

A photograph of a sunset over a body of water. The sky transitions from a deep blue at the top to a bright orange and yellow near the horizon. A crescent moon is visible in the upper left. A long, curved trail of dark spots, likely birds in flight, arcs across the sky. The water is calm, reflecting the colors of the sunset. In the distance, a small boat is visible on the water, and a line of lights marks the horizon. In the foreground, the dark silhouettes of wooden posts are visible.

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On the cover: Geese fly over Sandy Hook Bay. Photo by David Hawkins/American Littoral Society

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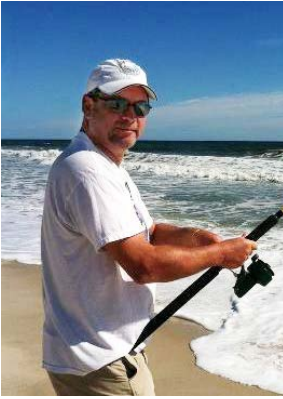
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From the Director's Desk



The diversity of life in Earth's oceans is a never-ending source of wonder. The sheer number, different and unique qualities, complexity of ecological interactions and simple beauty of marine and coastal wildlife should amaze us.

Those waters can provide a lifetime of engagement for our curiosity when we, as John Muir suggested, tug on one thing only to find it connected to everything else. Those interconnections literally hold the planet, and all the life it supports, together.

In the early 1980's Paul R. and Anne Ehrlich said that species are to ecosystems what rivets are to a plane's wing. There is a serious limit on how many can be lost before disaster strikes.

In E.O. Wilson's words, "Biodiversity as a whole forms a shield protecting each of the species that together compose it, ourselves included."

More and more, we seem to be in the middle of the scene in the old cartoons where the rivets start to pop with increasing speed, working their way down the wing's seam toward disaster.

The factual accounts, scientific confirmation and public reports detailing our tail spin toward a hard landing (to overextend the plane metaphor) are all around us: on the front pages of newspapers, as articles in the newsfeeds, in the calls for immediate action from conservation advocates.

Writer Russell McLendon put it succinctly: "Earth's species are now vanishing at rates unprecedented in human history. That matters for more reasons that many people realize."

The UN Convention on Biological Diversity warned – last year – that the world had two years to "seal a new pact on wildlife protection."

There are actions large and small that should be taken. As we enter the new year, the Society will continue its efforts to protect the diversity of marine life and its habitats through education, conservation and advocacy.

We are seeking to sustain our work restoring the Delaware Bay beaches relied upon by horseshoe crabs and migratory shorebirds. The marshes of New York City's Jamaica Bay will receive new attention and plantings from local communities. Dune grass will be planted as part of our education programs, clean water projects pursued, fish will be tagged to help keep track of their populations, ocean planning advocated through our Healthy Ocean Coalition, and people will walk with us on beaches as we explore the beauty and crucial diversity of those places where ocean meets land.

Beyond these efforts, we will continue to seek new avenues, approaches and collaborations in synch with our aims. We urge you to join us in facing this crisis.

Tim Dillingham

Why is Biodiversity Important?

By Julie Shaw







Humanity must stop the pace of wildlife extinctions — or face extinction, according to the United Nations.

The world has two years to seal a new pact on wildlife protection, the head of the UN body on wildlife, the Convention on Biological Diversity (CBD), told *The Guardian* in 2018, just days before the EU and 195 member

nations of the CBD gathered to try to stem the tide of species extinctions.

Nothing less than humanity is at stake, according to many observers.

“Biodiversity is life on Earth, and every extinction chips away at it, undermining the stability of the planet,” said Olivier Langrand, executive director of the Critical Ecosystem Partnership



But how exactly is biodiversity so important to humanity? Why is biodiversity necessary for the stability of the planet? It may not be self-evident, so here are four reasons.

Wildlife support healthy ecosystems that we rely on.

Conservation researchers Paul R. and Anne Ehrlich posited in the 1980s¹ that species are to ecosystems what rivets are to a plane's wing. Losing one might not be a disaster, but each loss adds to the likelihood of a serious problem.

Whether in a village in the Amazon or a metropolis such as Beijing, humans depend on the services ecosystems provide, such as fresh water, pollination, soil fertility and stability, food and medicine. Ecosystems weakened by the loss of biodiversity are less likely to deliver those services, especially given the ever-growing human population.

One example of this is Kenya's Lake Turkana² — the world's largest desert lake, a habitat for a variety of wildlife including birds, Nile crocodiles and hippos and a source of food and income for about 300,000 people. The lake is under heavy pressure because of overfishing, cyclical drought, changing rainfall patterns and the diversion of water by upstream developments,

Fund (CEPF), which gives grants to organizations to conserve biodiversity hotspots.

“We believe that if governments, businesses, civil society organizations and communities work together now, we can halt the biodiversity crisis,” Langrand said.

Lead photo: Winter wildlife of Sandy Hook. The seals returned to the bay in the past 20 years after a nearly century-long absence. Photo by David Hawkins/American Littoral Society

This page: The wetlands of Jamaica Bay provide a home for all sorts of wildlife not typically found in major urban centers, including Snowy Egrets.

and these changes are leading to a loss of biodiversity, declines in fisheries' yields and a reduced ability to support humans. Without conservation methods in place, this could be the fate of many more ecosystems.

Biodiversity is an essential part of the solution to climate change.

Nature can provide more than 30 percent of the solution to climate change by holding global warming below 2

degrees Celsius — and biodiversity is an essential part of the picture.

The destruction of forest ecosystems is responsible for 11 percent of all global greenhouse gas³ emissions caused by humans, so conserving forests would stop the release of these gases into the atmosphere. Trees and plants also store carbon in their tissue, making it even more necessary to protect them.

Some ecosystems, such as mangroves, are particularly good at



storing carbon and keeping it out of the atmosphere — where it contributes to climate change. Forests and wetland ecosystems also provide crucial buffers to extreme storms and flooding related to climate change. These ecosystems are complex, which means they function best, and are more resilient to the effects of climate change, when all the pieces of the ecosystem are in place — meaning the biodiversity is intact.

“For a relatively small investment,

high-biodiversity forests and other ecosystems can be conserved and restored as a powerful means to rein in climate change while also helping communities cope with associated storms, flooding and other impacts,” Langrand said.

Biodiversity is good for the economy.

At least 40 percent of the world’s economy⁴ and 80 percent of the needs of the poor are derived from biological resources.

Altogether, the food, commercial forestry and ecotourism industries could lose US \$338 billion per year⁵ if the loss of biodiversity continues at its current pace.

Meanwhile The Economics of Ecosystems and Biodiversity (TEEB) initiative estimates that global sustainable business opportunities from investing in natural resources could be worth \$2 to 6 trillion by 2050.⁶

Millions of people also depend on nature and species for their day-to-day livelihoods. This is particularly true for struggling communities in developing countries, who often turn to high-biodiversity ecosystems as their source of food, fuel, medicines and other products made from natural materials for their own use and as sources of income. Nature-related tourism is also a significant income generator for many people as well.

Biodiversity is an integral part of culture and identity.

Species are frequently integral to religious, cultural and national identities. All major religions include elements of nature and 231 species are formally used as national symbols in 142 countries.



Unfortunately, more than one-third of those species are threatened,⁷ but the bald eagle and American bison are examples of conservation successes because of their role as national symbols. Ecosystems such as parks and other protected areas also provide recreation and a knowledge resource for visitors, and biodiversity is a frequent source of inspiration for artists and designers.

About the author: Julie Shaw is director of communicators for the Critical Ecosystem Partnership Fund. CEPF is a joint initiative of l'Agence Française de Développement, Conservation International, the European Union, the Global Environment Facility, the Government of Japan and the World Bank. This article is reprinted with permission from the Conservation International website.

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Previous page: An aerial view of the world's largest desert lake. Kenya's Lake Turkana provides habitat for a variety of wildlife and a source of food and income for about 300,000 people.

This page: Habitat loss has contributed to a 90 percent decline in the world's Monarch Butterfly population. Similar population losses are being experienced by a number of pollinating insects, which fertilize many of the plants critical to the human diet.

