity and snacking. Come warm up with a story about what wildlife is eating this winter and make a tasty snack to take home.

FEBRUARY 6th

WHO LIVES IN THE SNOW?

BY JENNIFER BERRY JONES

Have you ever heard of the subnivean zone? Get in the zone with us as we find out who lives there and how they use it stay warm! Come ready to take a walk and look for signs of animals in the winter snow. Then we'll head inside to warm up, read a story, and make a snuggly craft to take home.

JANUARY 23rd

**SNOW DANCE
BY LEZLIE EVANS**

Do you get so excited whenever it's going to snow? Do you love to go out and play? Do you think the animals do? Come ready to play games in the snow and have some fun. Then we'll warm up with a story and make a craft about snowflakes.

FEBRUARY 20th

**IN THE SNOW
BY SHARON PHILIPS DENSMORE**

Do you like to watch the wildlife near your home in the winter? Do you ever put seed out for the birds? We'll take an "Eye Spy" walk to see what animals (or signs of them) you can spot. After our walk we'll warm up with a story and make a craft to take home for the wildlife near you.

DISCOVERY CENTER

WINTER BROWN BAG LUNCH LECTURES!

All programs are free and no registration is required – Bring your own lunch!

Visit greatbay.org for up-to-date program schedule.



For all programs call (603) 778-0015 or email beth.heckman@wildlife.nh.gov to register. Send checks payable to *Great Bay Stewards* to the address below marked **ATTN: Beth**

Great Bay Discovery Center
89 Depot Rd • Greenland, NH 03840
greatbay.org

DISCOVERY CENTER PRESENTS WINTER ADVENTURES 2014

PROGRAM SCHEDULE

Winter Bayventures for ages 6-11

FRIDAY, MARCH 14TH (SAU16 TEACHER WORKSHOP DAY)

A TASTE OF WINTER

How did Native Americans survive the winter? What did they eat? How did they dress? What did they live in and what did they do during the long winter months? We will spend the morning at our Abenaki campsite making food and crafts like the "People of the Dawn" once did.

9:30 am – 3 pm

Bring a lunch and dress for extended outdoor play!

\$35 GBS members

\$40 non-members

SAVE THE DATE!

Great Bay Discovery Center Volunteer Trainings

School Program Educator Training:

April 9, 9:30 am – 4 pm

Exhibit Room Educator Training:

April 11, 10 am – noon

Great Bay Discovery Center Opens for the Season!

Saturday, May 3rd – 10 am

The Great Bay Annual Art Show

Back by popular demand, the show will once again feature more traditional media, such as oil and watercolor paintings, sculpture and jewelry, "inspired by the New England Coast". The Stewards will be working together this year with volunteers, artists, and the staff of the Great Bay National Estuarine Research Reserve to put on an amazing show. Please join us at the Hugh Gregg Coastal Conservation Center for the opening reception, Friday, April 4, 6 pm, to 8 pm, and Saturday and Sunday from 10 am to 4 pm. For more information, please email art.show@greatbaystewards.org. Hope to see you there!

Ed Caito Receives the 2013 Evelyn Browne Conservation Award

The winner of this year's Evelyn Browne Award may have never tested the turbidity of Great Bay waters, taught a group of children about mud snails on a marsh, or planted a rain garden, but he has quietly and consistently ensured that hundreds of projects, programs and initiatives of both the Great Bay National Estuarine Research Reserve and the Great Bay Stewards, have received the most professional and sound financial direction and support possible. Edward Caito of Seabrook is this year's winner of the Evelyn Browne Conservation Award.

Ed has served as treasurer for the Great Bay Stewards since 1998. A Certified Public Accountant by trade, Ed has volunteered hundreds of hours over the years maintaining records and handling accounting for program fees that are generated at the Reserve, donations made to the Discovery Center, and for grant funding that Reserve staff bring in from non-profit, state and national agencies. Without this external funding, and without a trusted way of tracking these funds, the Reserve simply could not provide the programs or complete the projects that it does today.

Staff of the Reserve recognize that the efforts of providing valuable research, education, land protection and stewardship throughout the Great Bay Estuary have been made exponentially easier and possible because of Ed Caito. It is often easy to overlook those who don't visibly stand on the front line, but the Reserve is pleased to recognize and honor this real Great Bay hero! Congratulations Ed!

