

HABITAT HOTLINE *Atlantic*

2018 Annual Issue



HEALTHY FISHERIES NEED HEALTHY HABITAT

Monitoring our Changing Habitats along the East Coast

As the Chair of the Atlantic States Marine Fisheries Commission's Habitat Committee, it is my pleasure to present the *2018 Habitat Hotline Atlantic*. This year's issue focuses on the importance of monitoring our changing habitats along the United States East Coast. Monitoring of fishery resources is crucial to understanding changes to habitat and ecological functions of Commission-managed species. As these resources react to climate change effects like increased ocean and sea surface temperatures, sea level rise, and increasing ocean acidity, understanding the behavioral and functional processes within and between habitats can provide tools for planning adaptive management strategies. Evaluation of marine and estuarine habitats can also capture shifts in geographic distribution of species, document disease events and species vulnerabilities, monitor changes in the quality and quantity of wetlands, and assess human activities occurring within these habitats.

The *2018 Habitat Hotline Atlantic* also features examples of the commitment of the Habitat Committee and affiliated partners in improving fisheries habitat conservation through scientific research, restoration activities, partnerships, policy development, and education. It demonstrates the creative approaches to the challenges of understanding the dynamics of marine and coastal fish habitats. I invite you to enjoy reading about the various fish habitat-related conservation issues and projects happening along our coast.

January Murray
Habitat Committee Chair



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MONITORING OUR CHANGING HABITATS

Projecting Shifts in Thermal Habitat for Atlantic Species During the 21st Century

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The range of suitable temperatures for a species broadly determines its geographic distribution and is a fundamental component of habitat. Climate change will affect where these suitable temperatures occur and thus has the potential to alter the geographic distribution of productive habitat for most marine species. Indeed, ocean warming in recent decades on the U.S. Atlantic coast has already influenced the distribution, and potentially the regional productivity, of many important resource species.

In order to better prepare for potential climate impacts to U.S. fisheries we conducted projections of shifts in suitable thermal habitat for hundreds of marine species into the 21st century (<https://doi.org/10.1371/journal.pone.0196127>). To accomplish this, we first developed statistical models that described temperature preferences for each species. These “thermal niche models” were based on extensive monitoring data from bottom trawl surveys that are routinely conducted on the U.S. and Canadian continental shelves. These data tell us the thermal conditions where each species occurs, along with any preferences for seafloor characteristics (e.g., fine sediments, steep depth gradient).

The thermal niche model of each species was then coupled with predictions for how ocean temperatures will change throughout the 21st century. Predictions for future ocean conditions came from 16 different climate models, which were generated by 11 different research laboratories from around the world. To summarize our analysis here, we compare how the amount of suitable thermal habitat on the U.S. Atlantic continental shelf during the present time period might compare with habitat area at the end of this century, with the focus being on species managed by the Atlantic States Marine Fisheries Commission (ASMFC). While we conducted projections of habitat change for multiple future scenarios of climate change, we focus here on the “business-as-usual” scenario, where current trends in

global emissions continue into the future.

The projections for change in available thermal habitat in the coming century varied widely across species managed by the ASMFC (Fig. 1). Some species are projected to experience a major loss in suitable habitat during the summer season. For example, river herring and shad (*Alosa* spp.) show negative trends, which may indicate major losses in suitable summer foraging habitat. On the other hand, many species have projections for a net gain in thermal habitat, including black sea bass and scup.

These species also vary in how much uncertainty surrounds their projections, which results from variation among predictions from different climate models. For example, both Atlantic menhaden and bluefish are projected to have increases in habitat suitability, but the predictions for menhaden are much more uncertain and some climate models predict little change for this species.

While a number of the species shown here have a net neutral or even positive outcome in total thermal habitat area, these species may still exhibit major shifts in distribution that will challenge management. For example, spot may experience little change in overall thermal habitat area. Nevertheless, temperatures in the southeast largely become less favorable for this species, while conditions north of Cape Hatteras generally improve (Fig. 2). Thus, we anticipate a northward shift in spot distribution.

While many factors influence where a species occurs, we focused on temperature preference because that allowed us to isolate how ocean warming specifically might affect many

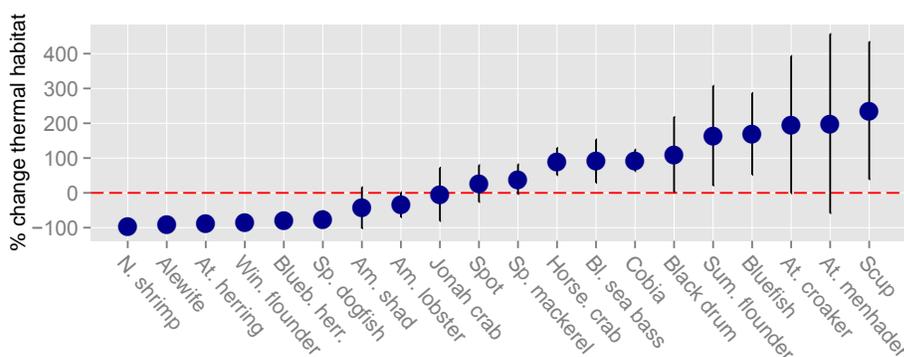


Figure 1. Percentage change in the amount of thermal habitat on the U.S. Atlantic continental shelf from the present time to the end of the 21st century. For each of the 20 species, the mean prediction from 16 projections of future climate is shown and the vertical lines indicate the amount of uncertainty. The dashed-red line indicates no net change in thermal habitat.

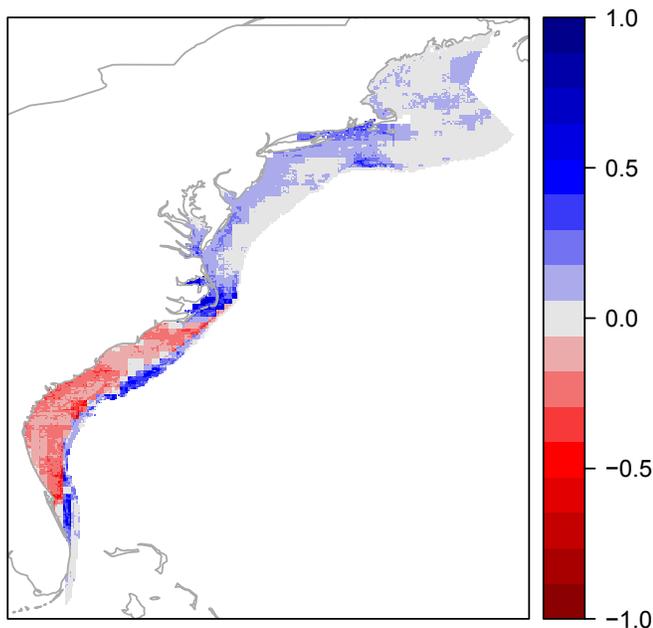


Figure 2. Projected change in thermal habitat suitability for spot (*Leiostomus xanthurus*) during the 21st century. Red areas indicate regions where thermal habitat suitability is projected to decline and blue areas represent areas where temperatures become more suitable.

species on the U.S. shelf. The unifying trend across species was for spatial shifts in thermal habitat, which will challenge resource management as stock boundaries or regional productivity may change. These projections in suitable thermal habitat, along with other emerging tools, will help resource managers anticipate where proactive policy is most critical.

Sentinel Monitoring for Climate Change in Long Island Sound

Cassandra Bauer, New York State Department of Environmental Conservation

In 2011, the Long Island Sound Study (LISS) developed a Sentinel Monitoring for Climate Change Program (SMCCP) and released a strategic plan to quantify the impacts of climate change and assist the LISS Management Conference in designing a climate change monitoring program for Long Island Sound ecosystems. The SMCCP funded an online climate change data citation clearinghouse to help address the need for a central repository for Long Island Sound climate change research. The SMCCP also funded three pilot-scale monitoring projects focusing on the impact of climate change on salt marshes and the species that inhabit them as well as changes in physical and chemical driver variables that were identified in the strategic plan.

The first pilot project, conducted by Christopher Elphick and Christopher Field from University of Connecticut, investigated potential indicators of climate change effects on key wildlife and ecosystem resources in Long Island Sound coastal environments. Their results suggested that while beach-nesting and colonial



Figure 3. Saltmarsh Sparrow. Photo credit: M. Szantyr.

waterbirds are not strongly influenced by core parameters (such as temperature, precipitation, and sea level) several saltmarsh bird and plant species, including Saltmarsh Sparrow, *Juncus gerardii*, and *Spartina alterniflora*, are strong indicators of sea level and tidal flooding (Fig. 3). The researcher's also collected baseline data in areas thought to be experiencing marine transgression and concluded that saltmarsh ecosystems are already being affected by increased coastal flooding, but coastal forest ecosystems may be resilient to such changes. Additional research and monitoring is needed to understand the rates of marine transgression and the challenges for saltmarsh conservation management in Long Island Sound. Priority next steps to advance monitoring biological responses to climate change along the Long Island Sound coast are highlighted in the final report.

The second pilot project, conducted by Robinson Fulweiler at Boston University, investigated the response of salt marshes to increased sea level rise by quantifying salt marsh accretion rates, measuring salt marsh decomposition rates, and synthesizing data of environmental factors indicative



Figure 4. Example of litterbag used to measure decomposition. Photo by S. Buckley.

of climate change (air and water temperature, sea level rise, wind, and precipitation). Seasonal rates of salt marsh respiration and rates of litterbag decomposition were quantified at six different salt marshes within Long Island Sound and the data were compared to historical rates recorded at these sites (Fig. 4). The results of this study showed that salt marshes in Long Island Sound do not appear to be keeping pace with

current rates of sea level rise even though recent accretion rates appear to be increasing. The researches also did not find any correlation between accretion rates, decomposition,

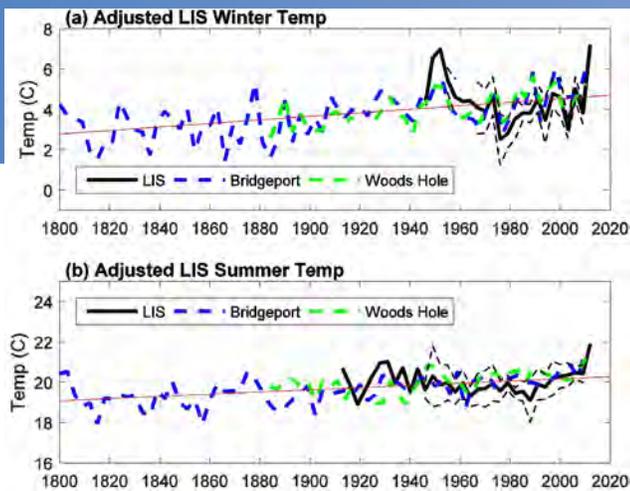


Figure 5. The summer (a) and winter (b) bin averaged LIS temperature index (black) series with the Woods Hole water (green) and Bridgeport air (blue) temperatures averaged in the same manner (figure taken from final report).

CO₂ fluxes and distance from the east river (the proxy for nutrient concentrations). Further research using site specific nutrient concentrations would likely add more clarification to the patterns that were observed.

For the third pilot project, researchers from Coastal Ocean Analytics (Jennifer O'Donnell, James O'Donnell, and Todd Fake), quantified local changes in the environment by evaluating physical and chemical driver variables such as precipitation, river discharge, sea level, air and water temperature, cloudiness, and wind. The researchers reviewed and analyzed existing data to assess whether the changes were a consequence of global scale climate change. Some of their results were: air and water temperatures of Long Island Sound have increased at a rate consistent with global averages (Fig. 5); there is no evidence of changes in annual precipitation rates; annual stream flow is increasing and the spring freshet is arriving 8 days earlier than a century ago; and sea levels are rising which will lead to an increase in the frequency of flooding. The researchers also

developed a website in order to disseminate the results and data from this study and facilitate further research.

Now that the pilot-scale projects have been completed, a goal of the LISS SMCCP is to develop and fund a long-term adaptive monitoring program to measure and evaluate sentinel indicators and associated parameters that would signal the magnitudes and rates of change in LIS habitats, biota, and processes caused by climate change. To learn more about the LISS SMCCP, please visit <http://longislandsoundstudy.net/research-monitoring/sentinel-monitoring/>. The site includes the updated 2018 LISS SMCCP and list of climate change indicators and recommendations.

An Update on the Florida Reef Tract Disease Event

Stephanie Shopmeyer, Florida Fish and Wildlife Conservation Commission - Fish and Wildlife Research Institute

In 2014, an unidentified white syndrome disease event began in Miami-Dade County close to the Port of Miami in Government Cut. The disease initially spread north through Broward (2015), Palm Beach (2016), and Martin (2017) counties and then moved south of Miami into the Upper (2016), Middle (2017), and Lower Keys (2018). The disease continues to spread within the Florida Keys National Marine Sanctuary with the leading edge of the disease currently at Looe Key near Summerland Key.