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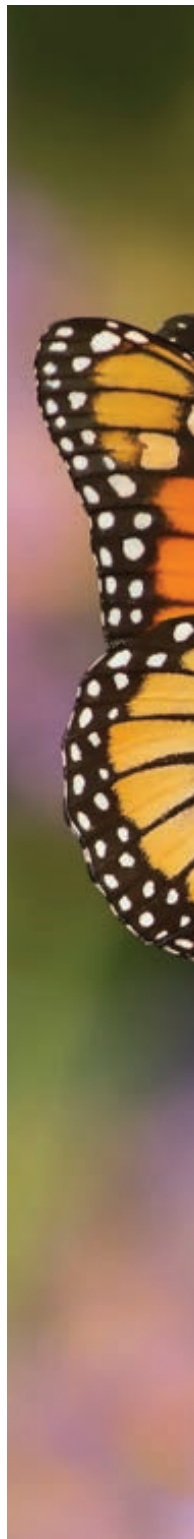
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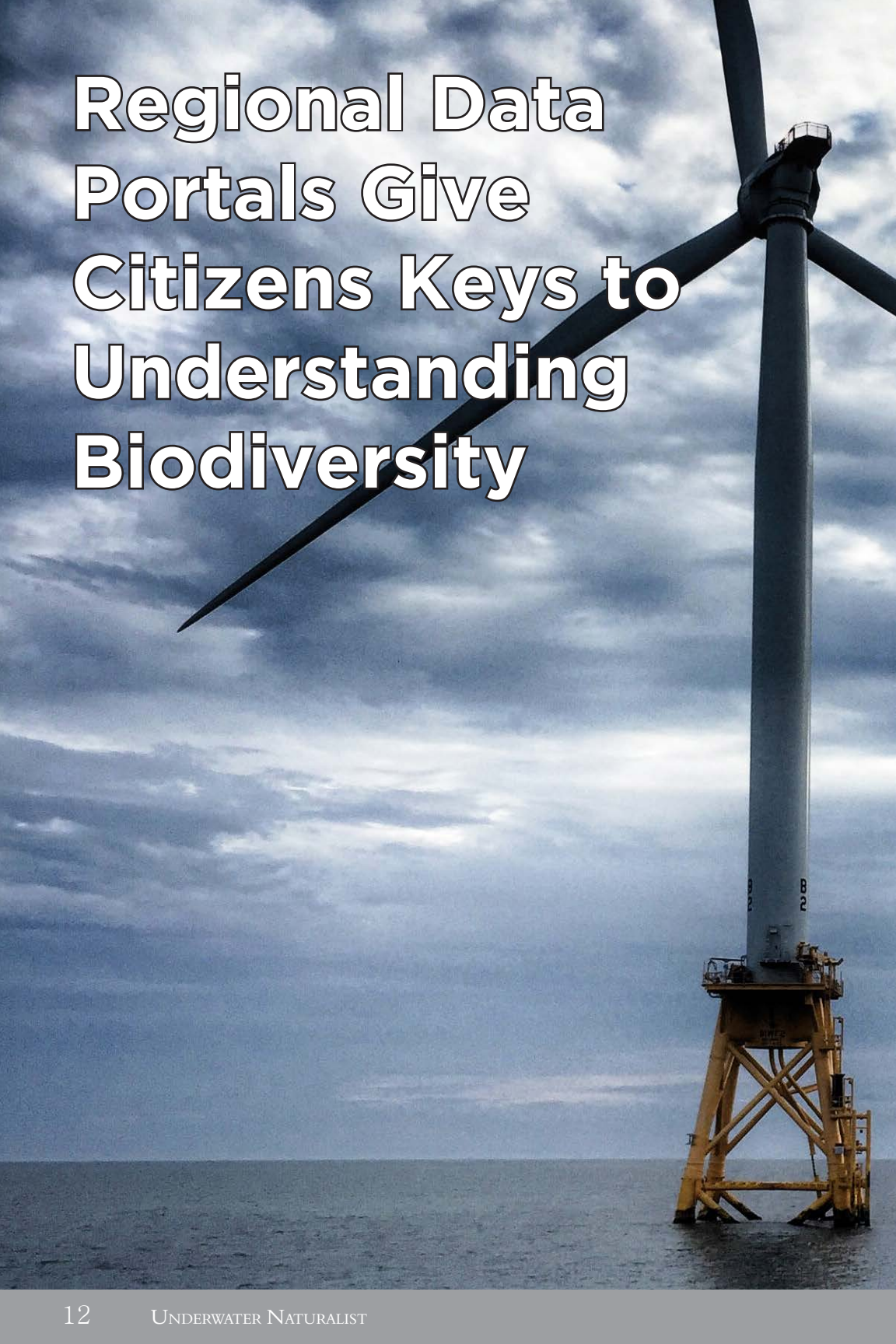
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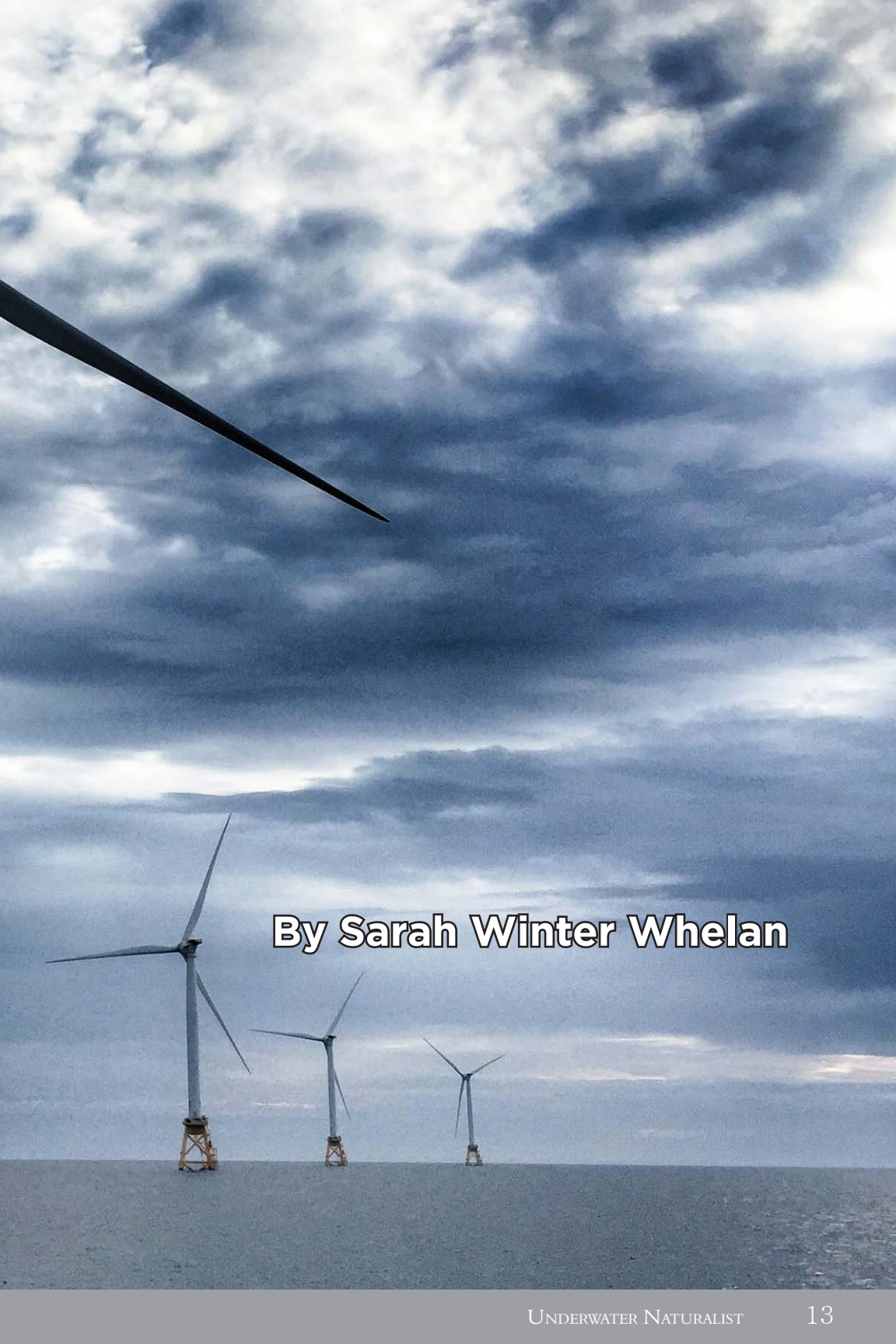
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Regional Data Portals Give Citizens Keys to Understanding Biodiversity



By Sarah Winter Whelan

The ocean, our coasts, and Great Lakes are public resources. Which means that these things belong to everyone in the United States — along with their associated resources — and that they are held in trust by our government.

In other words, those resources are managed through our tax dollars, by state and federal governments, on our behalf.

Generally, such management of our ocean and coastal resources happens as state and federal agencies implement laws and rules that regulate the conservation and use of those places. For example, these agencies are charged with determining such things as how much (if any) seismic testing, oil exploration, fishing, and offshore wind development is allowed.

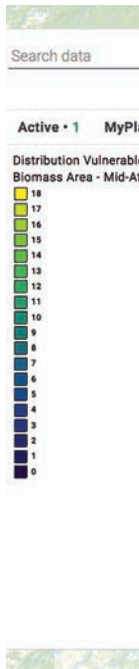
To do this, agencies collect information on our ocean and coastal ecosystems, the wildlife found within them, and the places or habitats vital

to maintaining their populations. Then those offices make decisions on how to ensure sustainability (i.e. that uses won't deplete those populations).

Biodiversity is essential for sustainability because ecosystems are biological communities of interacting organisms and the places in which they live. Given the interdependence of the animals and plants in an ecosystem, reducing the number or variety of species past a certain point can have disastrous consequences.

If saving ecosystems doesn't seem worthwhile in and of itself, it's important to remember that those communities of life are also critical to coastal economies that rely on such things as fishing and tourism.