Blue Carbon Savings & Loan

Often I find striking parallels between human institutions and the organization and processes of our natural ecosystems. Are the designs of nature applied to our social and economic systems through some evolutionary construct hidden within our DNA? Or is it simply our stumbling human omnipresence exerting artificial control over our natural ecosystems, making them more like our human institutions?

Meeting our needs for nature's goods and services at levels beyond her capacity to provide them may inevitably compromise and reshape interrelated natural resources and services. "Food or fiber" productivity in nature is probably akin to the "guns or butter" paradigm in economics, and society exerts an enormous impact on both systems. Compromised ecosystem functions are often invisible to the public, undervalued and largely ignored until they become visibly relevant in the tug-of-war between natural and human systems.

Among today's prominent human-nature skirmishes is the control of carbon dioxide, a greenhouse gas that is a driving factor in global warming. Through the millennia, nature has done a remarkable job sequestering carbon into long-term storage as oil and coal. I can only imagine what the climate, and biological productivity, must have been like when that immense carbon reservoir was being incorporated into living tissues and forming those massive fossilized reserves of carbon under the earth. Nature controlled the supply of carbon in various long and short term storage compartments, while releasing enough to keep the ecosystem productive and on an even keel, perhaps like the Federal Reserve exerts various controls over the money supply today. Climate and ecosystems both changed in response to the shifts in carbon pools, albeit very slowly over geologic time scales.

In a matter of a few centuries, society has also done a remarkable job of tapping into these reserves and providing the energy and carbon-based products that have made us so successful. But, because it has happened so quickly, neither ecosystems nor humans have had time to accommodate the unintended consequence of a changing climate. Faced with a "new normal" that has accountable pluses and minuses for human society, nature's tally of costs and benefits is much more complicated, and intractable. Recognize, through all these changes, that nature has provided an astonishing record of stability and resiliency to our environment. Management opportunities that employ ecosystem sequestering of carbon abound. Many actions will also buffer against the impact of climate change, mitigate flood water intensity and protect our life and property against storms and storm surge – virtually for free!

Our sister reserve, Waquoit Bay NERR on Cape Cod, is host to some remarkable and challenging research on one aspect of carbon control – the role natural salt marshes play in sequestering carbon. Dubbed "blue" carbon, not because of its color but its link to aquatic environments, it accumulates in saltmarsh vegetation via photosynthesis. The portion that is not recycled when the vegetation decays becomes part of the biomass that is stored in and beneath the root systems of a salt marsh.

In the study, a team of researchers are attempting to quantify "blue" carbon storage and greenhouse gas emission dynamics in tidal wetlands, and the effects of climate change and nutrients on those fluxes. This may sound easy until you think of the various pathways carbon and nitrogen follow in tidally complex waters, coming from the land as well as the sea. They pass through variable wetland soils and are trans-



© INVICTUS997 / DREAMSTIME.COM

ported in the air, challenging measurement. Seasonal rate changes occur as biological processes wax and wane with temperature and rainfall patterns. These natural variations have to be quantified in addition to the changes caused by nutrient enrichment and pervasive climate-change effects of temperature, drought and flood patterns.

Restoration of pollutant storage capacity depends on restoration of marsh health and stability. Ironically, in a kind of a malicious feedback loop, the carbon that is now in our atmosphere, some released from human destruction of salt marshes themselves, is contributing to sea level rise as polar ice caps melt. This may in turn degrade marshes that cannot keep pace through accretion – they essentially drown. These combined impacts coalesce into an uncontrolled turmoil of biological, geological and chemical interactions with highly uncertain outcomes.

Thus, wetlands are metaphorically a Blue Carbon Savings and Loan with myriad deposits and withdrawals being made, 24/7, somewhat unpredictably, but constrained by the "assets" of the bank – blue carbon storage. Like the Federal Reserve, we need to find the right dials to turn and levers to pull that will control the Blue Carbon Savings and Loan reserves to ensure as balanced a carbon condition as possible that meets our ecosystem and human needs while moderating the effects of climate change.