The disease has been confirmed to affect more than 20 species of stony corals (there are ~45 coral species in

Florida) and inflicts varying levels of loss, with the most susceptible coral species suffering complete mortality. The disease presents as focal and multi-focal lesions and has pale bleaching margins or distinct lines of tissue necrosis. The primary species affected at a reef site include *Meandrina meandrites*, *Colpophyllia natans*, *Dichocoenia stokesii*, *Pseudodiploria strigosa*, *Montastraea cavernosa*, *Siderastrea siderea*, and *Orbicella faveolata*. The disease is aggressive and can destroy all the living tissue on smaller corals (e.g. those smaller than the size of a basketball) in less than a



Southwestern disease boundary as of June 2018. Survey sites are marked where disease is currently present (red circles), sites where coral colonies are showing precursor signs of the disease (yellow circles), and sites where disease is currently absent (green circles).



month, but many of the larger important reef builders may only sustain partial mortality. Additionally, some species, in particular, two iconic species of coral in Florida, *Acropora cervicornis* and *A. palmata*, appear to resist this white syndrome disease.

Long-term monitoring data from Florida Fish and Wildlife Conservation Commission (FWC) Coral Reef Evaluation and Monitoring Project (CREMP) and Nova's Southeast Florida Coral Research Evaluation and Monitoring Project (SECREMP) show a nearly 50% reduction in coral cover on southeast Florida between 2015 and 2016 as absolute cover declined from 3% to 1.5% on southeastern reefs. This event is by far the most catastrophic loss of coral in the southeastern region since the inception of SECREMP. In 2016, coral cover in the Florida Keys was approximately 6.4% (1996 CREMP data show 12% stony coral cover; historical 1960s data show 60-70% stony coral cover). The 2017 and 2018 long-term monitoring data will likely confirm a further loss of coral that will equal or surpass three previous mortality events: mass bleaching in '97/'98 and '14/'15, and a winter cold kill in 2010.

Corals are complex animals that have unique relationships with single-celled algae, a consortium of microscopic bacteria, and other animals which can affect the coral's health. As a result of warm water events or other stressors associated with water quality degradation, certain bacteria associated with the coral can become pathogenic (disease causing) or other pathogens in the water column can invade the coral causing disease. The Florida Reef Tract has been exposed to an increasing array of both human-caused and natural stressors and several potential pathogens have been isolated from diseased corals.

Through collaborations with a multidisciplinary team of experts (see full partner list on page 6), FWC has been involved in research and monitoring to identify the potential causes of this white syndrome, evaluating the role of pathogens and relationships with environmental parameters in the progression of the disease, and developing potential treatments and adaptive management strategies to arrest the spread of the disease on individual colonies and halt the progression of the disease throughout the Florida Reef



White syndrome disease lesions on coral colonies of a) *Colpophyllia natans*, b) *Montastraea cavernosa*, c) *Meandrina meandrites*, and d) *Dipoloria labyrinthiformis* along the Florida Reef Tract in 2018. Photo credits: J. Stein.

Tract. Specifically, the Restoration Ecology Team (RET) led by Dr. John Hunt, Dr. William Sharp, and Kerry Maxwell at Fish and Wildlife Research Institute (FWRI) south Florida research lab has played an essential role in monitoring the disease's spatial progression along the reef tract and transmission rates, as well as, the collection of coral tissue cores and slurry samples for histological, TEM, and microbiome analysis at FWRI. As part of a State Wildlife Grant, sample analysis by Dr. Jan Landsberg and Dr. Yasu Kiryu will utilize diverse diagnostics and characterize the disease by identifying suspect pathogens. Results will assist management efforts to control the spread of the disease and provide options to treat, mitigate, or manage affected corals.

Our local communities can help! Reporting information on healthy and unhealthy corals help researchers and managers track the progression of the disease over the extensive reef system in South Florida. SEAFAN, Florida's coral health reporting tool, allows the public to describe conditions on the reef and upload images (www.floridadep.gov/fco/coral/content/seafan). In addition, simple life-style practices can lead to healthier oceans and corals reefs, such as recycling or properly disposing of trash, eliminating single-use plastics, using renewable energy sources, eating sustainable seafood, reducing the use of pesticides and fertilizers, and using reef-safe cosmetic products.

Partner List

Broward County, Coral Restoration Foundation, Cry of the Water, Environmental Protection Agency, Florida Aquarium, Florida Atlantic University, Florida Department of Environmental Protection (Florida Coastal Office, Florida Parks Service), Florida Fish and Wildlife Conservation Commission (Fish and Wildlife Research Institute), Florida Institute of Technology, Florida International University, George Mason University, Keys Marine Laboratory, Martin County, Miami-Dade County, Mote Marine Laboratory, National Oceanic and Atmospheric Administration (Coral Reef Conservation Program, Coral Disease and Health Consortium, Florida Keys National Marine Sanctuary), National Park Service (Biscayne National Park, Dry Tortugas National Park, South Florida/Caribbean Network), Nova Southeastern University/National Coral Reef Institute, Oregon State University, Palm Beach County, Palm Beach County Reef Rescue, Southeast Florida Coral Reef Initiative, Smithsonian Institution, The Nature Conservancy, United States Geological Survey (National Wildlife Health Center), University of Florida, University of Hawaii, University of Miami Rosenstiel School of Marine and Atmospheric Science, University of South Florida.

Salty Streams: the Effect of Road Salt on Anadromous Fish

Marek Topolski, Maryland Department of Natural Resources

Increased salinity of freshwater is an emerging indicator of water pollution from development, particularly from the Mid-Atlantic to the Northeast. In these regions there is a concern for increased levels of salt in drinking water. It may also be a concern for fisheries managers attempting to bring anadromous herrings back to their former abundance.

Determining the amount of salt in water is typically done by using a meter that measures how well water conducts electricity (conductivity measured as micro-Siemens per centimeter or $\mu\text{S}/\text{cm}$). In estuaries and the ocean, the high salt content results in very high conductivity which can be converted directly to salinity. Salinity measurements are not sensitive to small fluctuations in the amount of salt, but conductivity measurements are. Conductivity itself can be used as an indicator of salt content in freshwater habitats. Small differences in the amounts of salt may exceed the tolerance of many freshwater organisms.



Two examples of road salt in Maryland. Eventually, this salt can end up in our waterways, affecting diadromous fishes. Photo credit: MD DNR.

All freshwater streams have a natural base level of conductivity from weathering of rocks and soils that may differ by geographic region. For example, natural base levels are higher for non-tidal streams in Maryland's Piedmont ($150 \mu\text{S}/\text{cm}$) than those in the Coastal Plain ($109 \mu\text{S}/\text{cm}$). Rural streams in a Maryland study were 20-30% higher than the natural base level, while the streams from suburban watersheds were 140-240% higher. Increased conductivity beyond a natural base level is usually from road salt, but inorganic salts from eroding

concrete, sewage, industrial discharges, and fertilizer may contribute to the conductivity as well. Increased salt may also indicate that other pollutants from urban runoff are present in the water and problems may be due to more than salt alone.

In Maryland, fisheries biologists with the assistance of citizen scientists have been monitoring anadromous herring spawning (alewife, blueback herring, and hickory shad) and conductivity in six streams with watersheds that range from rural (agricultural and forest dominated) to suburban development since 2005. Intensity of herring spawning is measured as the percentage of plankton drift net samples with herring eggs and larvae (percent positive tows). Percent positive tows declined from approximately 80% for the most rural watershed to 20% for the most developed watershed. The amount of salt in these predominately non-tidal streams was correlated to the level of development. Percent positive tows also declined with increased stream salinity (conductivity). The relative impact on development on eggs and larvae appeared to be greater for herring than other anadromous fish native to Maryland.

Several hypotheses can be formed to relate decreased anadromous herring spawning intensity to increased stream conductivity. Eggs and larvae may die in response to changes in salt content that challenge poorly developed salt regulation ability (osmoregulation) of early life stages. Toxic amounts of contaminants may be associated with road salt. Changing stream chemistry may disorient spawning adults and disrupt upstream

migration. Recent research on stormwater ponds suggests that freshwater zooplankton, which larval fish feed on, decline with increased conductivity. Increasing conductivity (salinity) may also be a symptom of cumulative deterioration of the watershed rather than one specific cause. In any case, the relationship between conductivity and diadromous fisheries warrants further study.



Alewife in the Peconic River (left) and great egret preying on Alewife (right). Photo Credit: B. Young.

Long Island Volunteer River Herring Survey

Victoria O'Neill and Elizabeth Hornstein, New York State Department of Environmental Conservation

Alewives (*Alosa pseudoharengus*), also known as river herring, are anadromous fish that spend the majority of their lives in the Atlantic Ocean off the coast of Maine and Canada and only enter freshwater tributaries along the east coast of the United States in the spring to spawn. River herring, a relatively diminutive fish (adults average 12 inches in length) have been found spawning in tributaries from the Canadian Maritime to the Carolinas. The spawning run in New York usually lasts from late February through mid-May.

While small in size, their benefit to our ocean, estuary, and freshwater systems is exponential. During their journey from ocean to freshwater, they serve as a high energy food source for numerous predators including whales, dolphins, tuna, seals, herons, otters, and raccoons. Although their importance in the aquatic food web is well understood and

respected, their population numbers have declined in recent years due to overfishing, bycatch, poor water quality, and the creation of impediments to spawning ground access, such as dams. In recent years, alewives have come into consideration for protection under the Endangered Species Act.

In 2006, a group of partners including the Environmental Defense Fund and the South Shore Estuary Reserve, began the Long Island Volunteer River Herring Survey. The goal of the survey was to determine where on Long Island there were remnant runs of spawning alewife and document the timing of these spawning runs. Volunteers were trained to visit their local streams and creeks during the spring to monitor for the presence or absence of alewife. Since 2006, the survey has involved hundreds of volunteers who have identified 20 remnant runs across the Island.

Coinciding with this effort, in 2008 local municipalities, academic institutions, and environmental organizations formed the Long Island Diadromous Fish Work Group with a mission to advance fish passage and dam removal projects to benefit diadromous, migratory fish runs around



Hards Lake Fish Passage on the Carmans River in Brookhaven, NY, the first permanent fish passage on Long Island (left). Photo credit: Seatuck Environmental Association. NYSDEC staff opening the new fish ladder at Beaver Lake in Mill Neck, NY for the first time in 2018 (right). Photo credit: V. O'Neill.

Long Island. Since alewife are not equipped for jumping, they tend to have difficulty surpassing barriers as small as 1-2 feet in height. Dam removal is the preferred option for complete stream restoration, but it may not be the best choice for all project partners and constituents. Thus, engineered structures such as fish ladders and nature-like fishways are the next best alternative to moving fish over or around obstacles and to their spawning grounds.



Grangebel Park rock ramp/nature-like fishway on the Peconic River in Riverhead, NY, completed in 2010. Photo credit: Peconic Estuary Program.

The data collected by volunteers in the Long Island Volunteer Alewife Survey have assisted the Long Island Diadromous Fish Work Group in justifying the implementation of over 10 fish passage projects around Long Island. The first permanent fish passage was installed in the Carmans River in Brookhaven, NY in 2008. The most recent fish passage was installed at Beaver Lake in Mill Neck, NY in 2017.

A properly designed and installed fish passage, along with active management, can have an immediate impact on fish accessibility to a river system. Dr. Peter Daniels from Hofstra University placed a video camera in the fish passage at Beaver Lake during the first season it was open in 2018. During that inaugural river herring spawning season, he was able to capture nine shadowy video images of alewives using the passage. In order to jog the spawning run at this location, Dr. Daniels and the New York State Department of Environmental Conservation (NYSDEC) have been actively stocking Beaver Lake with hundreds of alewife for the last three years, captured from a large spawning run in the Peconic River. The hope is that these adults will spawn in Beaver Lake and the juveniles produced from the spawning will return to the river at maturity, in 3-5 years, to start their own spawning run. A subset of the stocked adult alewife were tagged by Dr. Daniels with Passive Integrated Transponder (PIT) tags. Many of these fish were recorded on receivers placed around the lake, indicating that the stocking efforts

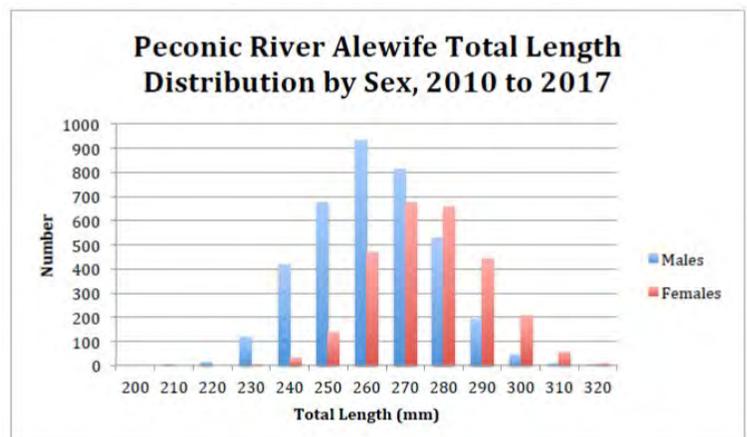
Year	Peconic River Estimated Alewife Spawning Population
2010	25000 to 40000
2011	20000 to 35000
2012	50000 to 75000
2013	60000 to 80000
2014	50000 to 75000
2015	20000 to 35000
2016	40000 to 55000
2017	45000 to 60000

Peconic River estimated alewife spawning run size and total length distribution by sex, 2010-2017. Data from B. Young.

have been successful. The site will continue to be monitored to see if there is an increase in the number of alewife using the passage over time.