For decades decisions about how to manage our ocean and coastal resources



Sources: Esri, GE...
Figure 2. Mid-Atlantic Ocean Data Portal showing Species Richness of Pelagic Birds

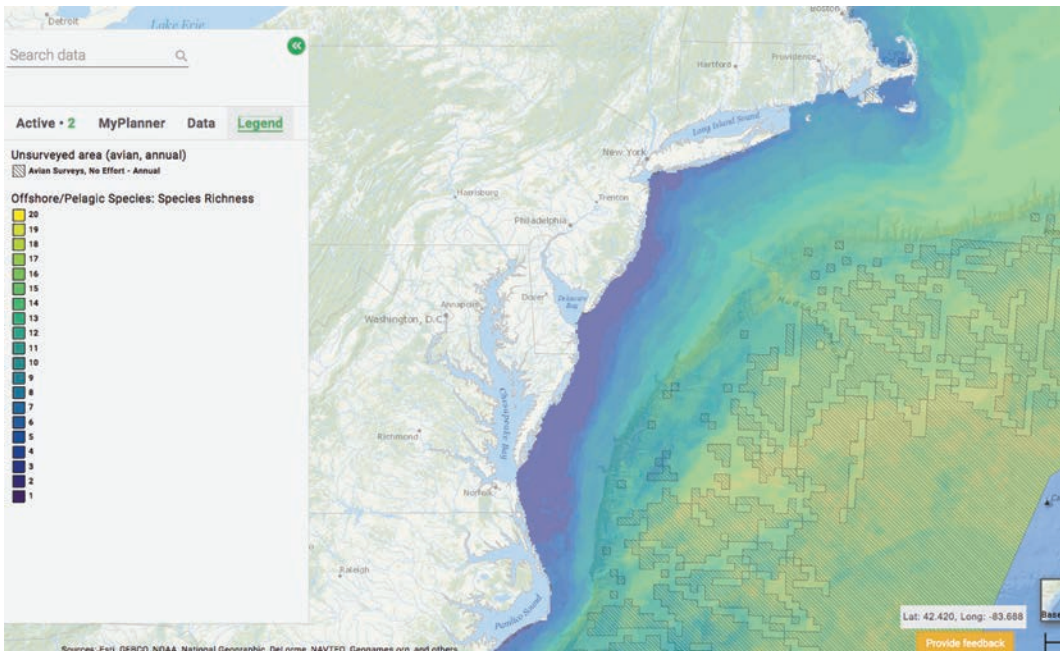
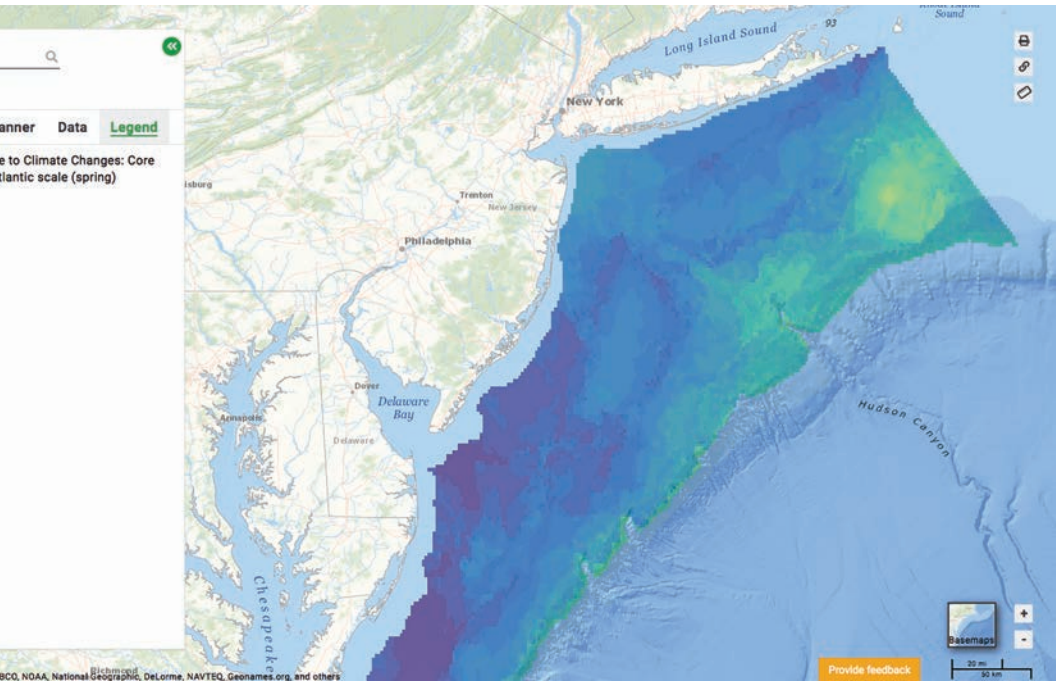


Figure 1. Mid-Atlantic Ocean Data Portal showing Species Richness of Pelagic Birds



Mid-Atlantic Ocean Data Portal showing distribution of fish core biomass areas vulnerable to climate change at a regional scale in spring

were made internally, meaning staff at these agencies were responsible for developing plans and then presenting them to the public for review and consideration.

As a result, coastal residents and citizen scientist were only offered the opportunity for input, participation, and recommendations at the end of the process, even on something that could have considerable impact to ocean and coastal resources. However, this is starting to change — hopefully to the benefit of biodiversity and citizen engagement.

Over the past six years, the Mid-Atlantic region has worked collaboratively at the state, federal and tribal level to provide citizens earlier and more in-depth access to the ongoing work to steward these resources. The

most concrete example of this is the Mid-Atlantic Ocean Data Portal, which provides the public free access to the same information our state and federal governments use to make decisions on using and protecting the ocean on our behalf.

Not only does the Mid-Atlantic Ocean Data Portal give everyone access to this data, but it does so on an entirely free web-based tool. That means any anybody wishing to engage in a decision around an ocean or coastal resource can drop into their library, log onto a computer, and immediately have access to over three thousand layers of data ranging from the species richness of offshore/pelagic species, to the distribution of fish vulnerable to climate change.



The Mid-Atlantic Ocean Data Portal's true value lies in the ability to compare data about marine life in a particular area of the ocean and potential activities in that area. For example, offshore wind is a new use that has the potential to take over huge swaths of the ocean. Ensuring that wind is sited responsibly is crucial to protect biodiversity in our Mid-Atlantic Ocean. Having maps that detail the living resources found in potential wind sites can decrease conflict and mitigate harm to biodiversity.

Data portals are not exclusive to the Mid-Atlantic. Portals exist around the country, with varying levels of data and detail. The Northeast region, ranging from Maine through Long Island Sound, has a data portal very similar to the Mid-

Atlantic, which covers from south of Long Island through Virginia.

Both portals were developed through similar processes — which involved coordination between state, federal, and tribal decision-makers — so it makes sense that the data sets are similar and form the core of the two most detailed and well thought out portals.

Other regions with portals include the South Atlantic region (North Carolina through the Florida Keys), the West Coast (Washington through California), and American Samoa. One connection to all the regional data portals is a national portal housed within the nation's primary federal ocean resource agency: the National Oceanic and Atmospheric Administration

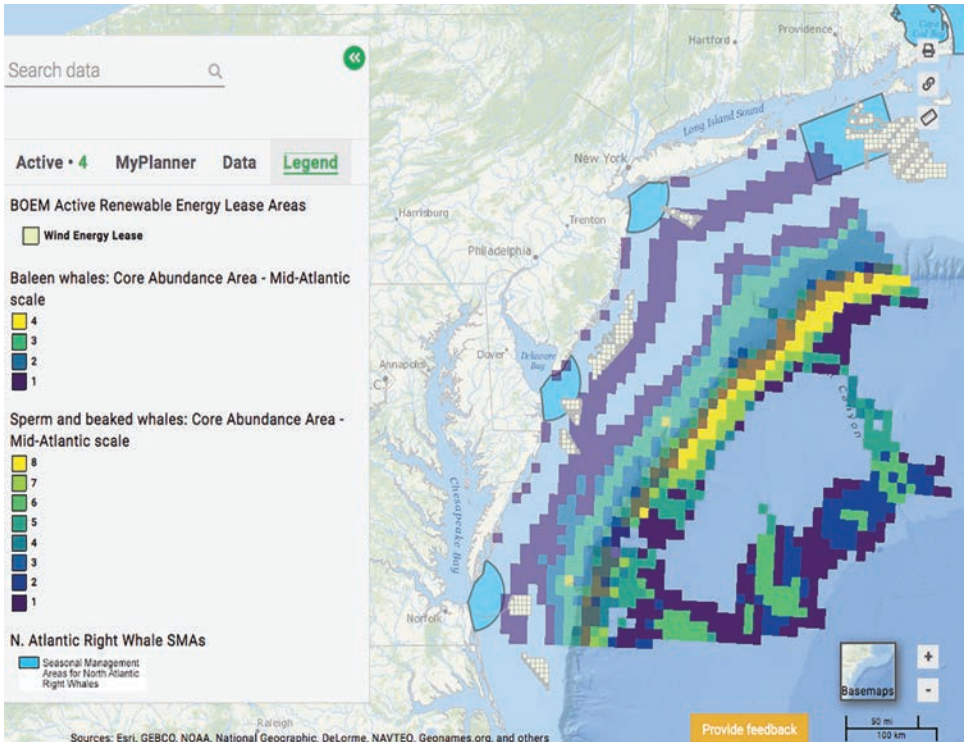


Figure 3. Mid-Atlantic Ocean Data Portal showing core abundance areas for baleen, sperm and beaked whales along sidie offshore wind areas and whale protected areas