Paul Stacey
Research Coordinator, GBNERR

Volunteering Across the NERRS

Did you know, when you volunteer at the Great Bay National Estuarine Research Reserve, you are a part of something much bigger? The 28 Reserves that are a part of the National Estuarine Research Reserve System (NERRS) owe a great deal of their success to the involvement of volunteers!

From residents to business owners, and college freshman to retirees, there are many volunteers that help NERRS programs thrive. Research volunteers build a foundation for national, regional and local management. Stewardship volunteers protect, manage and restore coastal habitats. Education volunteers promote estuary literacy and engage community members of all ages, encouraging coastal stewardship from a young age. Each Reserve has volunteers to help support these programs, ultimately stimulating the local and regional community investment in the continued health of the estuary. Estuaries are spawning grounds and nurseries for at least two-thirds of commercial fish and shellfish. These coastal habitats also buffer uplands

from coastal flooding and provide recreational opportunities. Community investment at these Reserves is crucial to the long-term sustainability of the estuary ecosystem.

Here in Great Bay, we are fortunate to have an amazing group of volunteers dedicated to the continued health of the NERRS. Our Reserve includes over 10,000 acres of protected land and water, and our Discovery Center, the educational hub, hosted over 3,700 visitors, and over 4,000 school children in 2013. With a small staff of full and part-time employees, we rely on the passion and commitment of our volunteers to help our Reserve succeed, our estuary stay healthy, and our community stay invested! The Great Bay NERR has 95 active volunteers that donated over 2,600 hours of their time in 2013. Across the System, a total of 115,280 hours were logged last year alone! This is the kind of community involvement that makes a real and measurable difference throughout our nation's estuaries.

Melissa Brogle
Volunteer Coordinator, GBNERR



UNH students rebuild a wigwam at Great Bay Discovery Center.

Volunteer Spotlight

Winter Volunteer Involvement

Holiday schedules and inclement weather make staying involved difficult, but we have some great opportunities for volunteers to have fun and support the Reserve throughout the season!

HOLIDAY TEA

Join us for tea and a cookie swap! Tuesday December 17th, 2 pm in the Gregg Center. Make enough of your favorite cookies to share, and bring the recipe. RSVP by Monday, December 9th: melissa.brogle@wildlife.nh.gov.

“FAVORITE MEAL” VOLUNTEER COOKBOOK

Now you can share your favorite meal with other volunteers! Bring in or email the recipes for your favorite meal. Include: appetizer, main course and dessert by January 3rd. We will put together a GBNERR Volunteer Cookbook to distribute to volunteers.

BROWN BAG LUNCH PRESENTATIONS

Brown Bag Lunches will continue this winter! We will host a presentation in January, February, and March. Bring your own lunch, drinks provided. If you have topics you would like us to consider, please let us know. Visit greatbay.org for program information.

RAIN BARREL PAINTING PARTY

Don your painting clothes and help us paint rain barrels to raise money for the education program. Elegant or quirky, colorful or earthy – it doesn't matter what your style is, just bring your imagination and get creative! Stay tuned for a specific date and details about this fun activity!

President's Corner



At the October 2013 Annual Meeting of the Great Bay Stewards, some changes were made to the Board of Trustees. Our outstanding President Jay Diener has stepped down from the position to take on

other responsibilities related to the Hampton-Seabrook estuary. He leaves huge shoes to fill and will be greatly missed. He has however agreed to continue helping with the Great Bay 5K Road Race, the Stewards major fundraiser. Officers for the new year are President, Jack O'Reilly; Vice President, Bruce Addison; Treasurer, Edward Caito; and Secretary, Joe Stieglitz. Along with Jay, Nancy Cauvet and Denise Ankarberg retired from the Board after many years of dedicated service to the Great Bay Stewards. We

will miss their thoughtful and enthusiastic contributions.

It is an honor to be chosen to lead this wonderful

organization for the next year. It is full of caring people who show their love of Great Bay by working to improve its health, and to protect it for all who live around it. I look forward to working closely with Cory Riley, Great Bay National Research Reserve Manager and her staff. They are an integral part of supporting our goal of protecting the Great Bay Estuarine System through education, land protection, research and stewardship. Some of the education they do is through spring and fall school programs. I have volunteered in the past to lead some of these programs and found them quite enjoyable and educational for me as well.