One of the most successful fish passage projects was the installation of the rock ramp/nature like fishway on the Peconic River in Riverhead, NY in 2010. This rock ramp restored access to 1.5 miles and 25 acres of diadromous fish habitat on Long Island's longest river. Retired NYSDEC biologist and Alewife Volunteer, Byron Young, has been monitoring alewife on the Peconic River since this fishway was installed to visually estimate the size of the run and collect baseline biological data (length, sex, and age). It is estimated that 40,000-80,000 spawning alewife use the rock ramp each year, making it the second largest alewife spawning run on Long Island. Additional fish passage projects are in progress upstream on the river, so the run should continue to grow as these are completed.

Thanks to the Long Island Volunteer River Herring Survey and the success of these fish passage projects, there has been increased momentum to restore connectivity of our rivers and streams on Long Island. The Seatuck Environmental Association, in partnership with the Long Island Sound Study, Peconic Estuary Program, and South Shore Estuary Reserve, recently published the Long Island Diadromous Fish Restoration Strategy. This document identifies a number of restoration priorities - check out the River Revival Project Map here. The goal is to double the amount of suitable river herring spawning habitat on Long Island and grow the alewife population from 150,000 fish to 1.5 million fish over the next 20 years.





A Dynamic Perspective of Habitat Management in the Northeast United States

Jonathan A. Hare, National Oceanic and Atmospheric Administration Fisheries, Northeast Fisheries Science Center

Essential Fish Habitat (EFH) was defined in the 1996 Sustainable Fisheries Act, which reauthorized the 1976 Magnuson-Stevens Fishery Conservation and Management Act. The eight Fishery Management Councils were required to describe and identify EFH: “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity”. Most Councils defined EFH for each managed species, but some Councils defined EFH from a habitat perspective, identifying the suite of species and life stages reliant on each habitat. In the 2006 reauthorization of Magnuson-Stevens Fishery Conservation and Management Act, deep-water corals received specific attention and Councils were provided the discretionary authority to protect these habitats from fishing gear damage.

In the Northeast U.S. Continental Shelf Large Marine Ecosystem, both the Mid-Atlantic and New England Fishery Management Councils have taken action to protect and conserve habitats that support fisheries. EFH has been designated using maps and text descriptions by the two Councils for each of four life stages for all managed species: eggs, larvae, juveniles, and adults. The descriptions include geographic area, temperature, salinity, depth, bottom type, and season. Both Councils also have defined Habitat Areas of Particular Concern (HAPC), which are considered high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. The Mid-Atlantic Fishery Management Council has defined two such areas. For summer flounder, HAPC is defined as “All native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH.” For golden tilefish, HAPC is defined as “portions of Norfolk, Veatch, Lydonia, and Oceanographer canyons within the depth range within the same depth contour identified as EFH; that is known to have clay outcrop/pueblo habitats.” The New England Fishery Management Council has also defined HAPCs. For Atlantic salmon, HAPC is defined as 11 rivers in central and eastern Maine. For juvenile Atlantic cod, HAPC is defined as a region on the northern edge of Georges Bank, inshore areas of the Gulf of Maine

and Southern New England between 0-20 meters, and a region of the Great South Channel east of Cape Cod and Nantucket. In addition to these species-focused HAPCs, the New England Fishery Management Council has identified habitat areas that are important for a variety of managed species: Cashes Ledge, Jeffreys Ledge/Stellwagen Bank, Bear and Retriever Seamounts, and a number of canyons along the shelf break.

Both Councils have also taken action to protect and conserve deep-water coral and their habitats from the effects of fishing. The Mid-Atlantic Fishery Management Council has defined a large coral protection area within the U.S. exclusive economic zone (EEZ) deeper than 450 meters that includes 15 submarine canyons between New York and Virginia where all types of bottom-tending fishing gear except lobster and Atlantic deep-sea red crab pots are prohibited. The New England Fishery Management Council has taken similar action restricting the use of bottom trawls and dredges in two discrete coral protection zones in the Gulf of Maine and in a broad zone deeper than 600 meters south of Southern New England and Georges Bank where all bottom tending would be prohibited, with the exception of Atlantic red crab pots.

In addition to Council actions, National Oceanic and Atmospheric Administration (NOAA) Fisheries has designated two Habitat Focus Areas in the Northeast: the Choptank River in Maryland and Delaware and the Penobscot River in Maine. These areas serve to demonstrate how NOAA’s science, service, and stewardship come together to improve habitat conditions for fisheries, coastal communities, and marine life, and to provide other economic, cultural, and environmental benefits our society needs and enjoys. The two Focus Areas overlap with designated EFH and HAPC in the region and the conservation, restoration, and research activities in these areas support the habitat objectives stated in the Magnuson-Stevens Fishery Conservation and Management Act.

The actions described above, which were designed to protect and conserve habitat under the Magnuson-Stevens Fishery Conservation and Management Act, are consistent with Ecosystem-Based Fisheries Management (EBFM). NOAA Fisheries defines EBFM as “a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related

components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals.” The concept of EFH recognizes the important interaction between species productivity and the habitats that support this productivity. Many of the HAPC designations in the region are based on their importance to a variety of managed species and to the ecosystem as a whole. The deep-sea coral protection areas of the two Councils encompasses more than 60,000 square miles, larger than the area of the State of New York. These areas are geographically specified and contribute to the overall resilience and sustainability of deep-water ecosystems.

EBFM is broader than the interactions between species and their habitats and includes human dimensions, species interactions, environmental and climatic factors, and of course, fishing. One of the six Guiding Principles identified in the NOAA Fisheries EBFM Roadmap is prioritize vulnerabilities and risks to ecosystems and their components across these multiple pressures. Along this line, NOAA Fisheries has developed a Habitat Assessment Prioritization procedure and this has been implemented in the Northeast region covering both Mid-Atlantic Fishery Management Council and New England Fishery Management Council managed species. This prioritization is focused on the interaction between individual species and their habitats. A broader risk assessment has been completed by the Mid-Atlantic Fishery Management Council as part of their Ecosystem Approaches to Fisheries Management. Risk elements were defined as aspects of the system that may threaten achieving the biological, economic, or social objectives that the Council desires from a fishery. Ecological, economic, social/cultural, food production, and management elements were included. Estuarine and offshore habitat were used as ecological elements, as were distribution shifts, which are in part related to climate-induced changes in the distribution of habitat. Fishery management aspects posed the greatest risk to the Mid-Atlantic Fishery Management Council meeting objectives, but habitat related aspects also created significant risk including changing distributions and estuarine habitats. This risk assessment emphasizes the need to understand the dynamic nature of habitat and the relationship to management.

The dynamic nature of habitat has received less attention in an EFH/HAPC context. The Northeast U.S. Shelf is one of the fastest warming ecosystems in the world and a number of species are changing distribution in response

to warming. Temperature, a physical component of habitat, has been defined as a component of EFH for all managed species in the ecosystem. There also is evidence of climate-driven changes in the distribution of biological habitat (e.g., seagrasses), which may impact fishery species. Geological features of habitat (e.g., intertidal zones, sediment distributions) are also changing in responses to changing climate, primarily sea level rise. The chemical nature of habitats are changing, with ocean acidification, changing freshwater inputs, and changes in water mass distributions. The NOAA Greater Atlantic Regional Fishery Office is finalizing guidance for integrating climate change information into habitat consultation processes. This guidance will include a strategy and process for incorporating climate change into habitat consultation processes, a synthesis of information on climate change science, information on the effect of climate change on fisheries and habitats, and a summary of existing tools for use in the consultation process. NOAA Fisheries is developing a Habitat Climate Vulnerability Assessment to provide a first order evaluation of the vulnerability of biological, physical, geological, and chemical habitats to a changing climate. The assessment will follow the vulnerability assessment framework and will define the sensitivity and adaptive capacity of habitats, as well as their exposure to climate change. This approach is in line with the NOAA Fisheries EBFM Roadmap, which recognizes the dynamic nature of marine ecosystem and proposes vulnerability assessments as a tool to “focus responses to the ever-changing and increasingly dynamic pressures that managers responsible for marine ecosystems face.” The approach also supports Magnuson-Stevens Fishery Conservation and Management Act requirements to describe and identify EFH.

Going forward - as dynamic pressures continue to influence habitats and species - we need to consider that all aspects of marine ecosystems are dynamic. As described above, changes in climate are major pressures on the Northeast U.S. Shelf ecosystem (e.g., warming waters, ocean acidification, sea level rise). Changes in human use of the ecosystem also are major pressures (e.g., fishing, coastal development, offshore wind energy development). As such, we should recognize that habitats and species use of habitats are changing and we should incorporate the dynamic nature of habitats into our considerations of EFH, HAPCs, and deep-sea coral conservation. Taking

see HABITAT MANAGEMENT on page 12



ATLANTIC COASTAL FISH HABITAT PARTNERSHIP UPDATE

Lisa Havel, Atlantic Coastal Fish Habitat Partnership

The Atlantic Coastal Fish Habitat Partnership (ACFHP or Partnership) has continued to help restore and protect fish habitat through on the ground conservation projects along the coast, science and data initiatives, and collaborating with partners to address fish habitat concerns in 2018.

On the Ground Conservation

ACFHP has continued to make progress promoting research on the relationship between black sea bass abundance and habitat characteristics in the Mid-Atlantic through a grant from the Mid-Atlantic Fishery Management Council. The project, led by Dr. Brad Stevens of University of Maryland Eastern Shore, is titled 'Hab in the MAB: Characterizing black sea bass habitat in the Mid-Atlantic Bight.' Dr. Stevens is comparing black sea bass abundance, stomach contents, and position in the food web with habitat characteristics black sea bass are associated with: bottom type; whether a reef is natural or artificial; and the plants, animals, and algae attached to each habitat. This work will lead to a better understand of the importance of habitat and prey community structure on black sea bass feeding ecology. Dr. Stevens and his team finished their final field season this year, and will finish analyzing their data in 2019.

ACFHP has partnered with the U.S. Fish and Wildlife Service (Service) for the ninth consecutive year to fund three new on-the-ground restoration projects in 2018 through National Fish Habitat Action Plan (NFHAP) funding. The NYSDEC is leading a project to retrofit traditional boat moorings with conservation moorings in Coecles Harbor, New York. Coecles Harbor has the most substantial eelgrass bed remaining in any New York harbor, and conservation moorings, with their smaller footprint and bungee-like design, will reduce impact to the eelgrass below and allow for recovery and increased resiliency. This will improve habitat for species such as bay scallop, fluke, puffers, river herring, and striped bass. The Nature Conservancy is working with partners to remove the Columbia Dam in Knowlton Township, New Jersey. The Columbia Dam is located less than 0.25 miles upstream of the confluence with the Delaware River, and is the first complete barrier to fish passage on the Paulins Kill. The removal will open 20 miles of streams and benefit species such as American shad, river herring, sea lamprey, and American eel. Finally, East Carolina University is working with partners to restore 0.11 acres of intertidal oyster reefs

in Back Sound, North Carolina. These reefs will protect over three acres of eroding and remnant salt marsh on Carrot Island, in the Rachel Carson Reserve. This project will benefit species such as red and black drum, flounder, Atlantic sharpnose and bonnet head sharks, black sea bass, and diamond back terrapins. For more information on this and other ACFHP-Service funded projects, please visit the ACFHP website at www.atlanticfishhabitat.org/on-the-ground-projects/.

Science and Data Developments

ACFHP has completed its NOAA-funded pilot project to characterize fish habitat conservation areas through GIS mapping and analysis for the southeast region of the U.S. from North Carolina to Florida, and will be releasing the results in January 2019. Four separate maps were created, based on ACFHP's subregional priority habitats. Diadromous and estuarine maps were produced from North Carolina to northern Florida, and estuarine and coastal (coral reef) maps were produced for southern Florida. The maps will help ACFHP and partners identify where best to invest effort and future NFHAP funds. Threats, such as impervious surface extent and barriers to fish passage, and well as habitat quantity and quality, were considered in the analysis. Funding from NOAA has been secured to begin mapping the rest of the ACFHP region in early 2019.

Outreach and Communication Developments

ACFHP spent a large portion of this year updating their website, www.atlanticfishhabitat.org. The new website has pages dedicated to our structure, priority habitats, our work, and how to get involved. It also has a downloadable database of the Species-Habitat Matrix, which was completed in 2009 and published in BioScience in 2016. Users can query the database based on any combination of subregion, habitat category, habitat type, species, and/or life stage.

Eric Anderson Receives the 2018 Melissa Laser Fish Habitat Conservation Award

The 2018 Melissa Laser Fish Habitat Conservation Award was presented by Pat Keliher, ASMFC vice chair and Dr. Laser's former boss, to Eric Anderson of the Palm Beach County Department of Environmental Resources on October 22nd at the 77th Annual ASMFC Meeting in New York, New York. Mr. Anderson is a Senior Environmental Analyst and has led the design and management of at

least 10 large scale restoration projects in the Lake Worth Lagoon. As project manager, Eric obtains permits, manages construction, coordinates funding, implements monitoring, provides education and outreach, incorporates innovative construction methods, and works with communities to improve their natural surroundings.