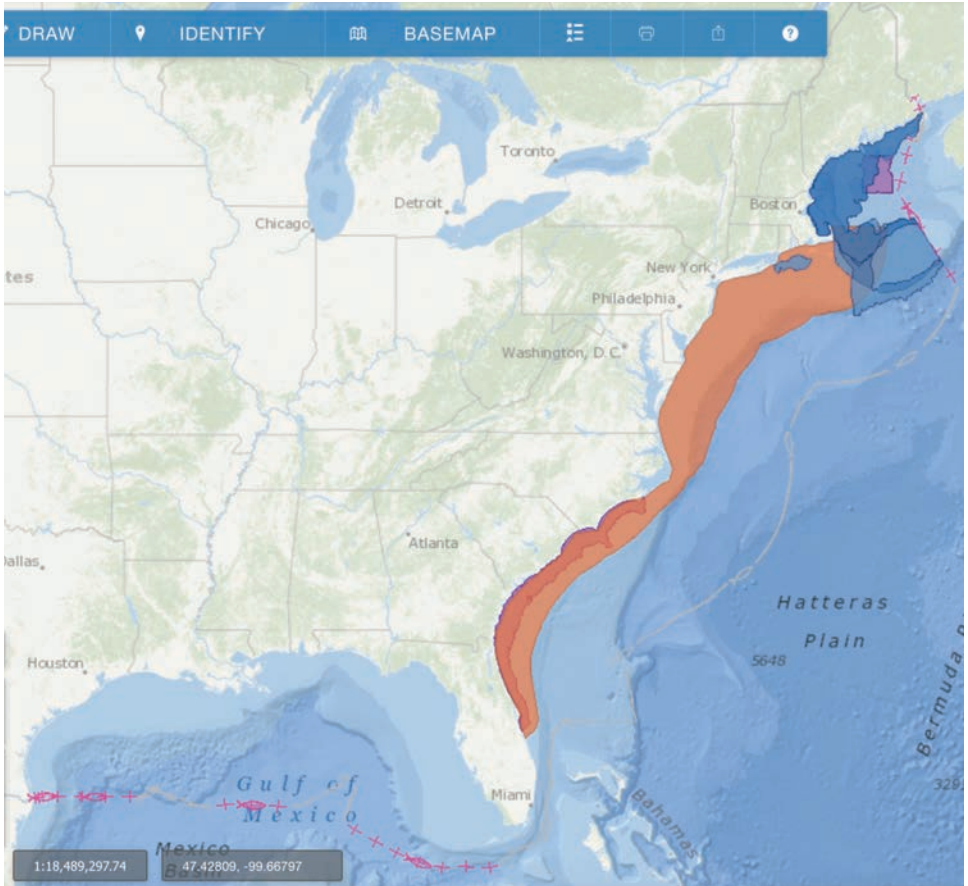


Figure 4. Marine Cadastre showing biologically important areas for cetaceans for feeding, migrating and reproduction

(NOAA). This portal, called Marine Cadastre, can help show citizens the larger scope of wildlife, use, and socioeconomics for the ocean and coasts of the entire United States and some territories.

While each regional portal functions at different scales and with different data layers, at their core they stand for the same principle: everyone having access to information about our shared, public resources.

In opening access to species information, portals give the public more authority and knowledge about how the ocean and our coasts function,

as well as their ecological diversity, abundance, and richness. Such information is vital for advocacy focused on protecting our ocean and coasts.

In the end, a more educated and engaged citizenry should ultimately lead to preservation of the biodiversity of our ocean, coasts, and Great Lakes through better decision-making by ocean and coastal agencies about how to serve us all as stewards of this vast public trust.

About the author: Sarah Winter Whelan is Ocean Policy Program Director for the American Littoral Society.



**By Dr. Christine Thompson
and Quinn Whitesall**

South Reeds Beach Reef, Middle Township,
Cape May County, New Jersey

Biodiversity Assessment: Intertidal Oyster Reefs Constructed Along Delaware Bay



The Delaware Bay hosts the largest population of the Atlantic horseshoe crab (*Limulus polyphemus*) in the world (ERDGC). As a response to Hurricane Sandy in 2012, the American Littoral Society (Society) and partners moved quickly to restore decimated horseshoe crab habitat on the New Jersey side of the Delaware Bay in time for horseshoe crab spawning the following spring. Since then, the Society and its partners have restored eight beaches in the Delaware Bay: Dyers Cove, Fortescue, Thompsons, Moores, Reeds, Cooks, Kimbles, and Pierces Point.

As part of National Fish and Wildlife Foundation (NFWF) and United States Fish and Wildlife Service (USFWS) grants awarded to the Society, a series of intertidal reefs were created at four of the restored beaches — Dyers Cove, Thompsons, Moores, and Reeds Beaches. To gauge the effectiveness of each reef, three monitoring components occurred following construction: (1) wave attenuation to monitor wave energy, (2) three dimensional scans of the shoreline provided by the Stockton University Coastal Research Center

to observe littoral drift and determine sand accretion, and (3) biological assessments to determine fish use and habitat for benthic invertebrates. This report will focus on the methodology, results and conclusions drawn from the data collected during demersal fish and benthic sampling biodiversity assessments.

Reef Locations

The southern end of Reeds Beach, located in Middle Township, Cape May County, New Jersey (Figure 1), was restored in 2013 and 2014. The Reeds intertidal reef was constructed in April of 2015, biological assessments began in August of 2015 and continued through the fall of 2018. Moores Beach, located in Maurice River Township, Cumberland County, New Jersey (Figure 2), was restored in 2013 and 2014. The Moores intertidal reef was constructed in April of 2016, biological assessments began August of 2016 and continued through the fall of 2018.

Thompsons Beach, located in Maurice River Township, Cumberland County, New Jersey (Figure 3), was

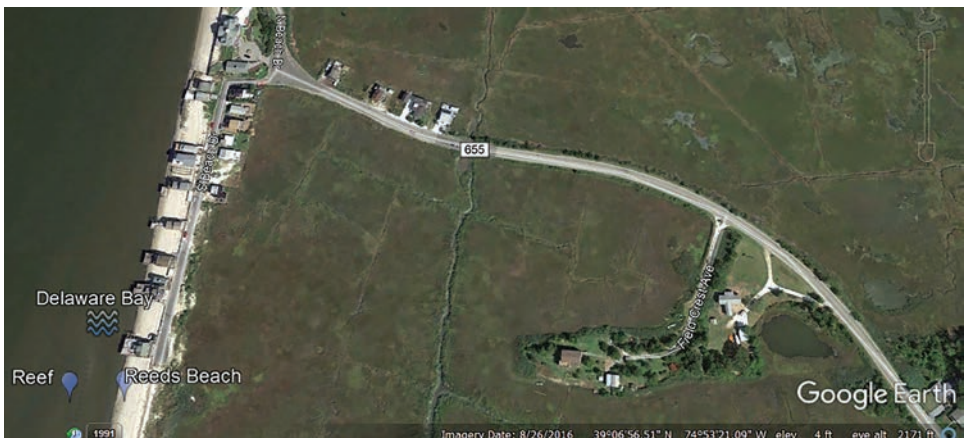


Figure 1. Reeds Beach & Reef. Middle Twp., NJ

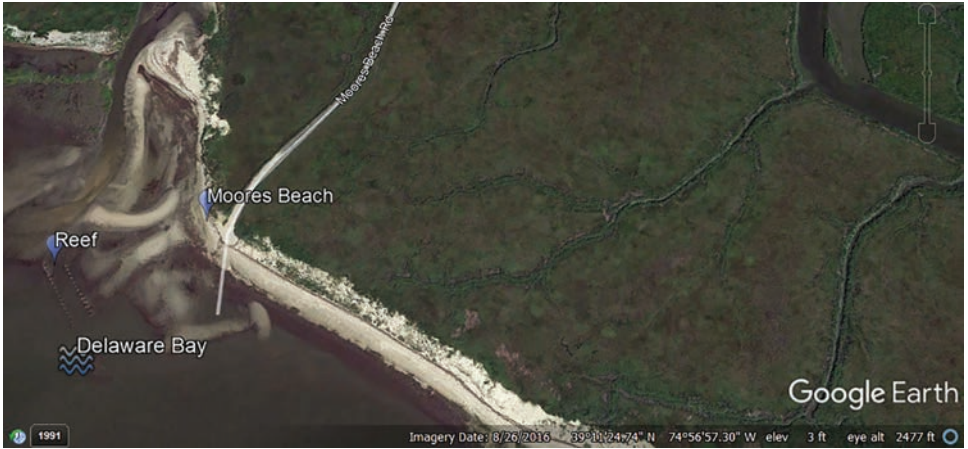


Figure 2. Moores Beach & Reef. Maurice River Twp., NJ



Figure 3. Thompsons Beach & Reef. Maurice River Twp., NJ



Figure 4. Dyers Cove Beach & Reefs. Downe Twp., NJ

restored in 2015. The Thompsons intertidal reef was constructed in April of 2017, biological assessments began in August of 2017 and continued through the fall of 2018.

Dyers Cove, located in Downe Township, Cumberland County, New Jersey (Figure 4), was restored in 2016. The eastern Dyers Cove reef was constructed in October of 2016, biological assessments began the following August of 2017. The western Dyers Cove reef was constructed in March of 2018, biological assessments began that August. Assessments continued at both reefs through the fall of 2018.

Reef Design

The general reef design (Figure 5) consists of two linear segments of cured, whelk shell positioned parallel to the restored beach. Each segment is approximately 200 linear feet, arranged in a herring bone pattern with a 12,000 square footprint. The inshore and offshore reef segments generally consist of fifteen (15) 5-foot-by-10-foot reef blocks with a 5 foot opening between

each block, sitting approximately 18-38 inches high and 50 feet from the Mean Low Water line (MLW). Reeds Beach reef only consists of eight (8) offshore reef blocks to allow for a separate study of horseshoe crab interaction. There is a 60 feet of space between the inshore and offshore reef segments designated as one of the biological assessments control locations. A high-density polyethylene netting with a 1/2-inch mesh was used to contain the shells, with each 2 1/2-foot bag weighing approximately twenty (20) pounds with an average of 35 shells per bag. The reef design varies slightly between each location due to the unique characteristics of each beach and property owners.

Demersal Fish Diversity Assessments

Sampling Methodology

Between the months of August and November, demersal fish monitoring events occurred at the intertidal oyster reefs adjacent to Reeds, Moores, Thompsons, and Dyers Cove beaches.