After a few years of discussion, the Board agreed to create and fill the position of part-time Great Bay Stewards Executive Director. We were extremely fortunate to have Peter Wellenberger fill that position. Peter is the former GBNERR Manager and



Peter Wellenberger

was the first Great Bay Waterkeeper. Peter's main goal is to increase membership and donations but you will usually find him helping out in many GBS activities. We have the utmost confidence in him.

One sign of a great president is the hiring of an excellent Administrative Assistant. Once again, and fortunately for me, my predecessor, Jay, hired Allison Knab for that position. Although I have only had the pleasure of working with Allison for a short time, I have been truly impressed by her dedication, intelligence and hard work. I look forward to working with her in the year ahead.



Allison Knab

One project the Stewards are involved with is called Soak Up the Rain. It has been championed by Jack Mettee and is headed up by new (this year) Board member Laura Byergo with the help of another Board member Jean Eno. It involves the installation of rain gardens where there will be a marked positive affect on runoff. Volunteers putting in a long hard day recently installed our first garden.

I will continue to provide you with updates on the Stewards efforts through this column, as well as through the monthly electronic newsletter that is sent to all members.

Jack O'Reilly
President, Great Bay Stewards



PLEASE JOIN US!

All interested parties are cordially invited to become Great Bay Stewards. Members receive Great Bay Matters and other pertinent mailings.

Annual dues may be paid by check made payable to the **Great Bay Stewards** and sent to: Membership Committee, 89 Depot Road, Greenland, NH 03840

- Guardian \$150 Protector \$75
 Steward/Family \$35 Student \$20 Other \$ _____

name _____
 address _____
 town _____
 state _____ zip _____
 email _____

Life Signs in Real Time

The National Estuarine Research Reserve System developed the System-Wide Monitoring Program (SWMP) with the primary goal of developing quantitative measurements of changes in water quality, biological systems and land-use in estuaries, to improve coastal zone management. In Great Bay, water quality data is collected in “real-time” in four locations throughout the estuary. This information is available to researchers, resource managers, educators and other coastal decision makers to quantitatively determine how estuary conditions are changing in both the short and long-term.

This data, coupled with biological monitoring of individual species, can give researchers definitive answers to questions about impacts from storms and pollutants. Included here are five species that live in the estuary, and a description of how changes in water quality can affect them.

EELGRASS AND TURBIDITY

Turbidity is a measure of water clarity, the higher the turbidity, the cloudier the water. Particles in the water reduce the distance light can travel. Eelgrass beds are very sensitive to the amount of light they receive. As turbidity increases, eelgrass beds often decrease in size and number. At low levels of turbidity, sunlight is able to reach the eelgrass beds and they grow at their optimal, normal rate. As turbidity increases, the number of plants decreases causing the blades of grass to grow taller in an attempt to reach the sunlight. High levels of turbidity reduce the numbers of plants significantly, in turn reducing available food for waterfowl and protective cover for a variety of fish species.

MUSSELS AND TEMPERATURE

Water temperatures in Great Bay are influenced by air temperature,

storm water runoff, and erosion (more particles in the water absorb sunlight, therefore increasing temperatures). Temperatures in turn, affect the amount of dissolved oxygen in the water, the photosynthetic rate of aquatic plants and algae, sensitivities of organisms to disease, toxins and parasites and the metabolic rate of organisms. Ribbed mussels metabolize optimally at a temperature between 27 and 75 degrees F. Sub-optimal temperatures of between 75 to 85 degrees cause mussels to close up, reducing feeding. At temperatures greater than 86 degrees, mussels will eventually die off.

LOBSTERS AND SALINITY

Salinity is the measure of dissolved salts, especially sodium chloride in the water. In general, Great Bay provides lower salinity habitats than the open ocean. Freshwater runoff, tidal changes and extreme weather can cause rapid and intense changes in salinities. Organisms that live in estuaries must be able to cope with these changes rapidly or move to a more stable location. Comparisons of water quality data to the presence or absence of lobster around extreme storm events can tell us many things about the impact of changing salinities on this species. Most lobsters in Great Bay tend to move down river toward the more saline waters of the Piscataqua. Other species such as oysters and clams cannot move and may die before conditions improve.