Mr. Anderson's work has focused on restoration of mangrove and seagrass habitats in particular, both ACFHP priority habitats in the South Florida subregion. One such project, Grassy Flats, was endorsed by ACFHP in 2012. Grassy Flats is a 12-acre, \$3.7 million seagrass, mangrove, oyster reef, and tidal marsh restoration project that included multiple partners and funding agencies. Since completion, the project has proven to be resilient and withstood the impact of Hurricane Irma in 2017. Mr. Anderson is a valued restoration partner who targets and fulfills ACFHP conservation goals, and finds innovative means to gain support, fund, and implement beneficial fish habitat projects. He also generously shares his skills and experiences with other practitioners. The Palm Beach County Department of Environmental Resources has earned a reputation of excellence for estuarine restoration work, which is largely due to Eric's hard work and dedication.

The Melissa Laser Award was established in 2012 in memory of Dr. Melissa Laser, a biologist with the Maine Department of Marine Resources and active member of the ACFHP Steering Committee. Melissa dedicated her career to protecting, improving, and restoring aquatic ecosystems both locally in Maine and along the entire Atlantic coast. For more information on the Melissa Laser Award, please visit: <http://www.atlanticfishhabitat.org/melissa-laser-fish-habitat-conservation-award/>.

Support ACFHP

There are many ways you can support ACFHP, including donating directly to our cause, indirectly via AmazonSmile, and by purchasing specific RepYourWaters merchandise, including hats and tshirts. To learn more, visit webpage:

<http://www.atlanticfishhabitat.org/donate/>



Pat Keliher, ASMFC vice chair (left), presents the 2018 Melissa Laser Fish Habitat Conservation Award to Eric Anderson. Photo credit: T. Berger, ASMFC.

HABITAT MANAGEMENT continued from page 10

these steps is consistent with the habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act and is an integral part of implementing Ecosystem-Based Fisheries Management.

NOTES:

- ¹<https://www.federalregister.gov/documents/2002/01/17/02-885/magnuson-stevens-act-provisions-essential-fish-habitat-efh>
- ²https://www.coris.noaa.gov/activities/deepsea_coral/dsc_strategicplan.pdf
- ³<https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/573a07797c65e405531b0c4d/1463421123630/HAPC-Supplemental.pdf>
- ⁴<http://www.mafmc.org/actions/msb-am16>
- ⁵<https://www.nefmc.org/library/omnibus-deep-sea-coral-amendment>
- ⁶The plan has not yet been approved by Department of Commerce
- ⁷https://www.st.nmfs.noaa.gov/Assets/ecosystems/ebfm/EBFM_Road_Map_final.pdf
- ⁸<https://www.st.nmfs.noaa.gov/ecosystems/habitat/prioritization/index>
- ⁹https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5a999982c830251006f8d0a5/1520015751630/SOE_MAB_RiskAssess.pdf
- ¹⁰https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/589a2b61d2b8575c64fe05ff/1486498674225/EAFM_Guidance+Doc_2017-02-07.pdf

UPDATES FROM AROUND THE COAST

NEW HAMPSHIRE

Dam Removals

Kevin Lucey, NH Department of Environmental Services, Coastal Program

The Sawyer Mill is comprised of two historic mill buildings flanking both sides of the Bellamy River off Mill Street in Dover, NH—approximately 1,400 feet upstream of tidally influenced waters. The mill buildings have been redeveloped into rental apartments known as Sawyer Mill Apartments. Between the two mill buildings, the river flows over two historic mill dams that were built around 1873 to provide hydropower and water supply for the former woolen mill. The dams are no longer used for any purpose.

The Upper and Lower Sawyer Mill Dams represent the first diadromous fish passage barriers on the Bellamy River, a major tributary river to the Great Bay Estuary. This dam removal project presents a unique opportunity to remove two high hazard dams that are located immediately upstream of the head-of-tide to re-establish connectivity between freshwater and tidal habitats, restore fish passage, improve water quality and reduce flood hazards.

The proposed design consists of the following key elements:

- Sediment Removal** Dredging and offsite disposal of all sediment within the Lower Impoundment (700 CY) and the mobile sediment within the Middle Impoundment (2,200 CY).
- Dam Removal** Removal of both the Upper and Lower Dams.
- Channel Construction** Construction of a natural channel through the Middle Impoundment.
- Fish Passage Enhancements** Cutting of a channel in the bedrock below each removed dam and installation of boulder clusters as velocity refugia throughout the constructed channel.
- Infrastructure Protection** Installation of protective measures for various structures, including the embankments/abutments adjacent to



Lower Sawyer Mill Dam, which is scheduled to be removed in 2018. Photo credit: K. Lucey.

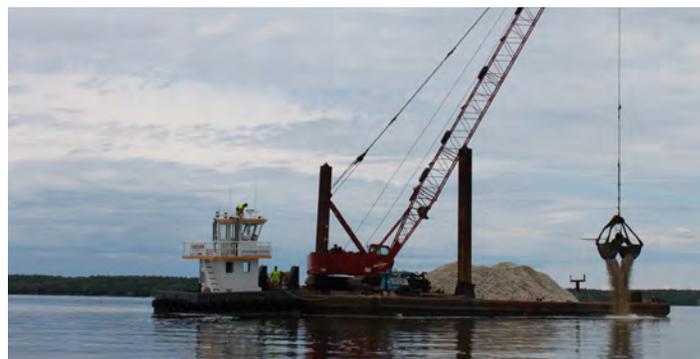
Infrastructure Protection (cont'd) each dam and the low-level gate, the two storm water outfalls on river right in the Middle Impoundment, a retaining wall downstream of the Lower Dam, the mill building foundations, the covered bridge piers, and the Route 108 Bridge.

The Lower Sawyer Mill Dam is scheduled for removal in 2018. The Upper Sawyer Mill Dam is scheduled for removal in 2019.

Oyster Restoration

Alix Laferriere, The Nature Conservancy New Hampshire

In 2018, The Nature Conservancy in partnership with the University of New Hampshire worked together to undertake oyster restoration efforts at three sites to achieve a five-acre footprint restoration in the Great Bay Estuary of New Hampshire. Two sites were in the mouth



Seasoned clam shell deployed as reef base for the 2018 restoration site at Woodman Point, Great Bay Estuary, New Hampshire. Photo credit: A. Laferriere.

of the Lamprey River, a one-acre site above the native reef and a two-acre site below the native reef and we also restored a two-acre site adjacent to Woodman Point. Five hundred cubic yards of seasoned clam shell was placed at the sites as reef base and in September 2018, one million juvenile oysters “spat on shell” were also placed on the reef base. To further inform our reef restoration project, The Nature Conservancy is partnering with Dr. Tom Lippmann from the University of New Hampshire Center for Coastal & Mapping Laboratory to conduct bathymetric surveys of the restoration site. Dr. Lippmann will conduct four surveys across seasons to examine fine scale sediment dynamics on and around the reef base. In addition, this year The Nature Conservancy’s Oyster Conservationist Program has engaged 200 volunteers across 92 sites, including families, schools, businesses, and individuals across the Seacoast Region of New Hampshire and Southern Maine to grow oysters on their private docks for the restoration effort. This work was supported by funds from the Natural Resources Conservation Service through the Regional Conservation Partnership Program to support conservation in New Hampshire’s coastal watershed.

Evaluating an Adaptation Strategy to Enhance Coastal Marsh Resilience

Gregg Moore, Jackson Estuarine Laboratory, University of New Hampshire

Coastal ecologists Gregg Moore and David Burdick from University of New Hampshire’s Jackson Estuarine Laboratory (JEL) in partnership with the Great Bay National Estuarine Research Reserve (Great Bay NERR) are leading a timely experiment examining the potential benefit of thin layer sediment addition to marshes suffering to keep pace with sea level rise. Their experiment is part of a \$500,000 federal research grant to lead a nation-wide study examining strategies to enhance salt marsh resilience against the effects of climate change. The JEL team will join researchers at seven other NERR sites across the United States in the collaborative project, entitled “Thin-Layer Sediment Placement: Evaluating an Adaptation Strategy to Enhance Coastal Marsh Resilience Across the NERRs.” This study is being conducted in New Hampshire Fish and Game’s Adams Point Wildlife Management Area of Great Bay Estuary, in an area of salt marsh that is showing effects of excessive flooding, which the team believes is linked to sea level rise.



Subsiding low marsh plots treated with 15 cm sediment additions; (a) recently added and (b) partway through the 1st growing season. Photo credit: G. Moore.

While salt marshes are one of the most productive ecosystems on Earth and provide important economic and environmental benefits, they are currently being threatened by rising sea levels, which are predicted to rise at a much higher rate in the near future. They exist along a very narrow elevation zone, and when flooded with water for too long, or too often, they will eventually drown. In many places, increasing rates of sea level rise are outpacing the marshes’ natural ability to adapt, negatively affecting their resiliency and the wildlife that depend on them. The University of New Hampshire JEL team is evaluating how marshes respond to the addition of various amounts of sediment at different marsh elevations and will compare these results to similar work being done by project partners across the country. The teams’ adherence to a collaborative process will engage end users throughout the project, helping to ensure the achievement of outcomes that meet the needs of coastal managers. Questions regarding this project may be addressed to the Principal Investigator, Dr. Gregg Moore at gregg.moore@unh.edu.

Early Detection of Invasive Species Using eDNA

Colleen McClare, Great Bay National Estuarine Research Reserve, New Hampshire Fish and Game

In recent years invasive species, especially crabs, have been entering New England’s waters. Whether brought here accidentally or migrated here due to warming water temperatures, they pose significant threats to the health of salt marshes as well as oyster and clam populations. The European green crab, Asian shore crab, Chinese mitten crab, and most recently the fiddler crab, have all sparked concern for scientists and researchers of New England NERRs. While traditional monitoring methods for invasive species are essential for estuarine management, they may miss early detection of newly-arrived invasive species or



presence of rare native species. Therefore, scientists at University of New Hampshire, led by Dr. Alison Watts, have teamed up with staff from the Great Bay, Wells (Maine) and South Slough (Oregon) NERs to develop a pilot program for early detection of invasive species. Here in New Hampshire, our research team is working with NH Fish and Game to compare traditional fish and crab monitoring surveys with this novel methodology.

Water and sediment carry traces of DNA, referred to as environmental DNA (eDNA), from fishes and invertebrates that live in that environment. This project aims to design and implement a monitoring system that utilizes eDNA sequencing to determine if invasive species are present in the waterways. eDNA methods provide a cost-effective way to determine which species are present in aquatic environments without needing to capture and identify them. Some, like the fiddler crab, are very elusive and hard to detect. Therefore, analyzing soil and water samples can provide an alternative method for determining if a species is present. This could act as an early warning system for invasive species, while also determining the presence of biodiversity of native species. The project partners will develop eDNA sample collection and analysis protocols as well as training materials for the use of eDNA materials for the NERs to use system-wide if the pilot program is successful.

This project is funded by the NER's System's Science Collaborative, which supports cooperative research across the NER that addresses coastal management problems important to the reserves. Though this project was motivated by the increased concern among the New England reserves, South Slough NER in Oregon has had similar concerns and therefore has joined in this pilot program. As technology advances, the NER System

aims to continue to advance its methods for protecting important estuarine environments nationwide. Questions regarding this project may be addressed to the Research Coordinator at Great Bay NER, Christopher Peter at Christopher.peter@wildlife.nh.gov.

MASSACHUSETTS

Mark Rousseau, Massachusetts Division of Marine Fisheries

Citizen scientists help to monitor eelgrass in DKP
Eelgrass (*Zostera marina*) beds have experienced severe declines over several decades in the Duxbury-Kingston-Plymouth (DKP) embayment, and there is a need and high level of local interest in tracking these changes. In late August 2018, scientists from the Massachusetts Bays National Estuary Program (MassBays) and the Massachusetts Division of Marine Fisheries (MA DMF) Habitat Program joined forces with local citizen scientists to monitor eelgrass extent and condition in DKP using a novel sampling methodology. Sampling stations were selected using a stratified random design, where strata included sub-embayments as well as persistence of eelgrass based on the Mass Department of Environmental Protection eelgrass polygons. The overall sampling area was determined based on bathymetry to include areas not previously identified as eelgrass but that may still be suitable habitat. Over the course of five sea days, teams sampled 250 sites for eelgrass presence and percent cover using an underwater camera mounted to a quadrat frame. Of those sites, 100 received additional sampling where eelgrass shoots were collected to measure plant height, width, disease and epiphytic cover. While the data have not yet been analyzed, the field component of this project was a great success. It is anticipated that the citizen group will continue this effort in future years. This work is part



Researchers collecting water samples for eDNA in Great Bay, New Hampshire (left). Photo credit: A. Watts.
Fiddler crab in Great Bay, New Hampshire (right). Photo credit: P. Stacey.

Quadrat photo containing eelgrass. Photo credit: MA DMF.



Collecting eelgrass measurements (left). Photo credit: MA DMF.
Volunteer deploying camera frame (right). Photo credit: MA DMF.



of the project *A Rapid Assessment Protocol for Eelgrass Monitoring in Estuarine Embayments* funded from the MassBays National Estuary Program under FFY17 U.S. Environmental Protection Agency (EPA) grant number 00A00436. The sampling kits developed for this project are available to loan to other citizen science groups who may wish to follow the methodology in their local embayments. Contact Jill Carr at Jillian.Carr@mass.gov for information about kits or to request an electronic copy of the methodology document.