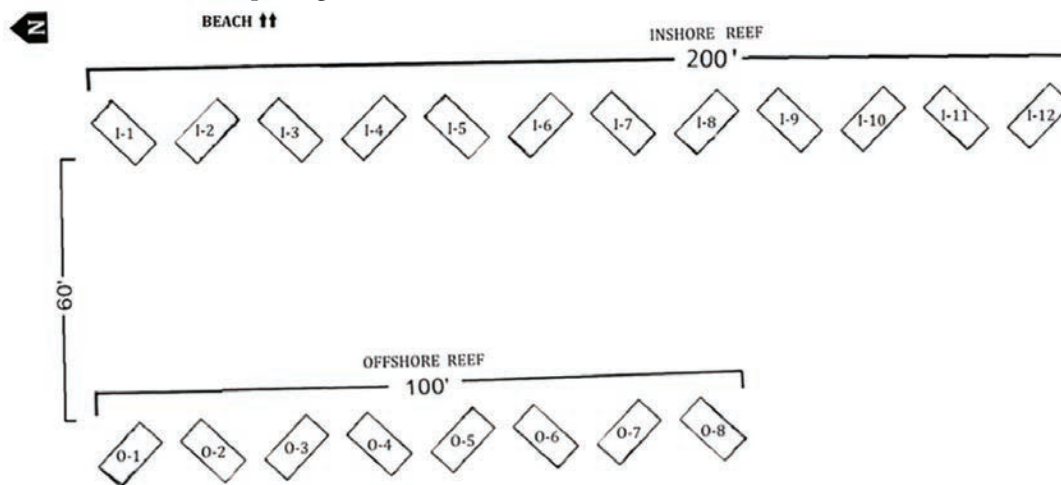
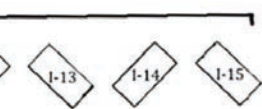


Figure 5. Reeds Beach reef design.

A 19-foot Carolina Skiff was used as the platform to access the reefs and to process all traps. A majority of the sampling events were selected within a few days of the new and full moon phases to ensure a sufficient amount of water at the reefs and accessibility in launching the boat from various marinas throughout the Bay.

Prior to each monitoring event, a reef segment from the inner and outer reef were randomly selected to survey. During a prior low tide, buoys attached to a 12 foot braided poly rope were walked out to the selected segments and tied to the reef to later locate the correct segments where the traps would be deployed. Trap deployment times were selected using a local tide table for each reef; traps were deployed approximately two hours prior to high tide. During each sampling event, nine fish traps were placed at the reef — three on the inner reef, three on the outer reef, and three for the control. Of those nine traps, four traps — three inshore and an inner control — were pulled and processed after a 4-hour soak and the remaining five — three offshore and



the two remaining controls — were pulled and processed after a 24-hour soak to ensure the trap was exposed to a full tide cycle. Due to risk of exposure at low tide, all inshore traps were pulled after a 4-hour soak. The offshore traps, offshore control, and control between the reefs were never exposed during low tide.

Sampling Equipment

Species were collected using a semi-oval collapsible trap with a dimension of 26x19x9-inch and a 6-inch throat. A 2½-pound weight was attached to the bottom to prevent the trap from tipping or drifting and a 10-foot braided poly rope with a 5x11-inch float attached to the top of the trap for identification and retrieval. The floats were labeled and varied in color to easily distinguish between reef segments and controls. A 10-foot PVC pipe was used to locate the top of the proper reef block to allow for precise location of the trap.

Processing Methods

After a soak time of four hours, all three of the inner reef traps and the inshore control trap were pulled onto the boat using a gaff. A 4-hour soak was necessary for the inshore traps to ensure that they would not be exposed during low tide. Traps were opened and emptied into sorting bins to be processed. All fish and crab species were identified using Peterson field guides. Once identified, the species were weighed, measured, and photographed. Weight and length were determined using a spring scale and fish board respectively. It should be noted that a variety of other benthic and planktonic species were discovered in the traps as bycatch. All species were returned live within the vicinity of the reef after being processed. This process was repeated the following day after a 24-hour soak for the remaining five traps — three on the outer reef, one control between the reefs, and one offshore control. All data was recorded on ALS data sheets.

Environmental Data Collection

Environmental monitoring occurred twice for each monitoring event — once during the 4-hour soak and once after 24-hour soak. Parameters measured included water temperature, salinity, turbidity, wind speed and direction, precipitation amount in the last 24 hours, cloud cover, and air temperature. Equipment used to measure the parameters included a centigrade thermometer, refractometer, secci disk, Kestrel wind and temperature meter, and a directional compass.

Benthic Diversity & Abundance Assessments

Sampling Methodology

Between the months of August and November, bags of whelk shell were sampled at reefs adjacent to Reeds, Moores, Thompsons, and Dyers Cove beaches to monitor diversity and abundance of benthic epifauna. Sampling events were scheduled an hour and a half before low-tide and bags were retrieved by walking in the intertidal once the top of the reef was visible. For each sampling event, shell bags were randomly selected from the top layer of three reef structures from the inshore reef and two from the offshore reef. The number of bags processed was dependent on available staff. The inshore reefs were blocked into three sections of five bags (north-south) and the offshore reefs were blocked into two sections of four bags to ensure even coverage along the reef. Bags that were partially underwater were carefully removed from the tops of the reef and walked back to shore for processing.



Processing Methods

After each bag was pulled, all shells from the bag were rinsed and placed into a plastic sorting bin. Organisms that came off or out of the shells when rinsing were then gently poured into a stack of graduated sieves. These organisms were considered “mobile” organisms and were identified and enumerated. A subsample of five individuals were measured for each species.

The total number of shells in each bag were counted and recorded. For bags of whelk shell, three shells were



Figure 6. Reeds Beach reef shell bags fused together with oysters

randomly selected, measured for length, and all encrusting organisms were enumerated. Fifty shells were sampled if an oyster shell bag was selected. Single individuals (barnacles, limpets) were counted, while colonial organisms (tunicates, bryzoans, algae) were estimated as percentage of coverage.

Environmental Data Collection

Environmental monitoring occurred for each benthic sampling event. Parameters measured included wind speed and direction, air temperature, precipitation amount in the last 24

hours, and cloud cover. Equipment used to measure the parameters included a Kestrel wind and temperature meter, and a directional compass.

Results

During the benthic biodiversity assessments, thirty species and 11,787 individuals were identified on the reefs. Striped anemone (*Haliplanella luciae*), black-fingered mud crab (*Panopeus herbstii*), mud dog whelk (*Nassarius obsoletus*), barnacles (*Balanus spp.*) and oysters (*Crassostrea virginica*) were the most prominent encrusting organisms



Reefs off Delaware Bay beaches have been constructed with the help of countless volunteers. Photo by David Hawkins/American Littoral Society

that were identified at each of the five reefs. Colonial organisms were also identified, such as bryozoan and brown algae, however they were noted as percentage of coverage.

Oysters were present during every assessment and new growth was spotted every season. Most shell bags at the Reeds Beach reef have become fused together with oysters, only visual assessments took place in 2017 and 2018 to minimize impact on oyster growth (Figure 6).

During demersal fish sampling events, fourteen species and 218 individuals were identified and released alive. Atlantic blue claw crabs (*Callinectes sapidus*) were most commonly found, followed by silver perch (*Bairdiella chrysoura*) and oyster toadfish (*Opsanus tau*). Two American eels (*Anguilla rostrata*), were also found; one eel was found during a benthic assessment at Dyers Cove and one eel

was found on the Reeds Beach reef during a demersal fish assessment. A majority of the individuals identified, with the exception of Atlantic blue claw crabs, were found in traps that were placed either on or adjacent to the reef. Species richness was far less great on the nearby control sandy-bottom sites.

Discussion

Oyster reefs provide a series of ecosystem services: seafood, storm protection, water quality, and habitat for other species (NOAA). The Delaware Bay was once the oyster capital of the world. In the early 1900s, South Jersey Bayshore communities were producing over 1 million bushels of oysters a year. Due to over harvesting and devastating diseases, many of the natural oyster reef beds in the Delaware Bay have vanished. In 2016, these communities were only able to harvest about 100,000 bushels (NPR). Oyster harvesting provides

significant economic value to these economically depressed areas of New Jersey.

Beaches naturally erode over time, however due to an increase in storms and sea level rise, natural erosion processes are happening at a quicker pace. Reefs are able to minimize the effects of wind-driven waves and slow the erosion process (Smithsonian), creating a more resilient shoreline. Data on wave attenuation of the reefs was collected and can be found in an additional report.

Adult oysters are filter feeders and are capable of filtering over 50 gallons of water a day. Oyster remove their food source in addition to any suspended sediments and excess nutrients from the water. These nutrients, though a necessary food source for the oyster, can be harmful when excess levels are reached in the water. Excessive nutrients can lead to harmful algal blooms and fish kills as a result of depleted dissolved oxygen (Sarasota Water Atlas).

Oyster reefs also create habitat for juvenile fish, crabs, and other invertebrate species. Since 2014, the Society has been using this discarded whelk shell to create this habitat. Channeled (*Busycotypus canaliculatus*) and Knobbed Whelks (*Busycon carica*) are commonly fished in the Delaware Bay, and there is no secondary use for the disposed shell. These shells provide interstitial space that is ideal protection for juvenile fish and crabs. This space also allows for the shells to lock together and create a sturdier structure. The calcium-carbonate hard surface of the shells creates ideal habitat for oysters, barnacles, and other encrusting species. The Society has been able to repurpose

250 tons of whelk shell which would otherwise be discarded in a landfill.

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Habitat Loss: The Role Humans Play in Habitat Protection





by Amberly Choi

What do the Great Barrier Reef, the Amazon Rainforest, the Florida Everglades, and the Delaware River Watershed all have in common?