FLOUNDER AND DISSOLVED OXYGEN

Dissolved oxygen levels play an important role in the growth and survival of animals that live in the Bay. The amount of oxygen in the water depends on several things:

- The amount of photosynthesis occurring (plants add oxygen during this process)



© STEVE MELANSON / DREAMTIME.COM

- Temperatures (cold water holds more oxygen than warm)
- Surface winds
- Excess nutrients (causes algal blooms which reduce oxygen during die off)
- Flounder are affected by oxygen levels by the rate in which they grow. Under optimal levels (greater than 6 mg/l), flounder will grow and flourish. Under low level conditions (less than 3 mg/l), growth of flounder and other fish species will be stunted.

RIVER HERRING AND PH

Fluctuations in Ph (how acidic the water is) can affect how toxic a pollutant can be to an organism. The Ph of water you drink at home is neutral, that’s about 7 on a scale of 1 to 14. In saltwater, the Ph remains relatively constant. Freshwater rivers and streams entering Great Bay however, may experience periodic changes in Ph levels.

The success of anadromous fish migrating up tributaries to reproduce is in part dependent on the Ph of the water. A period of low Ph can decrease survival of the eggs deposited on river bottoms. Sac fry of river herring are particularly susceptible to highly acidic waters. Extended rain and storm events can wash acid rain into rivers significantly increasing mortality of herring. No sac fry survive after 24 hours when the Ph is more acidic than 5.5.

Kelle Loughlin
Education Coordinator, GBNER
Director, Great Bay Discovery Center

Destination: *Washington*

Padilla Bay National Estuarine Research Reserve

Padilla Bay National Estuarine Research Reserve is located in the Puget Sound in Washington State. It was selected to become a Reserve in 1980, and like other Reserves, it has its own special story of how it came to be a National Estuarine Research Reserve. In the early 1900s, the Breazeale family made their homestead on the shores of Puget Sound. Their three children learned about the natural world as they explored the woods and waters of the area. The two sons continued to live on “Bay View” farm into adulthood, while the daughter, Edna spent over 40 years as a teacher in Seattle. When she retired, she moved back to the farm and soon learned about a proposal to build a Padilla Bay Industrial Park. She was so disturbed by the thought of the area being developed, that she helped organize a grassroots resistance, lobbying the legislature and getting signatures against the commercial interests. She started her campaign for the Bay in 1960. She spent over 20 years speaking for the land she loved as a child; the largest undisturbed saltwater tideland marsh in Puget Sound. The efforts of Edna and the Bay’s supporters succeeded and the mud flats of Padilla Bay remain undeveloped today. The Padilla Bay research and interpretive facility lies on the 64 acres of farm land that was gifted to the Reserve by the Breazeale children.

Currently, the research and interpretive facility, called the Breazeale Interpretive Center, carries on Edna’s vision; and the Reserve System mission of promoting research, education and stewardship of estuaries.

Research on eelgrass, invasive species and water quality is ongoing throughout the estuary. You might find a group of volunteers called the “Skagit Stream Team” collecting water samples in local streams for testing. The water quality results that are compiled from their efforts are then shared with interested agencies to help make decisions for the good of the estuary.

A successful stewardship project, Rogue Creosote Log Removal, is underway along the shores of Puget Sound. Creosote treated logs from dilapidated docks and pilings wash



Eel grass of Padilla Bay

up every year. Creosote is quite harmful to marine life as it slowly leaches into the water. However, when warmed by sunlight, the softened sticky substance becomes even more hazardous. Logs are identified and helicopters help move them to where they can be properly disposed of.

Education of local schools and public groups can often focus on a low tide exploration. When the tide goes out in Padilla Bay, the entire bay empties. This is somewhat unusual, as many bays do not have such an extreme tidal fluctuation. What this “emptying of the bay” allows is a very large expanse of eelgrass meadows to grow. In fact, over 25% of the eelgrass in Puget Sound is found in Padilla Bay and nearby Samish Bay. Eelgrass functions as a food source, water filter, habitat stabilizer, fish nursery and more. One can only imagine what would have happened to the entire ecosystem if Padilla Bay was turned into blacktop and smokestacks. Hats off to people like Edna Breazeale, who with a passion in their hearts for wild childhood places, set out to make a difference for everyone. For more information about Padilla Bay, visit their website at www.padillabay.gov.

Beth Heckman

Assistant Education Coordinator, GBNERR