Artificial Reef Site Selection Data Collection

The MA DMF is conducting site selection work in Cape Cod Bay to identify potential locations for new artificial reef deployments. Information about existing benthic conditions is gathered in three distinct phases: side-scan imaging acoustic surveys, underwater camera groundtruth imaging, and SCUBA diver transect monitoring. Acoustic survey data are processed via Geographic Information

Systems (GIS) to locate areas most suitable for artificial reefs. Locations are ranked based on lack of structure, proximity to structure, and ideal bathymetric conditions. Following the acoustic survey work, benthic conditions are verified by an underwater camera frame fixed with two GoPros and a Splashcam camera. Images collected at each site are then ranked in a second tier of site refinement. Finally, 100 meter diver transect surveys are conducted at the locations determined to be most suitable

based on the assessment of the acoustic surveys and camera work. Divers collect data on substrate, presence of algae, invertebrates, and fish within a two-meter distance on either side of the transect line. Survey work is expected to be completed by the end of 2018. The results of this work are intended to inform the permitting of several new artificial reef sites in Cape Cod Bay. For more information, please contact Mark Rousseau at Mark.Rousseau@State.ma.us.

Eelgrass Restoration Monitoring in Salem Sound

In May 2018 MA DMF completed eelgrass (*Zostera marina*) planting within a $\frac{3}{4}$ acre area in Salem Sound, Massachusetts as part of a restoration effort funded by the Massachusetts In Lieu Fee program (ILFP). This project was selected by an interagency review team for the ILFP and is intended to mitigate for habitat losses, including eelgrass loss, that occurred as a result of permitted coastal alteration projects. We used planting units of 10 shoots

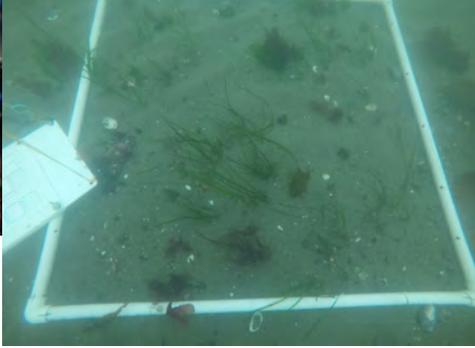


Side-scan sonar and photo/video survey equipment used for site selection (left). Photo credit: MA DMF. Divers collecting data along a transect (right). Photo credit: MA DMF.

tied into burlap discs and planted at a density of 50 shoots/m². Initial plantings were done in the spring and fall of 2017 with replanting conducted at some plots in the spring of 2018 to replace loss due to winter storm damage. Our first annual monitoring was completed in July 2018. At that time there was a 60% survival of the planting units overall with a mean shoot density within planted areas of 43 shoots/m². MA DMF will continue monitoring the restoration for a total of five years. For more information about eelgrass restoration and monitoring at MA DMF please contact Tay Evans at tay.evans@state.ma.us.

Diadromous Monitoring on the Mill River

MA DMF has been monitoring the restoration response of diadromous species in the Mill River, a Taunton River tributary, where passage to the headwater lake was obstructed for 200 years. Funding for restoration monitoring was provided by NOAA, The Nature Conservancy, and the U.S. Fish & Wildlife Service. The restoration project began in 2012 through a strong collaborative effort, and included three dam removals and reconstruction of an impassible dam to include a denil fish ladder, an eel ramp, and a low flow outlet. Early in the project, MA DMF conducted a river herring habitat assessment to ensure upstream habitats were of suitable quality for reintroduction (MA DMF Technical Report 67). River herring have been monitored via underwater video, both during the restoration below the lowest barrier to confirm fish were still present in the system, and at the top of the ladder to the lake following the final removal. A trap at the top



Divers planting eelgrass in m² areas with five planting units of 10 shoots each woven into a burlap disk (top). Photo credit: MA DMF. Monitoring quadrat within a planted area six months after planting (bottom). Photo credit: MA DMF.



Collecting eel length measurements (top). Photo credit: MA DMF. Installation of an eel ramp on the Mill River (bottom). Photo credit: MA DMF.

of the eel ramp has documented small numbers of young-of-year eels until the final dam was removed, when young-of-year eel counts increased significantly; age 1+ eels (small yellow eels) have entered the lake consistently since ramp installation in 2013. Yellow eel monitoring showed that abundance increased substantially when barrier removal began (<https://afspubs.onlinelibrary.wiley.com/doi/10.1002/nafm.10040>). Annual sea lamprey redd surveys revealed that restored river reaches are now being used for spawning (<https://www.eaglehill.us/NENAonline/articles/NENA-24-3/19-Trainor.shtml>). Monitoring will continue and expand in the coming years to better understand habitat use and changes in populations when habitats are reopened to diadromous fish. For more information on the Mill River restoration monitoring, please contact Sara Turner at sara.turner@state.ma.us.

NEW YORK

Dawn McReynolds, New York State Department of Environmental Conservation

Gay's Point Side Channel Restoration and Monitoring

Hudson River NERR staff began working with the New York State Thruway Authority in 2013 to design and implement the restoration of a tidal side channel at Stockport Flats, the northernmost site of the reserve located in Columbia County, NY. The project is the first of its kind in the Hudson River Estuary and is intended to restore a mosaic of shallow water, tidal wetland, and shoreline habitats.



Project area pre-construction Gays Point Drone imagery. Photo credit: A. Hendry, McGill University.



Project area post-construction, NYS Statewide Digital Orthoimagery. Photo credit: A. Hendry, McGill University.

These valuable habitats were destroyed on a large scale in the early twentieth century, particularly in the upper estuary, because of dredge and fill activities associated with the construction of the federal navigation channel. Preliminary feasibility studies for construction of the side channel included environmental and biological surveys, and hydraulic and sediment transport modeling. Baseline biological surveys in 2015 and 2016 included assessments of water quality, sediments, benthic macro-invertebrates, fish, and intertidal vegetation at both the project and reference sites. Construction of the 1,200 feet-long by 65 feet-wide side channel began in August 2017 and was completed by early November 2017. The project involved the excavation and onsite reuse of approximately 20,000 yd³ of historical dredge spoils and the installation of more than 5,000 native plant plugs and 600 live stakes. Five years of post-restoration monitoring will begin in 2018.

New York Artificial Initiative

The New York Artificial Reef Program is currently undergoing the largest expansion in state history. Through a cooperative effort between the New York Department

of Transportation, New York State Canal Corporation, and the New York Thruway Authority, we are receiving retired steel vessels, and demolition materials from the Tappan Zee Bridge and other transportation improvement projects. This includes steel pipes, beams, columns, fender piles, trusses, and concrete deck panels and bridge substructures. The first deployment of materials occurred on Shinnecock Artificial Reef in June of 2018. Nearly 1,100 tons of concrete and steel were

deployed in addition to a 74 foot tugboat, 40 foot tender, and a 110 foot dump scow. A week after deployment, black sea bass and tautog were observed exploring their new habitat. Four additional reef sites in the Atlantic Ocean including, Hempstead, Fire Island, Moriches, and Rockaway Reef, and one reef site in Long Island Sound (Smithtown Reef) are slated to receive materials in 2018.

NEW JERSEY

Russ Babb, New Jersey Department of Environmental Protection

Removal of Columbia Lake Dam in Warren County to Restore Large Portion of Paulins Kill to Free-Flowing Conditions, Benefiting Migratory Fish and Public Recreation

The New Jersey Department of Environmental Protection (NJDEP) joined other partners, including The Nature Conservancy, to launch a \$7 million project to remove the Columbia Lake Dam in Knowlton Township, Warren County, making a large stretch of the Paulins Kill free-



A piece of the Tappan Zee Bridge becomes part of a new patch reef. Photo credit: C. LaPorta, NYSDEC.



The 74' tugboat "Reliable" is lowered on Shinnecock Reef. Photo credit: C. LaPorta, NYSDEC.

flowing again. The project will restore important habitat for migratory fish, primarily American shad and American eel, and will enhance the public's recreational enjoyment of the Paulins Kill, a tributary of the Delaware River.

This project is part of a larger effort to restore rivers in the state to free-flowing conditions by removing obsolete dams. The removal of this dam will restore the ecological diversity of the Paulins Kill, opening a 10-mile stretch of the river to fish passage for the first time in more than a century. For years, removal of the 18-foot-high Columbia Lake Dam has been one of the highest-ranking projects of its kind in the nation for The Nature Conservancy.

The primary source of funding for the Columbia Lake Dam removal project is \$5 million from Natural Resource Damage settlements secured by the NJDEP's Office of Natural Resource Restoration. These are settlements that polluters pay for harming natural resources and are in addition to any money they spend on remediating pollution. The Nature Conservancy is providing an additional \$1.4 million. The U.S. Department of Agriculture's Natural Resource Conservation Service, the Service Fisheries Program, ACFHP, the Corporate Wetlands Restoration Partnership, and the National Fish and Wildlife Foundation are funding the balance.

Biological surveys conducted last year suggest American shad are making a strong comeback in the Delaware River, historically famous for a once-prodigious population of this important fish species. This apparent resurgence is likely the result of improved water quality in the lower river, years of efforts to manage the recovery of the species, and the restoration of tributaries through dam removals. The history of American shad runs deep in the Delaware River. American shad is the largest member of the herring family, weighing from four to eight pounds at maturity. Shad once supported important commercial and recreation fisheries along the Atlantic Coast, especially the Delaware



*The Columbia Lake Dam removal is a \$7 million project in Knowlton Township, NJ.
Photo credit: NJDEP.*

River. This species is anadromous, meaning it spends much of its life in the ocean and estuaries but needs access to freshwater for spawning. Water quality improvements over the years in the Camden and Philadelphia area made it possible for shad to move farther up river but dams built to generate power, for mills

and other now-obsolete purposes, greatly reduced their spawning habitat.

The Columbia Lake Dam, situated near the confluence of the Paulins Kill and the Delaware River, was built in 1909 by the Warren County Power Company. The 330-foot-long dam impounds the narrow, 43-acre Columbia Lake that stretches for 1.5 miles and is part of the New Jersey Division of Fish and Wildlife's Columbia Wildlife Management Area. For a NJ Division of Fish and Wildlife drone video of the dam, visit <https://vimeo.com/274110505>. As part of the preparations for the dam removal, the Division of Fish and Wildlife lowered the lake, removing and relocating a small number of fish and freshwater mussels. The NJDEP's Office of Natural Resource Restoration is spearheading the project for the state.

The NJDEP is also working with partners on plans to remove the Paulina Dam owned by Blairstown Township. Removal of this dam, located nine miles upstream of Columbia Lake Dam on the mainstem of the Paulins Kill River, would open even more habitat for fish in this system.

For information from the Division of Fish and Wildlife and a timeline, visit www.nj.gov/dep/fgw/news/2018/columbiadam_timeline.htm.

DEP is Making \$10 Million in Grants Available to Improve Water Quality in the Barnegat Bay Watershed

The NJDEP opened a \$10 million grants program to fund local projects to improve water quality in the Barnegat Bay watershed, an important ecological and tourism resource

for the state. Nonprofit groups, government agencies, and state colleges and universities have applied for funding for projects that will address stormwater runoff, also known as nonpoint source pollution. Reducing the impacts of stormwater runoff is one of the bigger challenges that many states face in improving the ecological health of their estuaries. This grant program is intended to spur projects – many of them innovative – that can be implemented on the local level to improve overall water quality in Barnegat Bay and its watershed.

The 660-square-mile watershed encompasses all or parts of 37 municipalities in Ocean and Monmouth counties and is an important driver of tourism-related activities. The 42-mile long bay is renowned for its fish and shellfish resources, as well as for wildlife-related activities such as fishing, crabbing, bird-watching and exploring nature. The NJDEP's Water Quality Restoration grants are made possible through funds provided under Section 319(h) of the federal Clean Water Act, Natural Resource Damage settlements the state has secured with polluters, and the state's Corporate Business Tax. Additional funding is also available in low-interest and principal-forgiveness (grant-like) loans through the New Jersey Water Bank, administered by the NJDEP in partnership with New Jersey Water Infrastructure Bank.

Stormwater runoff carries into waterways pollutants, such as nutrients from fertilizers and animal wastes, as well as automotive fluids and pesticides. Excessive nutrients can cause algae blooms that impact the ecological health of waterways and diminish recreational enjoyment. The NJDEP is seeking proposals for projects to reduce the input of nutrients, primarily nitrogen, which are transported into the bay by stormwater runoff. Proposals that mitigate nutrients in stormwater in the northern and southern portions of Barnegat Bay will be prioritized. This area has poorer water flow and is more highly developed than the southern bay. The NJDEP's broad nutrient reduction strategies include

development of a Toms River Watershed Restoration Plan and continued implementation of the Metedeconk River Watershed Protection and Restoration Plan.

Specific nutrient reduction strategies eligible under the grant program include wetland restoration, living shorelines and other resiliency projects, stormwater infrastructure mapping, stormwater basin retrofits, nutrient and pathogen source tracking, submerged aquatic vegetation and shellfish restoration, and stewardship education projects.

The NJDEP will also consider funding any other project consistent with its NJDEP Barnegat Bay Restoration, Enhancement and Protection Strategy at www.nj.gov/dep/barnegatbay/docs/BarnBay-REPS.pdf.