First, they all provide habitat — think of coral reefs, tree top canopies, and nesting birds in your backyard. Second, they are each a bustling hub of recreation, exploration, and biodiversity. Finally, and most importantly, they need our help.

What is Habitat Loss?

Habitat is defined by the U.S. Fish and Wildlife Commission as “a combination of environmental factors that provides food, water, cover and space that a living thing needs to survive and reproduce.”

Habitat loss is the gradual or rapid destruction of those environmental necessities that allows species to survive and thrive.

What Causes Habitat Loss?

The driving factor of wildlife habitat loss in recent years has stemmed from the necessity of humans and their communities to provide for our growing food, shelter, and water needs. But there are other factors as well

Coastal wildlife will lose their habitats as the sea level rises and species that live in higher-elevation habitats will be lost if they are unable to adapt quickly enough to temperature increases. The U.S. Fish & Wildlife Service has noted the growing body of evidence

linking climate change to shifts in wildlife populations and their habitats.

Habitat Loss and the Importance of Biodiversity

But why should we even care about habitat or species loss anyway? Well, we need to talk about biodiversity to understand that, which is defined by the Encyclopedia Britannica as the variety of life found in a place on Earth.

According to the World Wildlife Fund, biological diversity is the:

“...resource upon which families,

“There is no magical way for the human species to live independently of the larger biological system on which we deeply depend. Without nature and its plethora of resources, it is impossible to support ourselves and future generations. This is why we must each play a role in protecting the environment and its natural resources.”

communities, nations, and future generations depend. [Biological diversity] is the link between all organisms on earth, binding each other into an interdependent ecosystem, in which all species have their role.”

Biodiversity provides us with everything we need in order to thrive on this planet in addition to the sun and water. There is no magical way for the human species to live independently of the larger biological system on which we deeply depend. Without nature and its plethora of resources, it is impossible to support ourselves and future generations. This is why we must each play a role in protecting the environment and its natural resources.

Humans have been around on earth for hundreds of thousands of years and until now, our planet has never supported so many people at one

time. In fact, within the next 40 years, the human population is expected to reach 10 billion for the very first time in Earth's history [see figure 1].

Braulio Dias, the former Executive Secretary of the Convention on Biological Diversity, told BBC News:

“...the drivers behind species loss are mostly increasing — land conversion [for development] and degradation, pollution, climate change. And of course...consumption is growing — and most of that consumption is not sustainable.”

Yikes. To simplify what Braulio Dias says here, humans as a species are pushing out other species with their unsustainable consumption of resources.

The realities of our current situation are quite terrifying in the most powerful sense of the word, but in the same hand, wholly necessary to be aware of — especially if you: A) plan to be here for at least 50 to 60 more years or B) have young ones in your life that need to support themselves in the future. Facing these issues head on is our best chance to make things right. It is more important than ever before in human history to get involved in environmental protection.

Solutions to Habitat Loss: Knowledge and Involvement

Solutions to habitat loss and a lack of biodiversity — whether it's in an urban, suburban, or rural community — are possible and within reach.

There is a wealth of information accessible to many of us at the push of a button and more ways to connect with local, national, and global communities than ever before. We can draw inspiration and solutions from nearly anywhere in the world and apply them

in our own communities based on the specific challenges they face.

Cristiana Paşca Palmer, the current Executive Secretary of the Convention on Biological Diversity, told *The Guardian*:

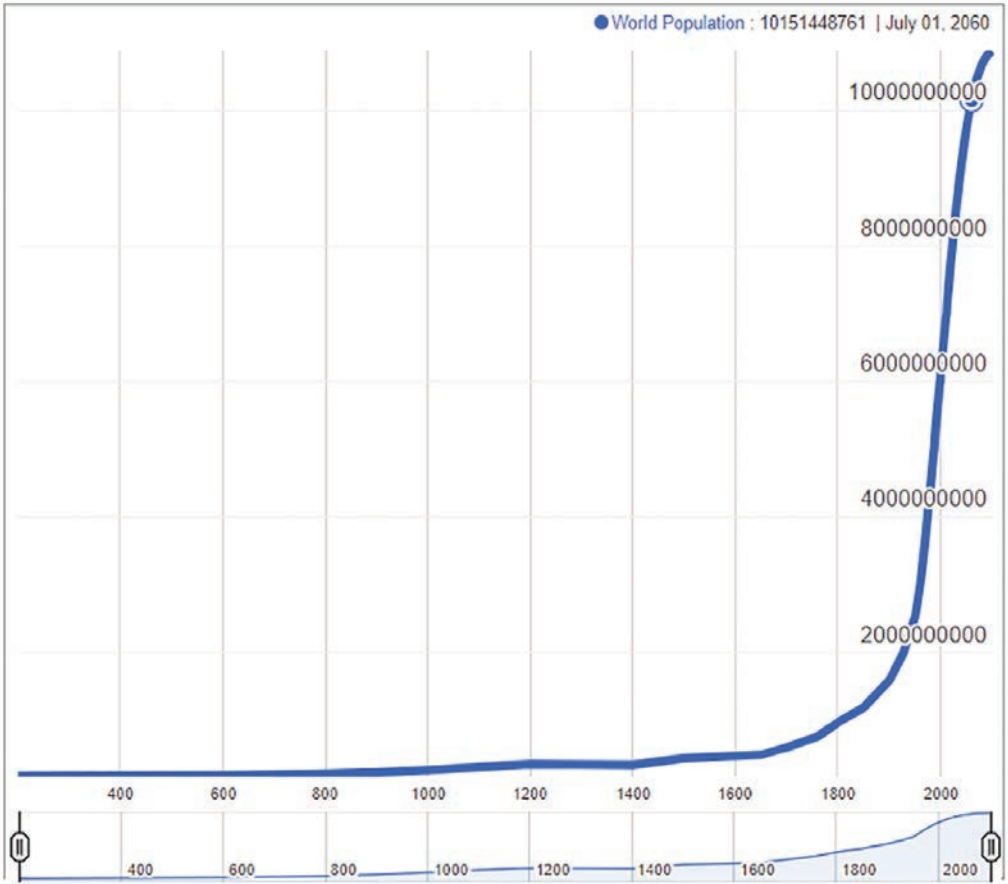
“Things are moving. There is a lot of goodwill,” she said. “We should be aware of the dangers but not paralyzed by inaction. It's still in our hands but the window for action is narrowing. We need higher levels of political and citizen will to support nature.”

We must all be environmentally-minded, simply because we all need the environment. The most important thing we can do is get involved, raise our knowledge of the situation, and share it with everyone we know — your mom, brother, father, sister, aunt, uncle, cousin, niece, nephew, friend, coworkers, basically anyone who will listen.

Once you start looking, solutions to combat habitat loss are everywhere. *A Sustainable Mind*, a podcast created by Marjorie Alexander in 2015, raises awareness about the world's most impactful environmental initiatives, organizations, and campaigns in a way that is accessible to anyone at any level of environmental knowledge. This was my personal starting point and continues to be a critical and personal source of motivation and creativity.

Local communities and organizations are great places to begin to

Previous Page: Volunteers help the American Littoral Society Habitat Restoration team construct reefs off a Delaware Bay beach near Cape May Courthouse, NJ during the Society's 2019 Shell-A-Bration event. Photo by David Hawkins/American Littoral Society



make an impact. Investing any available time and money in your community is an investment in your future and the

This Page: Human population trend over time, from the year 300 to the year 2060

Right: A rain garden built by the American Littloral Society and partners outside the Cumberland Insurance Group office on Shiloh Pike in Bridgeton, NJ. The rain garden helps prevent stormwater from carrying pollution into a nearby stream, as well as provides habitat for birds and insects. Photo by Shane Godshall/American Littloral Society

future of your children. To get myself involved with my community, I reached out and began working for Heritage Conservancy as a Delaware River Watershed Fellow for the past 5 months.

Heritage Conservancy is preparing for the obstacles ahead. By protecting over 15,000 acres of habitat, natural spaces, and farmland in southeastern Pennsylvania, Heritage Conservancy supports the biodiversity within many local wetland, meadow, and forest ecosystems that we cannot afford to lose. Their work supports local wildlife habitat and protects water quality.

Heritage Conservancy's work is essential as it continues its mission

to preserve and protect the natural and historic heritage of its local area while educating the next generation of environmental stewards throughout Bucks County, PA. Contributing to the beautification of communities throughout my county through their preservation work while their community engagement and stewardship teams work to conduct cleanups, tree plantings, and garden installations with local school groups and other volunteers.

Being a proud part of the Alliance for Watershed Education (AWE), Heritage Conservancy collaborates with 22 other environmental groups to raise awareness of the Delaware River Watershed and its diverse and important habitats.

Our Government's Role

The most influential law on habitat protection in the United States is a piece of legislation known as the Endangered Species Act (ESA). Since it passed in 1973 with bipartisan support, the ESA has been extremely effective. It has

stopped ninety-nine percent of listed plant and animal species from being driven to extinction, including the American Bald Eagle.

Crucially though, laws and the ways they are enforced are subject to amendments, or changes, by those we elect to local, state, and federal offices. Sometimes, those changes can be detrimental to the environment.

On August 12, 2019, the current presidential administration announced amendments to the regulations used to implement the ESA. These amendments weakened the ESA's ability to protect endangered species and their habitats.

Additionally, these changes decreased scientific oversight and crippled the ability for the ESA to decide what should or should not be protected. All of these changes make it much more difficult for the United States to prepare for the anticipated threats that climate change poses to American wildlife.

In terms of future habitat protection, governments all around the world play a significant role. By paying





attention to the laws and regulations responsible for protecting habitat for animals in your own municipality, city, state, and country, we as a citizenry can contribute to the protection of habitats such as the Everglades, the Amazon, the Great Barrier Reef, and any wildlife in our backyards and local forests, parks, and waterways.

In Conclusion

I'll re-emphasize here how critical it is that we each get involved in any way we can with habitat protection and environmental stewardship. Whether you are from an urban, suburban, or rural area, you can have a positive impact on your community and your local wildlife habitats. For our health and the health of our communities, we have no choice but to get involved and inspired to make a difference!

Find a local environmental education center and see how you can get involved with protecting wildlife and habitats in your area.

About the author: Amberly Choi served on the Alliance for Watershed Education of the Delaware River Heritage Conservancy at Bristol Marsh team. This article is reprinted with permission from AWEDR website.

This Page: Loss of nesting sites and pesticides containing DDT nearly wiped out the New York/New Jersey Osprey population by the early 1970s. Federal regulation of DDT, along with state efforts to preserve and restore nesting habitat have resulted in a population resurgence. Photo Courtesy of Marsh Williams.

R-Corps Saves Marshes and More

By Don Riepe, Director of the American Littoral Society Northeast Chapter

New York City's Jamaica Bay is home to expansive salt marshes, grassy areas that are covered or revealed above the water line with the movement of tides.

They may not look important, but salt marshes are crucial to the health of the surrounding city in many ways — not least because they play a key role in maintaining biodiversity in that urban setting.

Unfortunately, Jamaica Bay's wetlands have been eroding at an alarming rate. Losses are estimated at 40 to 50 acres a year, largely as a result of rising sea levels coupled with pollution that is exacerbated by development and population density in the area around the bay.

As part of the response to this problem, the American Littoral Society created the Jamaica Bay R-Corps. Formed in 2012, this Restoration Corps was designed to provide employment for at-risk youth in the city, who would work at restoration and maintenance of wetlands in Jamaica Bay.

"This program has been exceptional in providing people power to help save Jamaica Bay's marshes and connect young people to the coast, and we have been growing the approach in other areas," said Tim Dillingham, Executive Director for the American Littoral Society. In 2016, the Society started a Restoration Corps in support of its work along one of the other great estuaries of the mid-Atlantic, the Delaware Bay.

It Looks Mucky but It's Important

There are unique challenges for preserving biodiversity in urban areas, but there are indicators that a lack of plant and animal variety in such an ecosystem will eventually have profound physical and mental consequences for the human occupants.

The basic proximity of urban development and its accompanying stressors, such as water pollution, polluted stormwater runoff, air pollution, and disturbance from human activities, add to the pressures on maintaining habitat and biodiversity. Natural areas within urban settings such as New York City are often greatly reduced portions of once more expansive ecological systems.

Jamaica Bay is an 18,000-acre wetland estuary surrounded by the Rockaway Peninsula to the South, Brooklyn to the West, and Queens to the East. Comprising an area almost equal to that of Manhattan, the bay consists of numerous islands, a labyrinth of waterways, meadowlands, and two freshwater ponds.

The wetlands provide a unique environment for both wildlife preservation and urban recreation. Enclosed by the Rockaway Peninsula and protected from the Atlantic Ocean, the region currently hosts over 325 species of birds, 50 species of butterflies, and 100 species of finfish.

A favorite stop for migratory waterfowl, the area is an integral part of the larger, regional ecosystem. One of New York City's most extraordinary



natural resources, Jamaica Bay remains highly undeveloped thanks in no small part to the US government, which administers the vast majority as public land. Outside its tremendous environmental value it may be best known as the home of Kennedy airport.

The Jamaica Bay National Wildlife Refuge — the nation’s only wildlife refuge accessible by subway — take up more than one-third of the 39 square miles of waters and of the bay. Every year, millions flock there to enjoy outdoor activities like camping and boating.

The refuge, which lies along a major migration route called the Atlantic Flyway, also has a long-standing reputation for being a birder’s paradise. It serves as a pit stop for about 20 percent of North America’s bird species, and roughly 70 species — including egrets, ospreys, hawks, peregrine falcons, and barn owls — nest regularly there.

Jamaica Bay is also home to more than 100 species of fish, mollusks, crustaceans, diamondback terrapins, and the critically endangered Kemp’s ridley sea turtle.

But below the water’s surface, a lack of oxygen has been choking this aquatic life for decades.

The main culprits? Four nearby sewage treatments that were collectively dumping 250 million gallons of partially treated wastewater into the bay every single day. That kind of discharge may be free of bacteria, but it’s high in nitrogen, an organic pollutant that creates harmful algae blooms. The blooms turned the water murky and caused oxygen levels to plummet, making areas of the bay inhospitable to marine life and unusable to people.

Jamaica Bay’s salt marshes have been disappearing, due in part to the nitrogen pollution which disrupts the root systems of marsh grasses. Rising sea level brought on by climate change is also playing a role.

Those marshes are critical to the health of the city and the ecosystem.

“Salt marshes are a critical interface between the land and sea,” according to Linda Deegan, a scientist for the Ecosystems Center, who helped run a 10-year study on how nitrogen and phosphorus effect salt marshes. “They provide habitat for fish, birds, and shellfish; protect coastal cities from storms; and they take nutrients out of the water coming from upland areas, which protects coastal bays from over-pollution.”

The Jamaica Bay wetlands serve as ecological nurseries for fish, birds, and other wildlife — and they’ve been stalwart defenses against coastal storms, by dampening waves and substantially blocking or slowing down winds that accompany storms. They also filter out contaminants — like overflows of raw sewage and polluted stormwater.

While there are clear economic and resiliency incentives to preserving and protecting the marshes, there are other benefits. Among those is that the biodiversity fostered by those wetlands has a direct impact on the physical and psychological health of people living in densely packed urban areas, according to studies published in *Philosophical Transactions of the Royal Society B: Biological Sciences and Environmental Health Perspectives*.

Saving Marshes With Students

Recognizing the crucial benefits of Jamaica Bay's endangered ecosystem, the Littoral Society set out to restore them. But the Society wanted young city residents to play a key role in the effort. Thus, the Jamaica Bay R-Corps was born.

The program was initially supported by \$500,000 from the Triborough Bridge and Tunnel Authority (TBTA) as mitigation funding to restore 5 acres of saltmarsh on Rulers Marsh in Jamaica Bay.

With that money, 15 students from Brooklyn and Queens counties were hired in 2013 for 8 weeks of work the summer. That first season more than 88,000 plugs of *Spartina alterniflora* (aka marsh grass) was planted on the mitigation site. Each year, for the next 5 years, more grass was planted at both Rulers Marsh (10 acres) and Black Wall marsh (20 acres). Additional funding came from the NYC Dept. of Environmental Protection as part of their marine debris program as well as private foundations and several corporations, including Bloomberg Company, Mitsui, and Estee Lauder.

In 2018, the Society received funding from the NY State Department of Environmental Conservation to conduct cleanups and plantings at Coney Island Creek in Brooklyn as part of Governor Cuomo's "Vital Brooklyn" initiative.

In 2019, the Society received funds from New York City Department of Parks and Recreation to help plant 74,000 plugs of *Spartina* at a new city



The 2019 Jamaica Bay R-Corps

park on the edge of Jamaica Bay called Sunset Cove. That huge project involved volunteers from Bloomberg Company, Natural Areas Conservancy, and the We Luv You Foundation. After finishing that project and additional 30,000 plants were installed on Rulers and Blackwall marshes.

The Society also partnered with the Jamaica Bay/Rockaway Parks Conservancy, which gave us funds in 2019 for cleaning sites and maintaining trails at local community parks on the edge of Jamaica Bay. Through all of this, R-Corps students were also given the opportunity to sein for fish, band barn owls and ospreys, and take a trip to Governor's Island.

There's More to R-Corps Than Saving Marshes

There is strong evidence that there are big benefits to getting children out of buildings and into the natural world.

A report from the National Wildlife Foundation (NWF) says it isn't a coincidence that numerous studies show "American kids are out of shape, tuned out and stressed out."

"Today's kids are indoors far more than their parents were, with only a quarter of children playing outside daily as compared to nearly three quarters a generation ago, even in rural areas," the NWF *Be Out There* report states. "While contemporary parents spent their free time as kids exploring and playing in nature, their children devote only four to seven minutes a day to unstructured outdoor play like climbing trees, drawing with chalk on the sidewalk, taking a nature walk or playing a game of catch.

"Yet, kids spend more than seven hours each day in front of electronic media. Even preschoolers are not exempt. Most log an excess of 32 hours per week of TV, according to The Nielsen Company. By the time most children attend kindergarten, they have watched more than 5,000 hours of television — [which is] enough time to earn a college degree."

There is a real cost for this shift, NWF insists. It includes a doubling of the childhood obesity rate — accompanied by an incremental hundred-billion-dollar cost to our health care system — as well as declining creativity, concentration, and social skills.

In urban areas, the prevalence of buildings and pavement make nature even less accessible. However Littoral Society programs aim to do more than simply get kids outside and exercising.

"Bringing children onto the sand and into the water will do more than give them a deeper understanding of how nature works on our beaches and in our bays," says Tim Dillingham, Executive Director of the Littoral Society. "We believe it fosters a lifelong concern for nature, as well as a desire to help protect the diversity of ecosystems and the life in them, without which people simply can't survive."

That message is resonating in both the public and private sectors, as support grows not just for restoring and improving Jamaica Bay, but for programs that bring kids from a glass and concrete environment into the salt marshes that need to be saved in their own backyards.