American Littoral Society, US Fish & Wildlife Service, and State Partner on Wreck Pond Inlet Project

On October 29, 2012 Hurricane Sandy struck New Jersey. The strong winds, driving rain, and (perhaps most critically) high storm surge caused wide-spread destruction. Roads and residences were flooded in the small Jersey Shore community of Spring Lake. The storm also cut an inlet into Wreck Pond, a 73-acre coastal pond situated on the town's southern border. That may have



Working on the Wreck Pond Inlet Project. Photo credit: NJDEP.



marked the first time a natural inlet connected the pond to the Atlantic Ocean since the original inlet was replaced by pipe during the 1930s.

In the past, Wreck Pond was known as a fishing and recreational hotspot. Old-timers speak of prominent alewife and blueback herring runs. In early spring each year, hundreds of river herring would migrate into Wreck Pond, travelling up its tributaries to spawn. However, Wreck Pond became notorious in recent years for pollution and flooding. Even a small rain could push out enough bacteria to force a beach closure, while strong storms often resulted in damaged homes and property around the pond.

In the aftermath of Hurricane Sandy, the Service funded and partnered with the American Littoral Society to restore and improve the Wreck Pond inlet. Because the natural opening made by Hurricane Sandy was filling fast, it was decided that the natural inlet created by the storm would be too costly to maintain. Instead, project partners pursued the installation of a box culvert specifically designed for fish passage. As in other areas along the Atlantic coast, the number of spawning river herring in Wreck Pond had drastically decreased, with evidence pointing to the current pipe as a contributing factor since it limited fish passage, particularly after it was extended in the early 2000s.

Project managers for the American Littoral Society were confident that by adding the secondary culvert, they would improve access for fish and hopefully begin restoring river herring local populations. As an added bonus, the box culvert was designed to not only facilitate better fish passage, but also improve water quality through increased tidal flushing while reducing the risk of flooding for local residents. Recognizing these benefits, additional local, state, and private partners joined the project to secure further funding and add additional project components such as dredging and living shorelines. The ecological impact of the installed culvert (November 2016) is currently being assessed. The American Littoral Society has monitored river herring in Wreck Pond since 2014 and there are prior surveys from 2006 to 2008 that provide some benchmarks. While it will take time to quantify a change in river herring abundance or fish community assemblage post-construction, early results appear to show an increase of species entering Wreck Pond, with large schools of Atlantic menhaden and snapper bluefish seen

near the pond-side culvert entrance. In addition, pinfish, needlefish, and larger fluke appear to be more abundant.

This project has also allowed the American Littoral Society to engage the community, both through educational outreach to local schools and a citizen science monitoring program, as well as through the creation of a dedicated website www.WreckPond.org. The American Littoral Society has provided in-class lessons to approximately 500 students from local schools. These in-class lessons are coupled with field trips that provide students with hands-on experience conducting different types of scientific monitoring. These engagement efforts have been well received by students and community members. It is helping to connect people to their local environment, and foster an appreciation for the natural world around them and the services it provides.

The work is far from done. While data continue to be analyzed, Wreck Pond and the larger Wreck Pond Brook Watershed still face several ecological challenges. Already, the Service and American Littoral Society are working to install a fish ladder over Old Mill Pond Dam. This will open an additional one mile of spawning habitat for river herring.

PENNSYLVANIA

Benjamin D. Lorson, Pennsylvania Fish and Boat Commission, Division of Habitat Management

Fish Passage Restoration

Susquehanna River Fish Passage

Progress toward migratory fish restoration in the Susquehanna River basin continues through settlement negotiations between resource agencies and hydroelectric stations on the river. In April 2016, Exelon Generation Corporation (Exelon) and the Service reached an agreement to enhance diadromous fish restoration on the Susquehanna River over the next 50 years. This period spans the anticipated term of a pending Federal Energy Regulatory Commission (FERC) license for the Conowingo Hydroelectric Station (Maryland). In addition to improvements to existing fish passage facilities, Exelon will transport up to 100,000 American shad and up to 100,000 river herring annually above the four hydroelectric facilities on the lower Susquehanna (Conowingo,

Holtwood, Safe Harbor, and York Haven). This agreement follows agreements to enhance fish passage facilities and incorporate fish passage performance measures through negotiations for FERC operating licenses (Muddy Run Pump Storage Facility and the York Haven Hydroelectric Project) and re-development and amended FERC operating license (Holtwood Hydroelectric Station).

The 401 Water Quality Certification at the York Haven Hydroelectric Project requires the construction of a nature-like fishway along the main dam to be constructed by 2021. The planning and design phases of the project are well underway, and this project will likely represent the largest nature-like fishway on the Atlantic coast and allow for year-round volitional fish passage.

Ongoing and planned fish passage enhancements at the four lower Susquehanna River dams have prompted renewed interest in establishing year-round fish passage at the Sunbury inflatable dam. The dam is operated seasonally by the Pennsylvania Department of Conservation and Natural Resources (DCNR) to maintain a recreational boating pool. The dam blocks access to historic American shad spawning habitat in the North and West Branches of the Susquehanna River. Design plans have been developed to construct a bypass nature-like fishway on the West bank of the river to provide fish passage while maintaining the recreational pool. DCNR is currently amending the original design plans based on resource agency comments to better meet fish passage needs and address DCNR operation and maintenance concerns.

Dam Removal

Overall, Pennsylvania remains active in utilizing dam removal as a stream and river restoration tool. In 2017, there was a total of 16 dams removed across Pennsylvania and many of those were accomplished in Atlantic slope drainages. There will be several more dams removed from Pennsylvania's waters by the end of 2018. There is a wide range of partner organizations that assist in accomplishing the many projects across the state.

Pursuant to 401 State Water Quality Certification for the operation of the Muddy Run Pumped Storage Facility, Exelon provides annual funding to the Pennsylvania Fish and Boat Commission (PFBC) dedicated for dam removal. Thus, Susquehanna River tributary connectivity will continue to be improved by removing obsolete, non-functional dams in York and Lancaster Counties. Krady Mill Dam previously impounded Chiques Creek approximately three miles upstream from its confluence with the Susquehanna River. PFBC partnered with American Rivers to remove the dam in 2018. Combined with the Heistand Sawmill Dam removal in 2015 there has been approximately 16 miles of tributary habitat opened to unrestricted fish passage in the Chiques Creek drainage. Three other dam removal projects are ongoing with the assistance of Exelon funding.

DELAWARE

Jeff Tinsman, Delaware Department of Natural Resources and Environmental Control

Delaware Reefs Get USACE Rock

For the past several years, the navigational channel of the Delaware River and Bay has been undergoing a deepening process from 40 to 45 feet in depth. This will allow deeper



The removal of Krady Mill Dam, Chiques Creek, Lancaster County, PA. Photo credit: PFBC.



draft vessels to move from the mouth of the bay to access ports in Wilmington, DE; Philadelphia, PA; and Trenton, NJ. During December 2017 through February, 2018, rock was being removed from several reaches of the river in Pennsylvania. In some areas, bedrock was being blasted from the bottom and removed to provide the increased depth. In other areas, glacially deposited rock was encountered buried in fine sediment. These areas were in habitats used by Atlantic sturgeon and shortnose sturgeon. Both of these species are on the Endangered Species List. In order to minimize impacts from the blasting on these species, the U.S. Army Corps of Engineers (USACE) contracted with Environmental Research and Consulting, Inc. (ERCI) to catch sturgeon by trawl and relocate them away from the impacted area, minimizing potential negative impacts to the stock.

Rock of both types was loaded into hopper barges, with water and fine sediments pumped off into a confined disposal facility. Any toxics in the sediment would be removed with the fine sediment. Clean rock was then delivered to two Delaware artificial reef sites in Delaware Bay. Multiple deployments were made in a grid pattern with deployment targets about 600 feet apart. Deployments continued until the height of the pile approached the minimum clearance above structure requirement for the site. The result was rock piles 15 – 20 feet high surrounded by relatively open bottom. This rock substrate allows the establishment of an enhanced epifaunal community, dominated by blue mussels, which would not normally exist on featureless sand bottom. The rock and the blue mussel community provide protection and feeding opportunities for structure-oriented fish like tautog, black sea bass, triggerfish, spadefish, and summer flounder. Perhaps most important, the rock habitat will be used by juvenile black sea bass during their first two years when they are estuarine-dependent. Survival of these juveniles will be much greater on the rocky habitat than would be the case on open bottom. During this 86 day period, one million tons of rock were delivered free of charge to these two reef sites, to enhance fish habitat and provide fishing opportunities in Delaware Bay. A second round of rock placement began in July, 2018. This is a classic example of interagency cooperation to beneficially reuse the rock resource to improve fish habitat.

MARYLAND

Marek Topolski, Maryland Department of Natural Resources

Blode Dam Successfully Breached

After years of planning, the Bloede Dam along the Patapsco River was successfully breached on September 12, 2018. Bloede Dam serves as the first barrier on the Patapsco River blocking migratory fish swimming to and from the Chesapeake Bay. Its removal is the linchpin of a decades-long restoration effort that also included the removal of Simkins Dam (2010) and Union Dam (2011). Removal of Bloede Dam will restore more than 65 miles of spawning habitat for blueback herring, alewife, American shad, and hickory shad in the watershed, and more than 183 miles for American eel. Bloede Dam has served no functional purpose for decades and has posed a serious public safety hazard in Patapsco Valley State Park. There have been a number of injuries and deaths, with at least nine dam-related deaths since the 1980s, the most recent of which occurred in June 2015. Keeping the dam in place also would have been costly to taxpayers – at least \$1 million would have been needed for repairs to comply with Maryland dam safety requirements. It is estimated the entire dam will be removed by 2019. The removal of Bloede Dam would not be possible without long-term partnerships among NOAA, the State of Maryland, and American Rivers.

Oyster Restoration

In Somerset County, the Manokin River has been chosen as the fifth and final tributary for large-scale oyster restoration as per Maryland's commitment to the Chesapeake Bay Watershed Agreement. Working with the Interagency Oyster Restoration Workgroup, Oyster Advisory Commission, county oyster committees, and other partners, the Department of Natural Resources will restore the tributary using state funds. The restoration work would occur in deep water to avoid any public safety and navigation hazard to anglers, boaters, and commercial watermen. The Department of Natural Resources will engage local watermen in field work, plantings, and surveying. The selection is pending approval from NOAA and USACE.

Shoreline Resiliency Project

The Assateague State Park Shoreline Resiliency Project is currently taking place at the park's marina site. The restoration area is a tidal marsh complex that is rapidly

eroding. To address this issue, a series of 10 headland structures will be placed to dissipate wave energy of large coastal storm events. The headland structures will consist of boulders, cobble, and clean sand fill which will be planted with native wetland vegetation. This innovative approach will arrest erosion and provide habitat, while also providing the park with public access and education opportunities.

VIRGINIA

Tony Watkinson, Virginia Marine Resources Commission

Wetland Restoration Monitoring Continues at VCU Rice Center

A major wetland and stream restoration effort is underway at the Virginia Commonwealth University (VCU) Rice Rivers Center. Kimages Creek runs through the heart of the center. After the wetland surrounding the creek was clear cut by Civil War troops, the forest once again began to grow back. That forest again was cut, this time in the 1920s when the construction of an earthen dam and spillway at the mouth of the creek formed Lake Charles. The lake covered 70 acres of what had been tidal and nontidal freshwater wetlands and bottomland hardwood swamp forest dominated by bald cypress and tupelo gum.



*Kimages Creek runs through what was once a dammed lake.
Photo credit: Virginia Commonwealth University.*

In 2010, a section of the dam was removed, reuniting the creek, its wetlands, and the tidal waters of the James River. VCU Rice Rivers Center researchers collaborated with natural resource agencies and organizations to restore the area to its natural hydrology and ecology. Faculty and student projects now are monitoring the restoration of native plants in the wetland, which is making a significant increase in this critical habitat along the lower James River. A timelapse of the original dam removal project can be seen at: https://www.youtube.com/watch?v=qzHpRDlqgk&ab_channel=VirginiaCommonwealthUniversity.

VCU Rice Rivers Center researchers are also studying the effects of the restoration on wetland plant and microbial ecology, biogeochemistry, nutrient and carbon dynamics, the reestablishment of anadromous fish runs in the stream, conservation of key species of wildlife, and the control of invasive species in restored wetlands. Among these projects is the installation of an eddy covariance flux tower in the wetland restoration area. This equipment provides a powerful platform for quantifying carbon dioxide, methane and water vapor fluxes between the wetland and atmosphere at the ecosystem scale. One thing that makes the VCU Rice Rivers Center's flux tower especially important is its unique location in a restored freshwater tidal wetland, an underrepresented ecosystem in the global network of towers measuring carbon sequestration and methane emissions. In other words, not much is known yet about this ecosystem's ability to sequester — or perhaps emit — greenhouse gases. That information will be forthcoming as our equipment generates this critical data.