How do We Protect Ocean Biodiversity as We Race Toward Wind?

By Sarah Winter Whelan

The ocean does not exist solely for our benefit, it is also a vital, diverse ecosystem worth protecting in its own right.

Because the ocean cannot speak for itself, we must push our leaders to protect ocean biodiversity as seemingly everyone rushes toward planting a flag for wind, oil and gas, fishing, deep sea mining, and the countless other ways we stress the ocean. While there are real opportunities to mitigate our fossil fuel dependence, there are also real risks to things that are just as important: such as ocean habitat, along with the whales, fish, and other wildlife that live in that habitat.

There have recently been a dizzying number of Atlantic offshore wind announcements, including record-breaking lease auctions off the coast of Massachusetts and New York which quadrupled previous goals for generating capacity to a staggering 9,000 megawatts by 2035. These announcements mark a year of East Coast states jockeying for position to become the biggest producers of offshore wind power.

In the race toward renewable energy development, New Jersey has no intention of being left behind. Immediately after taking office, Governor Murphy committed to generating 3,500 megawatts of electricity by offshore wind by 2030. His administration is quickly working to make that a reality, by recently awarding its first contract to a Danish energy company that plans to build turbines capable of producing 1,100 megawatts of power annually.

Support for this plan goes beyond the Governor. A recent Monmouth University poll shows widespread bipartisan citizen support for placing wind farms off New Jersey's coast, with almost 50 percent of respondents supporting wind energy as a major priority for New Jersey over the next 10 years.

Fueled by public support and a continuous push toward renewable energy, offshore wind developers and responsible governments are making the usual promises to listen to communities that use and depend on the ocean.



This page: The Block Island Wind Farm, located off the coast of Rhode Island, is the first commercial offshore wind farm in the United States and generates about 30 megawatts of electricity. A number of Atlantic Coast states are launching similar but far larger projects, with New Jersey and New York alone aiming to build capacity for nearly 13,000 megawatts of power generation by 2035.

The assurance is they will only put wind turbines in places that will minimize harm to ocean ecosystems and existing uses, while also having the least impact on shore communities.

As coastal residents, it's up to us to ensure these commitments are met, especially in regards to the conservation of our ocean ecosystem. We need to hold decision-makers accountable. We are the beneficiaries of the public trust in which these ocean resources are held.

In the short term, there are three actions New Jersey and its fellow Mid-Atlantic states can take to help decrease our reliance on fossil fuels and mitigate climate change, while also protecting the ocean's biodiversity:

- 1. Identify ecologically special areas offshore, such as hot spots for biodiversity, productivity and abundance; areas where there are vulnerable and/or rare marine resources; and locations that are optimal fish habitat, prime recreational fishing sites, and/or corridors for migrating sea creatures. Once we have identified these places, we must then develop policies and mechanisms for deciding when and if uses can occur in those areas.*
- 2. Develop a broad, fully-funded, inclusive engagement process, co-led by states, tribal nations, and federal agencies. This would require re-investing in Mid-Atlantic ocean planning started by these entities in 2015 so that they could engage citizens and communities in planning for ocean uses, including offshore wind.*
- 3. Fund and broaden the use of our Mid-Atlantic Ocean Data*

Portal, which provides citizens and ocean users free access to the same information our state and federal governments use to make decisions on using and protecting the ocean on our behalf.

Citizens of New Jersey care about how and where we develop offshore. Over half of respondents to the Monmouth University poll say they would support developing offshore wind even if electricity rates increase — if it meant significantly reducing carbon emissions and our reliance of fossil fuels. But this tradeoff cannot come at the expense of the ocean's health.

We understand the impacts of climate change, which the ocean feels faster and more severely than we thought possible, require us to invest in energy alternatives. We also know that *proper planning and preparation prevent poor performance*. Therefore we have to be thoughtful and inclusive as we actively plan for a healthy and sustainable future for the ocean.

As we sprint to turn promises into leases and construction plans into functioning projects, the possibility of conflict, litigation, and poor outcomes increases exponentially. Embracing these three actions — protecting special places, engaging stakeholders through ocean planning, and using good science — offers a path to best meet the needs of our ocean, coastal communities, traditional ocean users, ratepayers, and citizens.

More than just the proper choice to make, it ensures that we won't simply exchange one set of problems for another, by requiring new development to preserve a healthy, productive ocean now, and for future generations.

Adapting to the Hurt of Sea Level Rise

By John A. Miller, P.E., CFM, CSM (MES 2018)
FEMA

I had the distinct pleasure of moderating author Gilbert (Gil) Gaul at the Princeton Free Library on October 17, 2019 during his book tour introducing *The Geography of Risk* (Sarah Crichton Books — Farrar, Straus and Giroux).

A couple weeks earlier, the Wharton Risk Center hosted Gil for a panel discussion at the University of Pennsylvania. Gil's book is making waves in the broad sense, and specifically in the floodplain management and adaptation professions, and has prompted me to ponder what is ahead pertaining to sea level rise — it is looking to me like a big hurt.

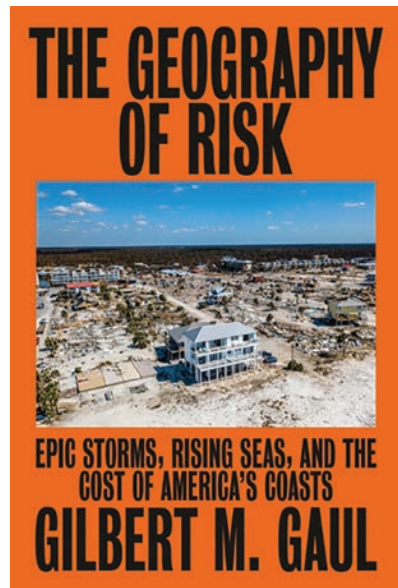
The Geography of Risk gives a synopsis of the political, policy and regulatory conditions that occurred through time that resulted in the substantial coastal exposure existing today. To date there has been a large transfer of private risk to the public, with the most obvious physical example being the cost of beach nourishment, and more concealed, for example, the unloading of liability of vulnerable mortgages to government-sponsored enterprises.

Despite the increasing prevalence of climate-change related risks like sea level rise and higher precipitation, I question whether there is the political will to modify our risk-taking habits that are entrenched since World War II.

Residents tend to support post-disaster funding of rebuilding and not for taking preventative measures. So far this has generally worked out for real estate interests and for the communities highly dependent on property tax revenue, with much recovery help from Federal taxpayers. In some New Jersey coastal municipalities, the tax base is greater now than in 2012 pre-Hurricane Sandy, due in part to the construction of larger dwellings where damaged homes were razed.

In the decades ahead, and consistent with Gil's book, I expect changes to be led not by policymakers; instead, I expect markets to drive adaptation.

In my Capstone¹ for my Penn Masters of Environmental Studies (MES) degree, I examined how sea level







rise will influence local governments' credit rating and how I expected this to be a motivator to communities. I continue to believe that institutional investors ultimately will act to shape adaptation of coastal locales, with recent evidence² that credit rating agencies will develop increased skill at assessing the risk over the term of the bond.

Lenders and reinsurance companies will also play a strong role in coastal adaptation. In a paper³ released by the Federal Reserve Bank of San Francisco, Michael D. Berman, having served as a fellow at the Penn Institute for Urban Research⁴, speaks of observed declining property value due to chronic flooding. He coins the term "blue-lining" where lenders will not offer standard 30-year term mortgages in areas of chronic flooding due to the risk of borrower loan default. As sea level rise continues to manifest along the coast, market signals will get further pronounced.

We have seen the Federal response to acute events, like hurricanes, and there is a predictable pattern in supplemental appropriations that drive a large recovery. In the United States we have little experience with a chronic threat like sea level rise — case studies are limited, so far, as to how the nation will respond to a growing all-tidal coast vulnerability.

The vulnerability is not limited to structures. Society, such as functioning schools, churches, and small businesses, and systems that support community functions, such as utilities,

This Page: Flooded streets in Ocean City, NJ, following a nor'easter in March 2013. The photo was taken by a Coast Guard crew member aboard an MH-65 Dolphin helicopter from Air Station Atlantic City.

transportation and commerce, will be exposed.

As I am quoted in Gil's book, I am now calling the approaching consequence the "Big Hurt." At the time home values drop and revenue declines, more capital will be needed for civil works protective measures and non-structure mitigation, all while credit ratings are dropping which will cause higher borrowing costs.

A failure cycle will be created.

Unlike prior housing market corrections, properties that lose value due to sea level rise will not see that value restored as the inundation of land increases through time. High risk areas will be out of bounds for lenders and insurers. That too will cause property values to plunge adding to the cycle.

Yes, this is serious and deeply concerning, but I share my hope that we will indeed adapt, even in the midst of pain. In addition to climate change mitigation (reducing carbon emissions) we can prepare for what is ahead with rising seas.

Governments and private partners can lessen the hurt by aggressively planning and implementing adaptation practices and land use practices, ones that consider not only our generations, but many in the future.

I call this the "no regret policy" where we anticipate additive solutions through time and avoid dead ends of diminished short-term gain — it will take creativity.

We must listen to the signals and engage the markets. Let us encourage finance, lender and insurance representative participation in our planning for sea level rise. A controlled and systematic adaptation, or abrupt

failure to future conditions, is up to all of us.

About the author: John A. Miller is the FEMA Region II Mitigation Liaison detailed to the state of New Jersey, dedicated to assisting the state in increasing its resiliency to natural hazards. This article is reprinted from the Water Matters newsletter of The Water Center at the University of Pennsylvania.

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