Removal of Monumental Mills Dam to Benefit Native Fish in Virginia

In October 2016, work was completed to remove the Monumental Mills Dam located on the Hazel River one-quarter of a mile upstream of the Rt. 640 Bridge in Rixeyville. The dam had been recently acquired by the Virginia Department of Game and Inland Fisheries (DGIF) and was surrounded by private property on both sides of the river, with no public access. It was originally built to power mill operations as early as 1816. It also provided hydro-electricity from the early 1900s until 1951. On October 4, 2011, the Culpeper County Board of Supervisors passed a resolution in support of removal of the dam by DGIF. The Service Fish Passage Program provided funding for the removal, and the cost was approximately \$60,000.



Originally constructed with native stone and mortar, and later capped with concrete, the 10-foot high and 140-foot long dam was in disrepair. Prior to removal, the dam served no commercial or environmental purpose and altered the natural form and function of the Hazel River. Removal has restored aquatic-organism access to 28 continuous miles of the Hazel River and 285 total miles including accessible tributaries. Monumental Mills Dam ranked number six in priority for dam removal in the Chesapeake Bay Fish Passage Program.

Removing the dam has provided migratory fish like American shad and river herring greater access to their historical spawning grounds and returned this section of the Hazel to a free-flowing river. Both shad and herring populations have drastically declined from their historical numbers due, in part, to overfishing and loss of connectivity and habitat. Access to spawning and rearing grounds within the watershed is a critical component in the effort to restore these valuable fish species. During pre-removal fish sampling, ten species, including sea lamprey (an anadromous species), that were present in the Hazel downstream of the dam were absent upstream of the dam. Post-removal sampling is scheduled for spring 2019 to document changes in fish species diversity and distribution.

The Monumental Mills Dam is just one of more than 84,000 dams in the U.S., many of which require significant

repairs or upgrades. This was the 17th dam removal in the Chesapeake Bay Watershed in Virginia since 2004. The Monumental Mills Dam is located upstream of another example of successful fish-passage restoration, the 2004 removal of the Embrey Dam on the Rappahannock River. DGIF has since documented American shad and blueback herring utilization of more than 28 additional miles of the Rappahannock as a result. Furthermore, hickory shad, alewife, and striped bass have been documented above the Embrey Dam site, and significant American eel population increases in the upper watershed have been directly linked to the removal of this dam.

SOUTH CAROLINA

Denise Sanger, South Carolina Department of Natural Resources

Living Shoreline Testing of Materials

The efficacy of living shorelines in South Carolina continues to be tested using a variety of materials including oyster shell, oyster castles, crab traps modified to serve as oyster habitat, and natural fibers (coconut coir and aspen shavings). The South Carolina Department of Natural Resources (SCDNR) is working with the state's Coastal Zone Management Agency, South Carolina Department of Health and Environmental Control (SCDHEC) and the ACE Basin and North

Inlet-Winyah Bay NERRs to test multiple approaches for shoreline stabilization which may also provide valuable intertidal habitat services. The ultimate goal of the project is to evaluate the effectiveness of different living shoreline options in order to guide future streamlining of permitting for the most effective options and thereby increase their use by South Carolina homeowners.

Charleston Harbor Deepening Project

The Charleston Harbor Deepening Project (Post 45) moved into the Construction Phase. The first contract, for deepening a portion of the entrance channel, was awarded in the fall of 2017. The project will both widen and deepen existing



*Before dam removal looking from the left towards powerhouse structure (left). Photo credit: VMRC.
July 2018 looking from the left bank toward a remnant portion of the dam (right). Photo credit: VMRC.*



Seining on Folly Beach prior to renourishment. Photo credit: SCDNR.

material will be obtained from the Folly River. Pre- and post-nourishment monitoring of the beach face is being conducted to assess potential impacts to the macrobenthic, nektonic, and zooplankton communities. The Grand Strand nourishment will place approximately 1.4 million cubic yards of material on area beaches. Garden City/Surfside Beach and North Myrtle Beach

channels to 48 – 52 foot mean low level water (MLLW) in the harbor and 54 foot MLLW in the entrance channel. Material will be placed offshore in the Charleston Ocean Dredged Material Disposal Site (ODMDS) or on land in confined disposal facilities. Limestone rock from the entrance channel will be used to construct nine artificial reefs as well as a berm around the ODMDS. Monitoring of the ODMDS is being conducted to assess any changes in the macrobenthic community and sediment composition within and surrounding the ODMDS. In addition, nearby hard bottom areas and the proposed berm area are being surveyed by divers and video cameras to assess the nekton community making use of these areas. Updates on the Charleston Harbor Post 45 Project are provided at <http://www.sac.usace.army.mil/Missions/CivilWorks/CharlestonHarborPost45.aspx>.

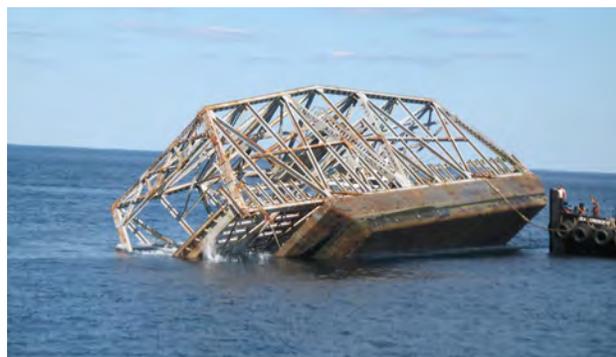
Sand Resources and Nourishment

The USACE is undertaking two beach nourishment projects at Folly Beach and along the Grand Strand (Garden City, Surfside Beach, Myrtle Beach, and North Myrtle Beach) during the summer and fall of 2018. Folly Beach was nourished in 2014, but the occurrence of several major storms in the intervening years has resulted in it being the recipient of an emergency renourishment project. The Folly Beach nourishment will place approximately 750,000 cubic yards of material on 2.5 miles of beach; the

were nourished last year; however, recent storm-related sand losses resulted in supplemental material being placed this year. The Garden City/Surfside Beach borrow area is being monitored for approximately three years to assess potential impacts to sediment composition, the macrobenthic community, and usage of the area by fish and sea turtles (via acoustic receiver arrays). The Myrtle Beach borrow area is being monitored for one year to assess potential impacts to sediment composition and the macrobenthic community related to warm-season dredging activity.

Artificial Reef Construction

Over 300,000 cubic feet of new offshore bottom habitat was created at 17 artificial reef locations. One reef construction project included deployment of a 168-foot long steel bridge truss on our deep-water Marine Protected Area (MPA) site. Another project included deployment of a 106-foot tugboat on Comanche Reef. Acoustic radio receivers on several reef sites continue to show the seasonal presence of highly migratory species from as far away as Massachusetts and Florida, as well as local migrants (inshore to offshore) such as sturgeon.



The 168-foot truss of the Highway 41 swing bridge, welded to the deck of a barge, being deployed on the Charleston Deep Reef MPA (left). Photo credit: SCDNR. The 106-foot tug, General Oglethorpe, being deployed on Comanche Reef (right). Photo credit: SCDNR.

GEORGIA

January Murray, Georgia Department of Natural Resources

Management of Artificial Reefs

Georgia's Department of Natural Resources (GADNR) continues to provide suitable and accessible quality habitats for coastal recreational anglers through enhancement of Georgia's 31 marine and 15 estuarine artificial reefs. These highly productive reef communities play an important role in Georgia's marine and estuarine ecosystems and coastal economies. Material enhancements of these reefs generate substantial biological benefits while providing popular recreational fishing and diving opportunities. Reef project goals include seeking partnerships from fishing clubs and other interested organizations as well as accepting financial and material donations in order to further develop Georgia's Artificial Reef System.

From July 2017-18, GADNR conducted three offshore artificial reef enhancements through deployments of donated materials of opportunity: 72 concrete pallet balls and 24 concrete sinkers at BSF Reef and two separate deployments to SFC Reef totaling 700 tons of concrete rubble. Partnerships as well as material and financial donations made all three projects possible. The newly permitted BSF Reef (2017) was established in partnership with the Savannah Sport Fishing Club and materials deployment occurred in partnership with Charleston, South Carolina's United States Coast Guard and the Federal Law Enforcement Training Center. On August 14th, 2017 the first materials enhancement at BSF Reef was conducted since its creation where materials, grouped in clusters, were deployed outward from the reef center point

(31°54.089'N / 80°50.073'W) along a north - south path to allow for trolling in 29 feet of water. The SFC Reef projects were conducted in partnership with the City of Brunswick who donated the concrete materials to enhance long-term sport fisheries habitat in Georgia's marine waters and to increase recreational fishing opportunities in both Glynn and Camden Counties. On December 6th and 19th, 2017 approximately 200 and 500 tons of concrete materials were deployed throughout the southwest quadrant of the SFC Reef in approximately 60 feet of water (general locations: 30°59.799'N / 81°02.778'W and 30°59.740'N / 81°02.958'W).



SFC offshore reef deployment. Photo credit: J. Murray, GADNR.



BSF offshore reef deployment. Photo credit: J. Murray, GADNR.



Henry Vassa Cate Inshore Reef Deployment. Photo credit: J. Murray, GADNR.

From July 2017-18, GADNR conducted four inshore artificial reef (IAR) enhancements through deployments of donated materials of opportunity at the High Point, Stafford Island, Henry Vassa Cate, and Jekyll Island Pier estuarine reefs. On August 16th, 2017, 22 sections of four-foot diameter concrete culverts, donated by the City of Brunswick, were deployed at the High Point Reef (31°31.508'N / 81°14.540'W). This project was a joint venture, with Georgia's Coastal Conservation Association (CCA) and the Building Conservation Trust - CCA's National Habitat Program, to enhance recreational fishing habitat adjacent to the northwest shoreline of Sapelo Island. On November 1st, 2017 Mortenson Construction donated materials and barge services to deploy 57 scrap concrete square pilings (24" x 24") ranging in size from 10 - 20 feet in length at the Stafford Island Reef (30°49.157'N / 81°29.280'W). The City of Brunswick donated 300 tons of concrete rubble that was deployed on April 6th, 2018 at the Henry Vassa Cate Reef from the deeper (31°06.228'N / 81°25.610'W) to shallower (31°06.218'N / 81°25.601'W) waters of the site.

On April 9th, 2018 the City of Brunswick donated 300 tons of concrete rubble for deployment at the Jekyll Island Pier Subtidal Reef which is accessible by land and provides excellent year-round fishing opportunities for coastal residents and tourists. Materials were deployed (31°07.018'N / 81°25.111'W) in 25 feet of water close to the west arm of the pier's back side. Materials deployed at all four IARs will develop long-term sport fisheries habitat creating shelter and feeding opportunities for a variety of fish species popular with recreational anglers in Georgia's estuarine waters. Both state (CMPA682) and federal (PGP37) IAR permit documents were submitted for renewal in December 2017/January 2018 and are still pending final approvals. Material inspection surveys via side scan sonar, aerial reef flyovers, and SCUBA diving were conducted and updates occurred to GADNR's artificial reef webpages <http://coastalgadnr.org/ArtificialReef> and <http://georgiaoutdoormap.com>.

Oyster Reef Restoration

Georgia's estuaries contain a high density of natural oyster spat. However, there is a lack of suitable "natural cultch" materials available for oyster settlement; therefore shell and other materials must be reintroduced into the environment to promote growth and expansion of new oyster reefs. In order to have shell available for restoration, maintenance, and test plot projects GADNR manages seven Shell Recycling Centers along the coast where community members from restaurants, oyster roasts and other events voluntarily donate oyster shells to be used in future projects. Shell is also bagged through volunteer outreach events and placed at designated restoration, maintenance, and/or test plot sites each spring. After shells are planted, oyster spat attach and grow creating a new oyster reef.

Fifty-two volunteers participated in a total of four "bagging events" where approximately 1,015 bags (7.6 tons) of recycled oyster shells were created, donating a total of 104 hours to project activities. GADNR's Oyster Shell Recycling activities provided 47.8 tons of cured (six to 12

months) shells for use in 2018 projects. Unfortunately, due to limited personnel and federal permit issues, GADNR did not conduct shell planting projects thus a 47.8 tons shell reserve remains available for use in future projects. GADNR performed a total of 17 oyster reef monitoring surveys at previously deployed inter-tidal restoration (2), maintenance (1), and test plot (12) reefs according to methods described in the GADNR Oyster Reef Restoration Monitoring Plan. Experimental materials known as fish aggregating devices were also monitored for oyster performance at two IAR enhancement sites.

FLORIDA

Kent Smith, Florida Fish and Wildlife Conservation Commission

Hurricane Irma Funding

FWC will be receiving almost \$45 million from NOAA to address impacts to fisheries in marine systems from the effects of Hurricane Irma, which made landfall in the

Florida Keys in September, 2017. This storm ravaged the Florida peninsula as it moved north, and caused damage to fishery habitats including seagrass and mangrove systems along its path. As part of this funding effort, approximately \$10 million will be applied to restoration of fishery habitat in affected areas. FWC staff in the Aquatic Habitat Conservation and Restoration Section are working with partners to identify mangrove and seagrass projects with a focus

of effort in the Keys and Southwest, Florida where impacts were the greatest. Funding will be allocated during 2019, and will be used to complete restoration projects over a two-year time frame. FWC anticipates that hundreds of acres of restored fishery habitat, along with restoration of the ecological functions supporting coastal fisheries, will result from this effort.

Living Shorelines

Partner organizations including The Nature Conservancy, Florida Sea Grant, FWC, The Marine Discovery Center of New Smyrna Beach, Florida Department of Environmental Protection (FDEP), the



*Isolated dead mangrove community at Oleta River State Park.
Photo credit: FWC.*



NSU researchers conducting large coral "fire break" mitigation. Photo credit: FWC.

Service, Restore America's Estuaries, and other NGOs and consultants continue to

develop tools to assist the public and private businesses with effective implementation of living shorelines along low to medium energy estuaries. The partner-based <http://floridalivingshorelines.com> website has been recently updated to provide private property owners interested in securing their shoreline from wave-based erosion information about this green technology. Some of the same partners have also secured funding for and begun to develop a workshop curriculum and regional program to expose consultants actively designing shoreline stabilization projects to living shoreline alternatives. Both efforts focus on targeting groups that have not been able to readily access current information on this green shoreline stabilization approach. These groups have expressed an interest in having this information readily available.

Coral Disease

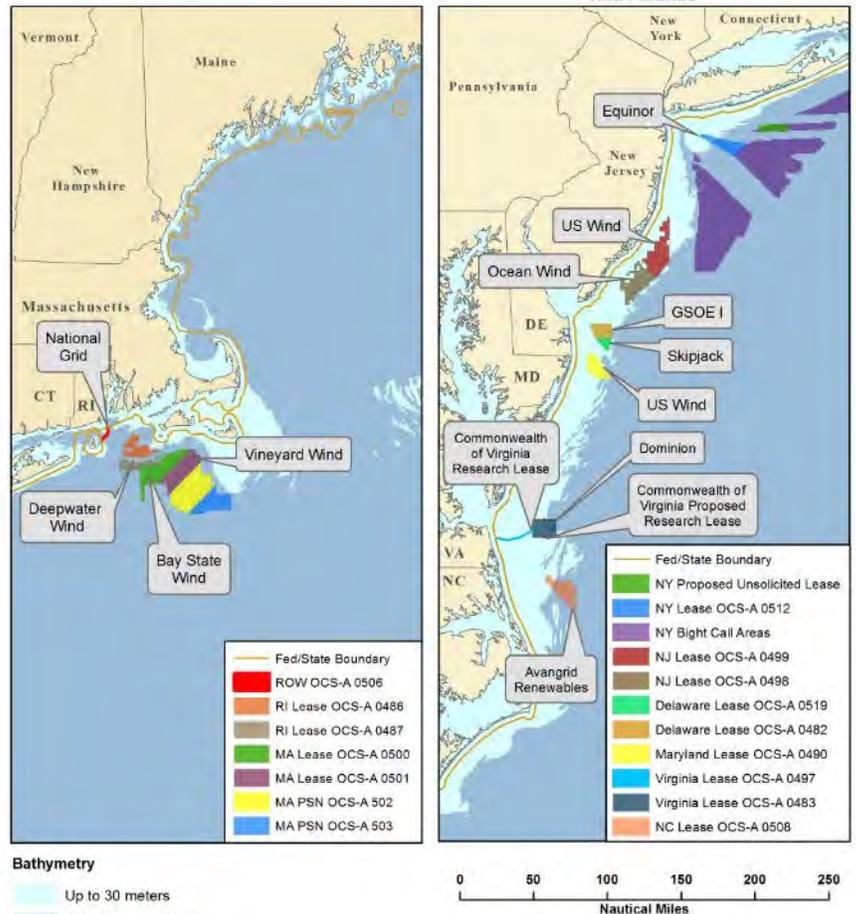
The current coral disease outbreak continues to affect large areas of stony reef-building corals throughout the Southeast and Keys portion of Florida. Although the cause of this disease is not yet known, a number of organizations including regional universities like Nova Southeast University, FWC, NOAA, FDEP and the Florida Keys National Marine Sanctuary have directed efforts to monitor the spread of the disease and mitigate its effects. One promising approach is to isolate healthy coral colonies on infected large "legacy" corals by creating disease "fire breaks" using chlorinated or antibiotic laced cement or epoxy. This is currently being tested in specific locations where corals historically resilient to other disease and bleaching outbreaks have occurred. The goal of this project is to identify and implement effective disease mitigation approaches that can be used to maintain legacy corals that may be more resistant to future disease vectors.



NEW ENGLAND AND MID-ATLANTIC FISHERY MANAGEMENT COUNCILS

Michelle Bachman, NEFMC and Jessica Coakley, MAFMC

On July 11, 2018, the New England and Mid-Atlantic Fishery Management Councils launched a new webpage that's designed to serve as a repository for information relevant to offshore wind development activities in the Northeast Region. The Councils worked closely with NOAA Fisheries on this collaborative effort. The easy-to-navigate webpage provides one-stop-shopping for fishermen and other stakeholders who are searching for essential resources associated with offshore wind energy production. The page provides direct links to government agencies, offshore wind developers, fishery liaisons, Council-developed comments, and more. Here's the webpage address: <http://www.mafmc.org/northeast-offshore-wind>.



Wind lease areas in the North and Mid-Atlantic. Map credit: Bureau of Ocean Energy Management.



Scamp, snowy grouper, and other fish swimming amongst *Oculina* coral thickets.
Photo credit: J. Reed, HBOI.

Both the New England and Mid-Atlantic Councils are working collaboratively with multiple fisheries management organizations, federal agencies, and academic researchers to assess the quality and quantity of fish habitat in the Northeast region. This Northeast Regional Marine Fish Habitat Assessment will conduct investigations to assess habitat suitability for key marine fish and shellfish species in the changing environment of the Northeast Shelf Large Marine Ecosystem. The habitat research will provide information to be used in the future to support federal EFH assessments and EFH consultations. The work will also aim to identify habitat areas that are rare, sensitive, vulnerable, or are uniquely important to ecosystem function. The assessment will support next generation EFH designations for both Councils.

2018 marked the second year of implementation for the Mid Atlantic's Frank R. Lautenberg Deep-Sea Coral Protection Area. In January, the New England Council followed suit by approving a similar, large coral conservation zone that extends from the shelf break out to the edge of the Exclusive Economic Zone and encompasses 20 canyons and four seamounts. The New England Council's amendment also identifies two smaller areas in coastal eastern Maine for coral protection, plus a coral research area in Jordan Basin. Rulemaking on the New England zones is pending but is expected to take effect in 2019.

Questions:

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NOAA GREATER ATLANTIC REGIONAL FISHERIES OFFICE

Lou Chiarella, NOAA Greater Atlantic Regional Fisheries Office

Creation of Regional Offshore Wind Team

Over the past few years, there has been a significant increase in offshore wind leasing and permitting activity throughout the Greater Atlantic Region. NOAA Greater Atlantic Regional Fisheries Office (GARFO) has created the Regional Offshore Wind Team to coordinate our internal and external communication on issues associated with offshore wind. The team includes the appropriate GARFO divisions and offices, the Northeast Fisheries Science Center and both the New England and Mid Atlantic Fishery Management Councils. A charter is being developed to clearly outline the roles of team members and NOAA Fisheries Headquarters, along with coordination procedures, in order to ensure effective and efficient responses to Bureau of Ocean Energy Management (BOEM) in order meet administration priorities.

Programmatic Agreement with Federal Highway Administration

This year, GARFO completed the development of a programmatic agreement with the Federal Highway Administration. This effort focuses on a broad range of transportation activities throughout the Greater Atlantic Region, and identifies a suite of measures to protect EFH and conserve protected resources. This agreement includes clear guidance on conservation measures to be incorporated into project design at the early stages of a project. In addition, this provides a streamlined permitting process to address certain activities, thus allowing NOAA Fisheries resources to be dedicated to higher priorities.

Engineering with Nature Initiatives

Following up on the October 2016 Engineering with Nature (EWN) workshop between NOAA and the USACE held in Gloucester, MA, the USACE convened another workshop in Philadelphia, PA to focus on developing pilot projects and innovative techniques for using Engineering with Nature principles to beneficially use dredged material, increase coastal community and ecological resiliency and restore and protect aquatic habitats. GARFO is part of an interagency team that includes NOAA's Office of Protected Resources, Office of Habitat Conservation, the USACE Philadelphia District, the North Atlantic Division and their Environmental Research and Development Center,



the Service, the State of New Jersey and others to develop guidance on project design, implementation, and monitoring. This initiative is linked to national and international efforts to develop guidelines on the use of natural and nature-based features for sustainable engineering.

NOAA FISHERIES SOUTHEAST REGION

Pace Wilber, NOAA Southeast Regional Office

During federal fiscal year 2018, NOAA Fisheries received 838 requests for project consultations in North Carolina, South Carolina, Georgia, and the Atlantic coast of Florida. Cumulatively, these projects proposed impacts to over 25,000 acres of coastal and wetland habitats. NOAA Fisheries was able to review 418 of the consultation requests and provided conservation recommendations for 88 projects.

Fish Passage

In 2017, NOAA Fisheries worked with the Service and state agencies to complete and file with the FERC three comprehensive plans: the Roanoke River Diadromous Fishes Restoration Plan, Santee Basin Diadromous Fish Passage Restoration Plan, and Cape Fear River Basin Action Plan for Migratory Fish. In 2018, FERC accepted these plans thereby ensuring the objectives have special standing during FERC's licensing of hydroelectric facilities within the respective river basins. Each plan focuses on restoring diadromous fish populations to levels needed for historical species richness and viable fisheries. During 2018, NOAA Fisheries led development of detailed implementation strategies for the Santee Basin Plan and led workgroups focused on implementing the Cape Fear Plan. An important milestone for the Santee Basin Plan was completion of a Comprehensive Relicensing Settlement Agreement for the Parr Shoals Hydroelectric Project, which establishes new water flow regimes for enhancing habitat for shortnose sturgeon, American shad, blueback herring, and American eel. During 2019, NOAA Fisheries will focus on implementing the Roanoke Plan.

Port Development

NOAA Fisheries continued assisting state partners and the USACE with implementing the Port of Savannah and Port of Charleston navigation improvement projects, including beneficial uses of dredged material to build artificial reefs for fish and islands for nesting shorebirds. Additionally

for the Port of Savannah, NOAA Fisheries continued working with the USACE on the design for the fishway at New Savannah Bluff Lock and Dam; the fishway partly mitigates impacts to foraging habitat used by sturgeon from the harbor dredging. The fishway includes a rock-arch ramp weir atop the old dam. NOAA Fisheries also is assisting the USACE with project designs for the Port Everglades Navigation Improvement Project, which will include dredging within and adjacent to coral reef habitat thereby placing an exceptionally high premium on use of innovative dredging methods for avoiding effects to sensitive resources. These measures will include a three-month period each year when no dredging will occur within the areas adjacent to coral reef habitat. The no-dredging period coincides with the time of year when coral spawning is most frequent and susceptibility to heat stress is at its highest.

Highways Projects

NOAA Fisheries, the Federal Highway Administration, and state Departments of Transportation in North Carolina, South Carolina, and Georgia, completed a Best Management Practices (BMP) manual for highway projects. The manual is part of an effort to streamline the consultations required by the Magnuson-Stevens Act (MSA) and Endangered Species Act (ESA). The manual identifies information needs for common project types, provides standardized effects analyses for those projects, and recommends BMPs for minimizing impacts to NOAA-trust resources. During the latter part of 2018, the manual became the basis for programmatic MSA and ESA consultations that further streamline consultations for important highway projects. NOAA Fisheries expects to complete the programmatic consultations by December 2018.

GULF OF MAINE RESEARCH INSTITUTE

Graham Sherwood, Gulf of Maine Research Institute

The Gulf of Maine has experienced fundamental changes over the last 40 years. The coastal region has seen dramatic declines in groundfish, an explosion of lobsters, loss of habitat for critical species such as alewives (and subsequent recovery), and the appearance of more southern species such as black sea bass.

Researchers at the Gulf of Maine Research Institute (GMRI) have undertaken a comprehensive survey of



Summer interns Rebecca Atkins (left) and Verena Lucke seine sampling for littoral fish in Casco Bay. Photo credit: G. Sherwood, GMRI.

the near shore fisheries ecosystem around Casco Bay. Over a ten-year period (beginning in 2014), the Casco Bay Aquatic System Survey, or CBASS, will monitor and describe changes in this ecosystem, revealing potential linkages to changes in climate and ocean conditions, land use practices (e.g., fish passage) and other changes in the marine ecosystem (e.g., invasive species). This work will

give us an unprecedented view of how a critical ecosystem functions and how it is changing – essential information for fisheries and coastal resource management. For more information on CBASS and GMRI, visit: <https://www.gmri.org/our-work/research/projects/casco-bay-aquatic-system-survey>.

Acknowledgements

HABITAT PROGRAM MISSION

To work through the Commission, in cooperation with appropriate agencies and organizations, to enhance and cooperatively manage vital fish habitat for conservation, restoration, and protection, and to support the cooperative management of Commission managed species.

REPRODUCTIONS

Any portion of this newsletter may be reproduced locally with credit given to the ASMFC Habitat Program.

2018 PUBLICATION

The 2018 Annual Publication of Habitat Hotline Atlantic was made possible by the contributions of many, but the Habitat Committee would like to specifically acknowledge the efforts of the 2018 Editors:

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Dawn McReynolds (NYSDEC)
Tina Berger (ASMFC)

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Funding provided by Sport Fish Restoration
Banner photo South Atlantic Fishery Management Council